ETSI TS 129 515 V17.10.0 (2024-07)

5G;
5G System;
Gateway Mobile Location Services;
Stage 3
(3GPP TS 29.515 version 17.10.0 Release 17)

Reference
RTS/TSGC-0429515vha0

Keywords
5G

ETSI

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Contents

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

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  - 3 or greater indicates TSG approved document under change control.
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In the present document, modal verbs have the following meanings:

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shall not indicates an interdiction (prohibition) to do something

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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.

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cannot indicates that something is impossible

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

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 [5] and 3GPP TS 29.501 [6].

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 23.273: "5G System Location Services (LCS)".

[5] 3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".

[6] 3GPP TS 29.501: "5G System; Principles and Guidelines for Services Definition; Stage 3".

[7] OpenAPI Initiative, "OpenAPI Specification Version 3.0.0", https://spec.openapis.org/oas/v3.0.0.

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

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

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

[11] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".

[12] 3GPP TS 29.572: "5G System; Location Management Services; Stage 3".

[13] ITU Recommendation E.164: "The international public telecommunication numbering plan".

[14] 3GPP TS 29.503: "5G System; Unified Data Management Services; Stage 3".

[15] 3GPP TS 33.501: "Security architecture and procedures for 5G system".

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

[17] 3GPP TS 29.510: "Network Function Repository Services; Stage 3".

[18] 3GPP TS 22.071: "Location Services (LCS); Service description; Stage 1".

[19] 3GPP TR 21.900: "Technical Specification Group working methods".

[20] 3GPP TS 29.518: "5G System; Access and Mobility Management Services; Stage 3".

[21] 3GPP TS 29.002: "Mobile Application Part (MAP) specification".

[22] 3GPP TS 33.256: "Security aspects of Uncrewed Aerial Systems (UAS)".

[23] 3GPP TS 37.355: "Technical Specification Group Radio Access Network; LTE Positioning Protocol (LPP)".

3 Definitions of terms, symbols and abbreviations

3.1 Terms

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 Symbols

Void

3.3 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].

5GC	5G Core Network
AMF	Access and Mobility Management Function
GAD	Geographical Area Description
GMLC	Gateway Mobile Location Centre
GPSI	Generic Public Subscription Identifier
LCS	Location Services
LDR	Location Deferred Request
MO-LR	Mobile Originated Location Request
MT-LR	Mobile Terminated Location Request
NEF	Network Exposure Function
NI-LR	Network Induced Location Request
NRF	Network Repository Function
SUPI	Subscription Permanent Identifier

4 Overview

The Gateway Mobile Location Centre (GMLC) is the network entity in the 5G Core Network (5GC) supporting Location Services (LCS). Within the 5GC, the GMLC offers services to the AMF, GMLC and NEF via the Ngmlc service based interface (see 3GPP TS 23.501 [2] and 3GPP TS 23.502 [3]).

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

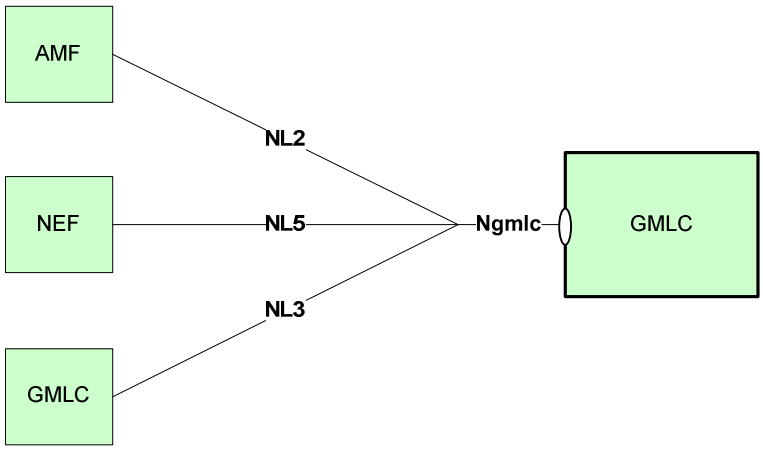

Figure 4-1: Reference model – GMLC

The functionalities supported by the GMLC are listed in clause 4.3.3 of 3GPP TS 23.273 [4].

5 Services offered by the GMLC

5.1 Introduction

The table 5.1-1 shows the GMLC Services and GMLC Service Operations:

Table 5.1-1: List of GMLC Services

Service Name	Service Operations	Operation Semantics	Example Consumer(s)
Ngmlc_Location	ProvideLocation	Request/Response	H-GMLC, NEF
	LocationUpdate	Request/Response	AMF, V-GMLC
	LocationUpdateNotify	Notify	NEF
	CancelLocation	Request/Response	H-GMLC, NEF
	EventNotify	Notify	H-GMLC, NEF

Table 5.1-2 summarizes the corresponding APIs defined for this specification.

Table 5.1-2: API Descriptions

Service Name	Clause	Description	OpenAPI Specification File	apiName	Annex
Ngmlc_Location	6.1	Ngmlc Location Service	TS29515_Ngmlc_Location.yaml	ngmlc-loc	A.2

5.2 Ngmlc_Location Service

5.2.1 Service Description

The Ngmlc_Location service enables an NF to request location determination (current geodetic and optionally local and/or civic location) for a target UE. The following are the key functionalities of this NF service.

- Allow the consumer NF to request the current geodetic and optionally local and/or civic location of a target UE.

- Allow the consumer NF to subscribe/unsubscribe the geodetic and optionally local and/or civic location of a target UE for some certain events.
- Allow the consumer NF to cancel an on-going periodic or triggered location request of a target UE.
- Allow the consumer NF to get notified about the geodetic and optionally local and/or civic location of a target UE when some certain events are detected.

5.2.2 Service Operations

5.2.2.1 Introduction

The service operations defined for the Ngmlc_Location services are as follows:

- ProvideLocation
- LocationUpdate
- LocationUpdateSubscribe
- LocationUpdateNotify
- CancelLocation
- EventNotify

5.2.2.2 ProvideLocation

5.2.2.2.1 General

The following procedures are supported using the "ProvideLocation" service operation:

- Provide Location of a single UE
- Provide Locaitons of a group of UEs

5.2.2.2.2 Provide Location of a single UE

The service operation is used during the procedures:

- 5GC-MT-LR Procedure for the commercial location service (see 3GPP TS 23.273 [4], clause 6.1.2)
- Deferred 5GC-MT-LR Procedure for Periodic, Triggered and UE Available Location Events (see 3GPP TS 23.273 [4], clause 6.3.1)

The ProvideLocation service operation is invoked by a NF Service Consumer, e.g. a NEF or GMLC, towards the GMLC to request to provide the location information (geodetic location and, optionally local and/or civic location) for a target UE or to subscribe to periodic or triggered deferred location for a target UE. See Figure 5.2.2.2.2-1.

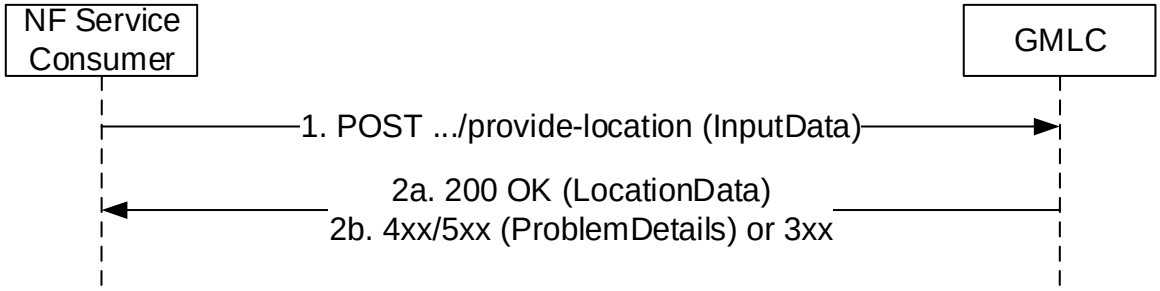

Figure 5.2.2.2.2-1: ProvideLocation Request/Response for a target UE

1. The NF Service Consumer shall send an HTTP POST request to the URI associated with the "provide-location" custom operation. The input parameters for the request (the target UE identification (SUPI or GPSI), required QoS, supported GAD shapes, LCS client type, external Service Identity, Codeword, service coverage, LDR type, serving AMF address, LDR reference, scheduled location time, integrity requirements) should be included in the HTTP POST request body, H-GMLC Callback URI may be included in the HTTP POST request body to V-GMLC (eventually to AMF) for implicit subscripiton of EventNotify provided by AMF, and NEF Callback URI may be included in the HTTP POST request body to GMLC/H-GMLC for implicit subscripiton of EventNotify provided by GMLC/H-GMLC.

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, local position, civic location, positioning methods, integrity result,…).

If geographic area(s) are received in the request for area event, the GMLC (or V-GMLC when roaming) shall convert the received geographic area(s) into a corresponding list of cell and/or tracking area identities when invoking AMF location services.

2b On failure or redirection, one of the HTTP status code listed in Table 6.1.3.2.2-2 may be returned. For a 4xx/5xx response, the message body may contain a ProblemDetails structure with the "cause" attribute set to one of the application errors listed in Table 6.1.3.2.2-2.

5.2.2.2.3 Provide Locations of a group of UEs

The service operation is used during the procedures:

- Bulk Operation of LCS Service Request Targeting to Multiple UEs (see 3GPP TS 23.273 [4], clause 6.8)

The ProvideLocation service operation is invoked by a NF Service Consumer, e.g. a NEF, towards the GMLC (e.g. (H)GMLC when roaming) to request to provide the location information (geodetic location and, optionally local and/or civic location) for a target group of UEs or to subscribe to periodic or triggered deferred location for a target group of UEs. See Figure 5.2.2.2.3-1.

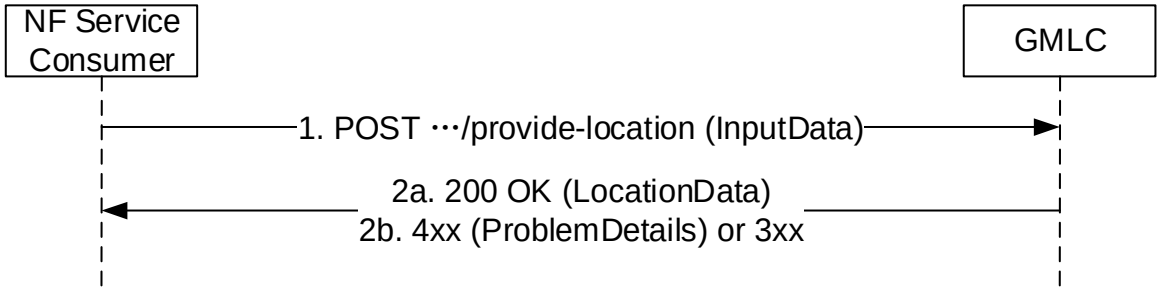

Figure 5.2.2.2.3-1: ProvideLocation Request/Response for a target group

1. The NF Service Consumer shall send an HTTP POST request to the URI associated with the "provide-location" custom operation. The input parameters the target group identification (the External Group ID or the Internal Group ID), LCS client type, eventNotificationUri shall be included in the HTTP POST request body, LDR type, LDR reference shall be also included in the request if requesting the deferred LCS service, the required QoS, supported GAD shapes, external Service Identity, service coverage should be included in the request. If the request is related to location determination at the scheduled time, the scheduled location time shall be included in the HTTP POST request body.

   GMLC shall translate the target group identification into the list of the UE identifications which belong to the target group by invoking the related service provided by UDM, then for each UE in the list, GMLC initiates following steps of procedures of the 5GC-MT-LR or Deferred 5GC-MT-LR as defined in 3GPP TS 23.273 [4] clause 6.8.

   If geographic area(s) are received in the request for area event, the GMLC (or V-GMLC when roaming) shall convert the received geographic area(s) into a corresponding list of cell and/or tracking area identities when invoking AMF location services.

2a. On success, "200 OK" shall be returned. The response body shall contain the success type.

2b On failure or redirection, one of the HTTP status code listed in Table 6.1.3.2.2-2 may be returned. For a 4xx/5xx response, the message body may contain a ProblemDetails structure with the "cause" attribute set to one of the application errors listed in Table 6.1.3.2.2-2.

5.2.2.3 LocationUpdate

5.2.2.3.1 General

The service operation is used during the procedure:

- 5GC-MO-LR Procedure (see 3GPP TS 23.273 [4], clause 6.2)

The LocationUpdate enables the NF consumer (e.g. AMF) to update UE location information towards the GMLC. See Figure 5.2.2.3.1-1.

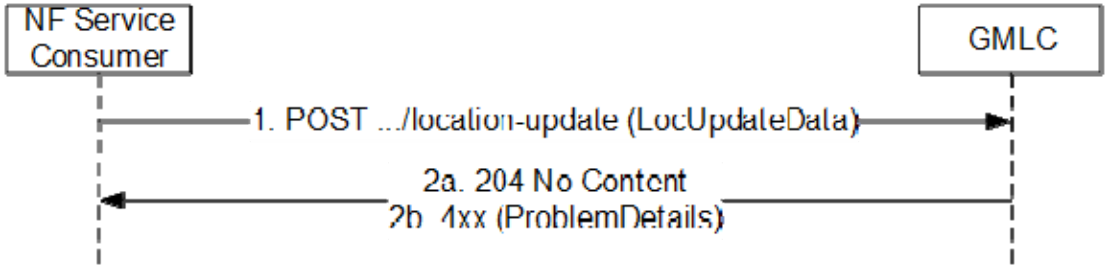

Figure 5.2.2.3.1-1: LocationUpdate Request/Response

1. The NF Service Consumer shall send an HTTP POST request to the URI associated with the "location-update" custom operation. The request body shall contain a LocUpdateData object..

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

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.3.4.2-2 may be returned. For a 4xx response, the message body may contain a ProblemDetails structure with the "cause" attribute set to one of the application errors listed in Table 6.1.3.4.2-2.

5.2.2.4 CancelLocation

5.2.2.4.1 General

The service operation is used during the procedure:

- Deferred 5GC-MT-LR Procedure for Periodic, Triggered and UE Available Location Events (see 3GPP TS 23.273 [4], clause 6.3.3)

The CancelLocation enables the consumer NF to use the service operation to cancel a deferred 5GC-MT-LR procedure for periodic or triggered location for a single UE or for a group. See Figure 5.2.2.4.1-1.

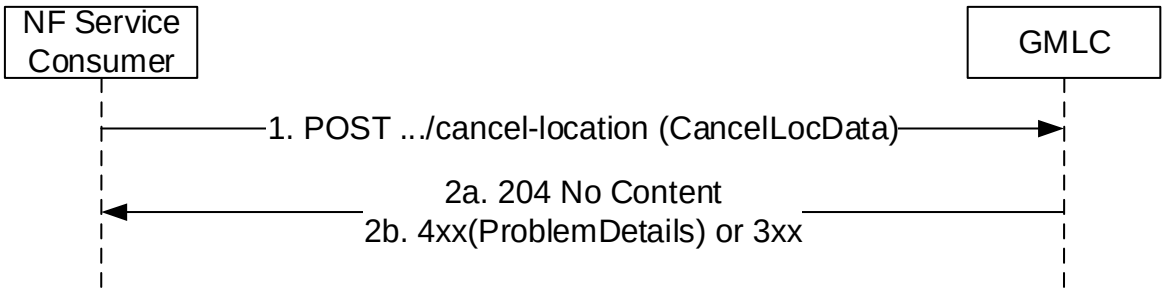

Figure 5.2.2.4.1-1: CancelLocation Request/Response

1. The NF Service Consumer shall send an HTTP POST request to the URI associated with the "cancel-location" custom operation. The input parameters for the request ((H-)GMLC contact address, LDR reference number, LMF identification, serving AMF address) should be included in the HTTP POST request body.

2a. On success, "204 No Content" shall be returned.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.3.3.2-2 may be returned. For a 4xx response, the message body may contain a ProblemDetails structure with the "cause" attribute set to one of the application errors listed in Table 6.1.3.3.2-2.

5.2.2.5 EventNotify

5.2.2.5.1 General

The following procedures are supported using the "EventNotify" service operation:

- EventNotify for a single UE
- EventNotify for the UEs in a target group

5.2.2.5.2 EventNotify for a single UE

The service operation is used during the procedure:

- Deferred 5GC-MT-LR Procedure for Periodic, Triggered and UE Available Location Events (see 3GPP TS 23.273 [4], clause 6.3.1 or clause 6.3.2)

The EventNotify for a single UE enables the consumer NF (e.g. (H)GMLC, NEF) to get notified about the geodetic and optionally local and/or civic location, the completion or activation of deferred location, mobility to a different AMF/MME of a UE with deferred location for a target UE when some certain events are detected. See Figure 5.2.2.5.2-1.

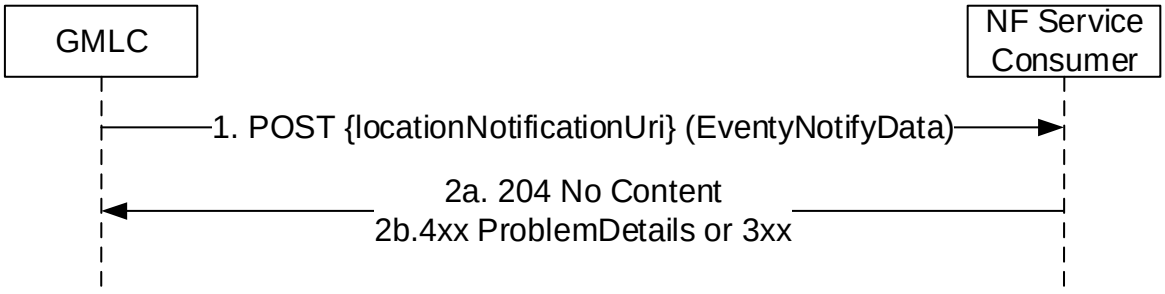

Figure 5.2.2.5.2-1: EventNotify Notification for a single UE

1. The GMLC shall send an HTTP POST to the locationNotificationUri to send a notification. The input parameters for the notification (Notification Correlation ID, UE (SUPI and if available GPSI), Type of location related event

(e.g. deferred location for the UE available event, activation of location for periodic or triggered location, mobility of a target UE to a new AMF or MME for a deferred location, Geodetic Location, Local Location, Civic Location, Position Methods Used, serving LMF identification, integrity result, etc.) should be included in the HTTP POST request body. The locationNotificationUri shall be set to:

If the notification is sent from (V)GMLC to (H)GMLC when roaming with (V)GMLC used,

- the hgmlcCallBackURI received from the AMF/LMF;

If the notification is sent from (H)GMLC to NEF,

- the callback URI of NEF provided by NEF during requesting the ProvideLocation service operation for the periodic or triggered deferred location for a target UE or ;

- the callback URI of NEF locally provisioned in the (H)GMLC.

2a. If the notification is received, the NF Service Consumer shall reply with the status code 204 indicating the notification is received, in the response message.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.4.2.3.1-2 may be returned. For a 4xx response, the message body may contain a ProblemDetails structure with the "cause" attribute set to one of the application errors listed in Table 6.1.4.2.3.1-2.

5.2.2.5.3 EventNotify for the UEs in a target group

The service operation is used during the procedure:

- Bulk Operation of LCS Service Request Targeting to Multiple UEs (see 3GPP TS 23.273 [4], clause 6.8)

The EventNotify for the UEs in a target group enables the consumer NF (e.g. NEF) to get notified about the geodetic and optionally local and/or civic locations (immediate locations or deferred locations) for the UEs in target group, the failures of requesting location for the UEs in the target group, completion or activation of deferred location for the UEs in the target group. See Figure 5.2.2.5.3-1.

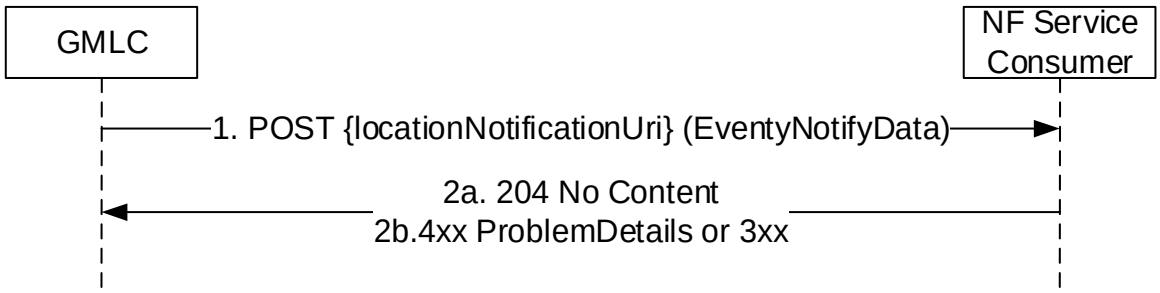

Figure 5.2.2.5.3-1: EventNotify Notification for the UEs in a target group

1. The GMLC/(H)GMLC shall send an HTTP POST to the locationNotificationUri to send a notification. The Request body shall contain event report(s) for one or more UEs in the group. The event report for each UE shall include the LDR Reference, UE identifier (SUPI or GPSI), location data (location data for immediate location service request or location data for deferred location service request) or failure cause of positioning. The locationNotificationUri shall be set to:

   - the callback URI of NEF provided by NEF during requesting the ProvideLocation service operation for a target group of UEs or;

   - the callback URI of NEF locally provisioned in the GMLC/(H)GMLC.

2a. If the notification is received, the NF Service Consumer shall reply with the status code 204 indicating the notification is received, in the response message.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.4.2.3.1-2 may be returned. For a 4xx response, the message body may contain a ProblemDetails structure with the "cause" attribute set to one of the application errors listed in Table 6.1.4.2.3.1-2.

5.2.2.6 LocationUpdateNotify

5.2.2.6.1 General

The service operation is used during the procedure:

- 5GC-MO-LR Procedure (see 3GPP TS 23.273 [4], clause 6.2)

The LocationUpdateNotify enables the NF consumer (e.g. NEF) to get notified about the UE location information update. See Figure 5.2.2.6.1-1.

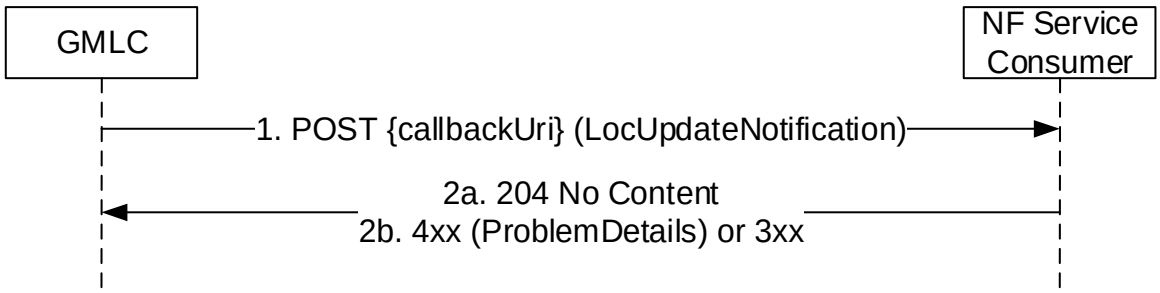

Figure 5.2.2.6.1-1: LocationUpdateNotify Notification

1. The GMLC shall send an HTTP POST request to the callback URI of the NF consumer (e.g. NEF). The response body shall contain a LocUpdateNotification object.

   The callback URI (e.g. NEF address for callback) is locally configured on GMLC or discovered via NRF.

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

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.4.3.3.1-2 may be returned. For a 4xx response, the message body may contain a ProblemDetails structure with the "cause" attribute set to one of the application errors listed in Table 6.1.4.3.3.1-2.

5.2.2.7 LocationUpdateSubscribe

5.2.2.7.1 General

This service operation is used by a NF Service Consumer (e.g. NEF) to trigger a subscription to notifications on UE location information update for the 5GC-MO-LR Procedure (see 3GPP TS 23.273 [4], clause 6.2). See Figure 5.2.2.6A.1-1.

NOTE: This service operation is not used by the current stage 2 specifications in 3GPP TS 23.273 [4], i.e. the subscription to notifications on UE location information update is implicit.

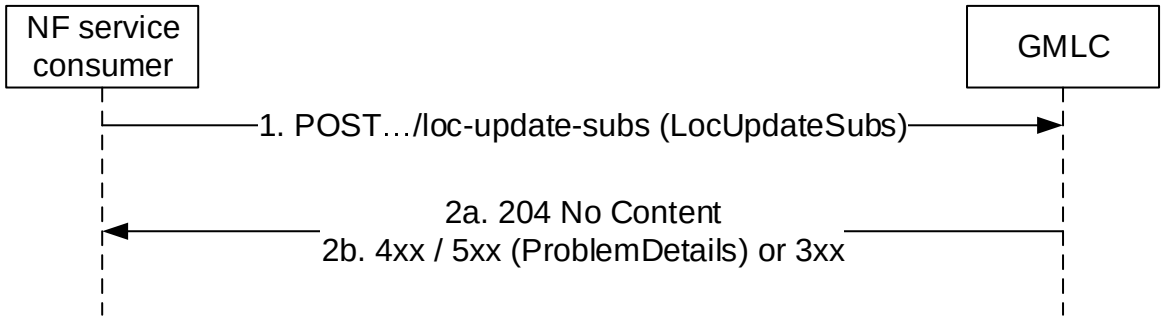

Figure 5.2.2.7.1-1: Subscription to UE location information update

1. The NF service consumer (e.g. NEF) sends a POST request to the parent resource, i.e. collection of subscriptions (.../loc-update-subs), to create a subscription to UE location information update for the 5GC-MO-LR Procedure, as provided in LocUpdateSubs information conveyed in the message body.

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

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.3.4.2-2 may be returned. For a 4xx/5xx response, the message body may contain a ProblemDetails structure with the "cause" attribute set to one of the application errors listed in Table 6.1.3.4.2-2.

6 API Definitions

6.1 Ngmlc_Location Service API

6.1.1 Introduction

The Ngmlc_Location service shall use the Ngmlc_Location API.

The API URI of the Ngmlc_Location API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests from the NF service consumer towards the NF service producer shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [6], i.e.:

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

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [6].
- The <apiName> shall be "ngmlc-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 [8], shall be used as specified in clause 5 of 3GPP TS 29.500 [5].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [5].

HTTP/2, as defined in IETF RFC 7540 [8], shall be used as specified in clause 5 of 3GPP TS 29.500 [5].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [5].

HTTP messages and bodies for the Ngmlc_Location service shall comply with the OpenAPI [7] 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 [9], 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 [5].
- The Problem Details JSON Object (IETF RFC 7807 [10]). 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 [5], clause 5.2.3.2.2.

This API does not define any new HTTP custom headers.

6.1.3 Custom Operations without associated resources

6.1.3.1 Overview

The structure of the custom operation URIs of the Ngmlc_Location service is shown in Figure 6.1.3.1-1.

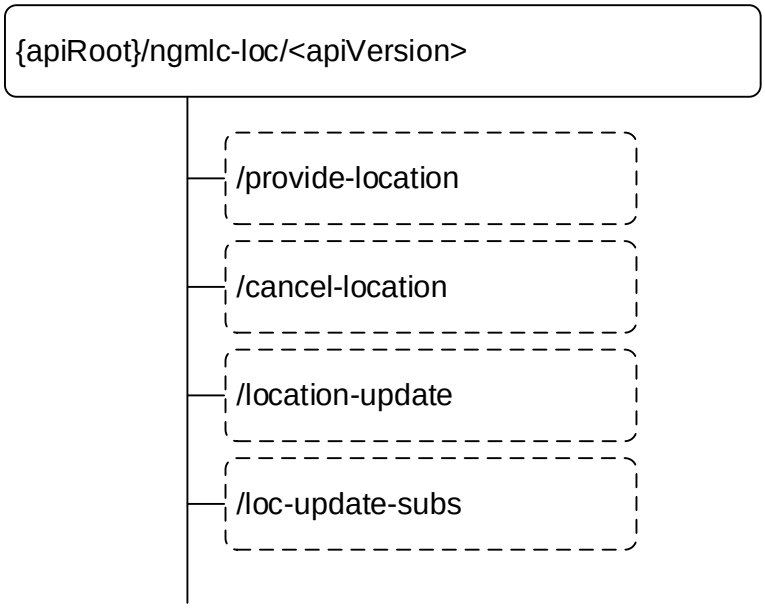

Figure 6.1.3.1-1: Custom operation URI structure of the Ngmlc_Location API

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

Table 6.1.3.1-1: Custom operations

Custom operation URI	Mapped HTTP method	Description
{apiRoot}/ngmlc-loc/<apiVersion>/provide-location	POST	Request or Subscribe the geodetic and optionally local and/or civic location of a target UE or a target group of UEs
{apiRoot}/ngmlc-loc/<apiVersion>/cancel-location	POST	Cancel an on-going periodic or triggered location request of a target UE or a target group of UEs
{apiRoot}/ngmlc-loc/<apiVersion>/location-update	POST	Enable the UE to update UE location information towards the consumer NF
{apiRoot}/ngmlc-loc/<apiVersion>/loc-update-subs	POST	Enable a NF service consumer (e.g. NEF) to subscribe to UE location information

6.1.3.2 Operation: provide-location

6.1.3.2.1 Description

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

6.1.3.2.2 Operation Definition

The operation shall support the response data structures and response codes specified in tables 6.1.3.2.2-1 and 6.1.3.2.2-2.

Table 6.1.3.2.2-1: Data structures supported by the POST Request Body on this resource

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

Table 6.1.3.2.2-2: 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 subscription of periodic or triggered location of the UE, or represents completely or partially accept of the requesting locations for a target group. Upon success, a response body is returned containing the different parameters of the location data if obtained, such as: - Geographic Area - Local Location - Civic Location - Age of Location - Accuracy of Location - Positioning methods
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, tthe URI shall be an alternative URI of the resource located on an alternative service instance within the same GMLC or GMLC (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 GMLC or GMLC (service) set.
ProblemDetails	O	0..1	403 Forbidden	The "cause" attribute may be used to indicate one of the following application errors: - POSITIONING_DENIED - UNSPECIFIED - UNSUPPORTED_BY_UE - DETACHED_USER See table 6.1.6.3-1 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 6.1.6.3-1 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 - PEER_NOT_RESPONDING See table 6.1.6.3-1 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 [5] other than those specified in the table above also apply, with a ProblemDetails data type when needed (see clause 5.2.7 of 3GPP TS 29.500 [5]).				

Table 6.1.3.2.2-3: 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 GMLC or GMLC (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 6.1.3.2.2-4: 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 GMLC or GMLC (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

6.1.3.3 Operation: cancel-location

6.1.3.3.1 Description

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

6.1.3.3.2 Operation Definition

This operation shall support the request and response data structures and response codes specified in table 6.1.3.3.2-1 and table 6.1.3.3.2-2.

Table 6.1.3.3.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
CancelLocData	M	1	The information is used to cancel deferred 5GC-MT-LR for a single UE or for a group of UE.

Table 6.1.3.3.2-2: 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 GMLC or GMLC (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 GMLC or GMLC (service) set.
ProblemDetails	O	0..1	403 Forbidden	The "cause" attribute may be used to indicate one of the following application errors: - UNSPECIFIED - LOCATION_SESSION_UNKNOWN See table 6.1.6.3-1 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 [5] other than those specified in the table above also apply, with a ProblemDetails data type when needed (see clause 5.2.7 of 3GPP TS 29.500 [5]).				

Table 6.1.3.3.2-3: 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 GMLC or GMLC (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 6.1.3.3.2-4: 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 GMLC or GMLC (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

6.1.3.4 Operation: location-update

6.1.3.4.1 Description

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

6.1.3.4.2 Operation Definition

This operation shall support the request and response data structures and response codes specified in table 6.1.3.4.2-1 and table 6.1.3.4.2-2.

Table 6.1.3.4.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
LocUpdateData	M	1	Input parameters to the "location-update" operation

Table 6.1.3.4.2-2: 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 update 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 GMLC or GMLC (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 GMLC or GMLC (service) set.
ProblemDetails	O	0..1	403 Forbidden	The "cause" attribute may be used to indicate one of the following application errors: - UNSPECIFIED - UNREQUESTED_BY_UE - UNKOWN_EXTERNAL_CLIENT_OR_AF - UNREACHABLE_EXTERNAL_CLIENT_OR_AF See table 6.1.6.3-1 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 [5] other than those specified in the table above also apply, with a ProblemDetails data type when needed (see clause 5.2.7 of 3GPP TS 29.500 [5]).				

Table 6.1.3.4.2-3: 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 GMLC or GMLC (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 6.1.3.4.2-4: 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 GMLC or GMLC (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

6.1.3.5 Operation: loc-update-subs

6.1.3.5.1 Description

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

6.1.3.5.2 Operation Definition

The operation shall support the request and response data structures and response codes specified in tables 6.1.3.5.2-1 and 6.1.3.5.2-2.

Table 6.1.3.5.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
LocUpdateSubs	M	1	Contains the subscription to UE location update information that is to be created.

Table 6.1.3.5.2-2: 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 the successful UE location information subscription creation.
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 GMLC or GMLC (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 GMLC or GMLC (service) set.
ProblemDetails	O	0..1	403 Forbidden	The "cause" attribute may be used to indicate one of the following application errors: - UNSPECIFIED - UNREQUESTED_BY_UE See table 6.1.6.3-1 for the description of these errors.
NOTE: The mandatory HTTP error status code for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [5] also apply.				

Table 6.1.3.5.2-3: 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 GMLC or GMLC (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 6.1.3.5.2-4: 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 GMLC or GMLC (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 Notifications

6.1.4.1 General

6.1.4.2 Eventnotify

6.1.4.2.1 Description

The EventNotify operation is used to the occurrence of periodic or triggered location event for a target UE to a consumer NF (e.g. (H)GMLC, NEF) or used to report the locations (e.g. the immediate locations or deferred locations) for the UEs in a target group to a consumer NF (e.g. NEF).

6.1.4.2.2 Notification Definition

Call-back URI: {locationNotificationUri}

See clause 5.2.2.5 for the description of how the GMLC obtains the Call-back URI of the NF Service Consumer.

6.1.4.2.3 Notification Standard Methods

6.1.4.2.3.1 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 6.1.4.2.3.1-1 and table 6.1.4.2.3.1-2.

Table 6.1.4.2.3.1-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
EventNotifyDataExt	M	1	Input parameters to the "Event Notify" operation

Table 6.1.4.2.3.1-2: 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 one of the following application errors: - UNSPECIFIED - LOCATION_SESSION_UNKNOWN See table 6.1.6.3-1 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 [5] other than those specified in the table above also apply, with a ProblemDetails data type when needed (see clause 5.2.7 of 3GPP TS 29.500 [5]).				

Table 6.1.4.2.3.1-3: 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 6.1.4.2.3.1-4: 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

6.1.4.3 LocationUpdateNotify

6.1.4.3.1 Description

The LocationUpdateNotify operation is used to deliver the location update for a UE to a consumer NF (e.g. NEF).

6.1.4.3.2 Notification Definition

Call-back URI: {locationUpdateCallbackUri}

6.1.4.3.3 Notification Standard Methods

6.1.4.3.3.1 POST

This method sends a Location update notification to the NF Service Consumer.

This method shall support the request and response data structures and response codes specified in table 6.1.4.3.3.1-1 and table 6.1.4.3.3.1-2.

Table 6.1.4.3.3.1-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
LocUpdateNotification	M	1	Input parameters to the "LocationUpdateNotification" operation

Table 6.1.4.3.3.1-2: 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 one of the following application errors: - UNSPECIFIED - UNKOWN_EXTERNAL_CLIENT_OR_AF - UNREACHABLE_EXTERNAL_CLIENT_OR_AF See table 6.1.6.3-1 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 [5] other than those specified in the table above also apply, with a ProblemDetails data type when needed (see clause 5.2.7 of 3GPP TS 29.500 [5]).				

Table 6.1.4.3.3.1-3: 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 6.1.4.3.3.1-4: 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

6.1.5 Data Model

6.1.5.1 General

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

Table 6.1.5.1-1 specifies the data types defined for the Ngmlc_Location service based interface protocol.

Table 6.1.5.1-1: Ngmlc_Location specific Data Types

Data type	Clause defined	Description	Applicability
InputData	6.1.5.2.2	the input parameters in ProvideLocation service operation	
LocationData	6.1.5.2.3	the response parameters in ProvideLocation service operation	
CancelLocData	6.1.5.2.4	the input parameters in CancelLocation service operation	
LocUpdateData	6.1.5.2.5	the input parameters in LocationUpdate service operation	
EventNotifyData	6.1.5.2.6	the input parameters for the target UE in EventNotify Notification service operation	
UePrivacyRequirements	6.1.5.2.7	UE privacy requirements from (H)GMLC to the serving AMF or VGMLC(in the roaming case) for the target UE	
LocUpdateNotification	6.1.5.2.9	Location Update Notification	
LocUpdateSubs	6.1.5.2.10	UE location information subscription	
EventNotifyDataAdditionalInfo	6.1.5.2.11	Additional information to Event Notify Data	
EventNotifyDataExt	6.1.5.2.12	Extended Event Notify Data for UEs of a target group	
AreaEventInfoAddition	6.1.5.2.13	Additional information for Extended Area event information	
AreaEventInfoExt	6.1.5.2.14	Extended Area Event Information	
IntegrityRequirements	6.1.5.2.15	GNSS integrity requirements	
AlertLimit	6.1.5.2.16	Alert Limit	
IntegrityProtectionLevel	6.1.5.2.17	Integrity Protection Level	
IntegrityResult	6.1.5.2.18	Integrity Result	
ServiceIdentity	6.1.5.3.2	service identity	
CodeWord	6.1.5.3.2	codeword	
ExternalClientIdentification	6.1.5.3.2	external client identification	
E164CountryCodeOfGeographicArea	6.1.5.3.2	E.164 country codes for geographic areas	
LcsServiceTypeId	6.1.5.3.2	LCS Service Type Id	
TimeToAlert	6.1.5.3.2	Time-to-Alert	
TargetIntegrityRisk	6.1.5.3.2	Target Integrity Risk	
HorizontalProtectionLevel	6.1.5.3.2	Horizontal Protection Level	
VerticalProtectionLevel	6.1.5.3.2	Vertical Protection Level	
PseudonymIndicator	6.1.5.3.3	It defines if a pseudonym is requested	
LocationRequestType	6.1.5.3.4	NI-LR, MT-LR or MO-LR	
LocationTypeRequested	6.1.5.3.5	the location type requested by the LCS client	
EventNotifyDataType	6.1.5.3.6	the type of event that triggers event notification	
FailureCause	6.1.5.3.7	Positioning failure cause	
SuccessType	6.1.5.3.8	Success Type to indicate full or partial success	
IntegrityComputingEntity	6.1.5.3.9	Integrity Computing Entity	

Table 6.1.5.1-2 specifies data types re-used by the Ngmlc_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 Ngmlc_Location service based interface.

Table 6.1.5.1-2: Ngmlc_Location re-used Data Types

Data type	Reference	Comments	Applicability
Gpsi	3GPP TS 29.571 [11]		
Supi	3GPP TS 29.571 [11]		
Uri	3GPP TS 29.571 [11]		
AmfId	3GPP TS 29.571 [11]		
NfInstanceId	3GPP TS 29.571 [11]		
ExternalClientType	3GPP TS 29.572 [12]		
LocationQoS	3GPP TS 29.572 [12]		
LcsQosClass	3GPP TS 29.572 [12]		
SupportedGADShapes	3GPP TS 29.572 [12]		
PeriodicEventInfo	3GPP TS 29.572 [12]		
AreaEventInfo	3GPP TS 29.572 [12]		
MotionEventInfo	3GPP TS 29.572 [12]		
LdrType	3GPP TS 29.572 [12]		
LdrReference	3GPP TS 29.572 [12]		
AgeOfLocationEstimate	3GPP TS 29.572 [12]		
PositioningMethod	3GPP TS 29.572 [12]		
AccuracyFulfilmentIndicator	3GPP TS 29.572 [12]		
LmfIdentification	3GPP TS 29.572 [12]		
LcsServiceType	3GPP TS 29.572 [12]		
VelocityRequested	3GPP TS 29.572 [12]		
LcsPriority	3GPP TS 29.572 [12]		
VelocityEstimate	3GPP TS 29.572 [12]		
TerminationCause	3GPP TS 29.572 [12]		
PositioningMethodAndUsage	3GPP TS 29.572 [12]		
GnssPositioningMethodAndUsage	3GPP TS 29.572 [12]		
LcsServiceAuth	3GPP TS 29.571 [11]		
Ecgi	3GPP TS 29.571 [11]		
Ncgi	3GPP TS 29.571 [11]		
Altitude	3GPP TS 29.572 [12]	Altitude	
BarometricPressure	3GPP TS 29.572 [12]	Barometric pressure	
MinorLocationQoS	3GPP TS 29.572 [12]	Minor Location QoS	MUTIQOS
LocationPrivacyVerResult	3GPP TS 29.518 [20]		
ExternalGroupId	3GPP TS 29.571 [11]	External Group Identifier	
GroupId	3GPP TS 29.571 [11]	Group Identifier	
CivicAddress	3GPP TS 29.572 [12]	Civic Address	
GeographicArea	3GPP TS 29.572 [12]	Geographic Area	
LocalArea	3GPP TS 29.572 [12]	Local area specified by different shape	
RedirectResponse	3GPP TS 29.571 [11]		
DateTime	3GPP TS 29.571 [11]	Date and Time	
HighAccuracyGnssMetrics	3GPP TS 29.572 [12]	High Accuracy GNSS Metrics	

6.1.5.2 Structured data types

6.1.5.2.1 Introduction

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

6.1.5.2.2 Type: InputData

Table 6.1.5.2.2-1: Definition of type InputData

Attribute name	Data type	P	Cardinality	Description	Applicability
gpsi	Gpsi	O	0..1	Generic Public Subscription Identifier (NOTE 3).	
supi	Supi	O	0..1	Subscription Permanent Identifier (NOTE 3).	
extGroupId	ExternalGroupId	O	0..1	This IE may be present when requesting LCS service for a group of target UEs, if present this IE shall contain the External Group ID (NOTE 3).	
intGroupId	GroupId	O	0..1	This IE may be present when requesting LCS service for a group of target UEs, if present this IE shall contain the Internal Group ID (NOTE 3).	
externalClientType	ExternalClientType	M	1	This IE shall contain LCS client type	
locationQoS	LocationQoS	O	0..1	Requested location QoS Multiple QoS Class (lcsQosClass sets to "MULTIPLE_QOS") shall only be used when GMLC support MUTIQOS feature.	
supportedGADShapes	array(SupportedGADShapes)	O	1..N	Supported Geographical Area Description shapes	
serviceIdentity	ServiceIdentity	O	0..1	Service identity	
serviceCoverage	array(E164CountryCodeOfGeographicArea)	O	1..N	A list of E.164 country codes for geographic areas (see ITU Recommendation E.164 [13]) where the LCS client is permitted to request and receive UE location information.	
ldrType	LdrType	C	0..1	Location deferred request event type	
periodicEventInfo	PeriodicEventInfo	C	0..1	Periodic event information of the location request for a target UE	
areaEventInfo	AreaEventInfoExt	C	0..1	Area event information of the location request for a target UE	
motionEventInfo	MotionEventInfo	C	0..1	Motion event information of the location request for a target UE	
ldrReference	LdrReference	C	0..1	Notification correlation ID It shall be present in the request from NEF if it is allocated by NEF for the Deferred 5GC-MT-LR procedure. It shall be present in the request from NEF for requesting location service for a group of UEs. It shall be present in the request to VGMLC for the Deferred 5GC-MT-LR procedure.	
hgmlcCallBackUri	Uri	O	0..1	Notification target address for HGMLC	
eventNotificationUri	Uri	O	0..1	The call-back Uri of NF service consumer (i.e. NEF) for implicit subscription to notification of Eventnotify. This IE should be included and is used to receive the location information for UEs in the group when requesting LCS service for a group of target UEs or requesting deferred 5GC MT LCS service for a single UE.	

externalClientIdentification	ExternalClientIdentification	O	0..1	External LCS client identification	
afId	string	O	0..1	The identification of AF that initiated location request	
uePrivacyRequirements	UePrivacyRequirements	O	0..1	UE privacy requirement	
lcsServiceType	LcsServiceType	O	0..1	LCS service type This IE may be present when being sent from HGMLC to VGMLC. When present, it shall contain the LCS service type, which is mapped from attribute serviceIdentity of the LCS Request by the HGMLC.	
velocityRequested	VelocityRequested	O	0..1	Velocity of the target UE is requested	
priority	LcsPriority	O	0..1	Priority of the location request	
locationTypeRequested	LocationTypeRequested	O	0..1	Requested type of location, applicable to location immediate request (NOTE 2)	
maximumAgeOfLocationEstimate	AgeOfLocationEstimate	O	0..1	Requested maximum age of the location estimate	
amfId	AmfId	O	0..1	The identification of serving AMF	
codeWord	CodeWord	O	0..1	Code word (NOTE 1)	
scheduledLocTime	DateTime	O	0..1	The scheduled time for location determination	
reliableLocReq	boolean	C	0..1	This IE shall be included with the value "true" to indicate that reliable UE location information is required, as specified in 3GPP TS 33.256 [22] clause 5.3.2. When present, this IE shall be set as following: - true: the reliable UE location information is required - false (default): the reliable UE location information is not required	
integrityRequirements	IntegrityRequirements	O	0..1	When present, this IE shall indicate the integrity requirements.	

NOTE 1: Checking of the Codeword in UE applies only when the Codeword parameter is present and when the codeWordCheck parameter (specified in clause 6.1.5.2.7) is present and set to TRUE.
NOTE 2: If the LocationTypeRequested parameter is set to value "NOTIFICATION_VERIFICATION_ONLY", then the lcsServiceAuthInfo attribute in the uePrivacyRequirements IE, if present, shall be set to either "NOTIFICATION_ONLY" or "NOTIFICATION_AND_VERIFICATION_ONLY".
NOTE 3: If retrieving the location for a target UE, the UE identification (attributes gpsi and/or supi) shall be included, if retrieving the UE locations for a target group, the group identification (attributes extGroupId and/or intGroupId), UE identification and group identification shall be included exclusively.

6.1.5.2.3 Type: LocationData

Table 6.1.5.2.3-1: Definition of type LocationData

Attribute name	Data type	P	Cardinality	Description	Applicability
gpsi	Gpsi	O	0..1	Generic Public Subscription Identitfier	
supi	Supi	O	0..1	Subscription Permanent Identifier	
locationEstimate	GeographicArea	O	0..1	Geographic area of the target UE	
civicAddress	CivicAddress	O	0..1	Civic address of the target UE	
localLocationEstimate	LocalArea	O	0..1	When present, this IE shall indicate a local area in renference system.	
ageOfLocationEstimate	AgeOfLocationEstimate	O	0..1	Age of location estimate	
timestampOfLocationEstimate	DateTime	O	0..1	When present, this IE shall indicate the estimated UTC time when the location estimate corresponded to the UE location (i.e. when the location estimate and the actual UE location was the same).	
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.	
accuracyFulfilmentIndicator	AccuracyFulfilmentIndicator	O	0..1	The indication whether the obtained location estimate satisfies the requested accuracy or not	
ueVelocity	VelocityEstimate	O	0..1	Responded UE velocity, if requested and available	
ldrReference	LdrReference	C	0..1	Notification correlation ID It shall be present in the response to NEF if it is allocated by HGMLC for the the Deferred 5GC-MT-LR procedure.	
altitude	Altitude	C	0..1	If present, this IE indicates the altitude of the positioning estimate. This IE shall be sent from (V)GMLC to (H)GMLC if received by VGMLC from AMF when roaming.	
servingLMFIdentification	LMFIdentification	C	0..1	If present, this IE contains the identification of a serving LMF for periodic or triggered location. This IE shall be sent from (V)GMLC to (H)GMLC if received by VGMLC from AMF when roaming.	

locationPrivacyVerResult	LocationPrivacyVerResult	C	0..1	If present, this IE contains the result of location privacy verification by UE. The IE shall be included from (V)GMLC to (H)GMLC if received from the serving AMF by (V)GMLC when roaming and a location request with notification and privacy verification only indication is sent to the serving AMF via (V)GMLC by (H)GMLC during location request procedure..	
successType	SuccessType	C	0..1	This IE is only used for requesting LCS service for a group, and shall be present to indicate one of the following value. - SUCCESS_COMPLETELY - SUCCESS_PARTIALLY The value "SUCCESS_COMPLETELY" indicates that requesting/subscribing to LCS service is successful for all the UE(s) within the group identified by the external/internal group ID. The value "SUCCESS_PARTIALLY" indicates that requesting/subscribing to LCS service is only successful for a part of the UE(s) within the group identified by the external/internal group ID. The default value of this attribute is "SUCCESS_COMPLETELY" if this IE is not present.	
achievedQos	MinorLocationQoS	O	0..1	When present, this IE shall contain the achieved Location QoS Accuracy of the estimated location. This IE shall be present if received.	MUTIQOS
acceptedPeriodicEventInfo	PeriodicEventInfo	C	0..1	This IE shall be present if received from AMF/LMF. When present, this IE shall provide the accepted periodic event reporting information.	

haGnssMetrics	HighAccuracyGnssMetrics	C	0..1	This IE should be included when received from LMF/AMF. When present, this IE shall indicate the high accuracy GNSS metrics for the location estimate.	
integrityResult	IntegrityResult	C	0..1	This IE should be present when the integrity requirements are present in the request. When present, this IE shall indicate the integrity result.	

6.1.5.2.4 Type: CancelLocData

Table 6.1.5.2.4-1: Definition of type CancelLocData

Attribute name	Data type	P	Cardinality	Description	Applicability
supi	Supi	O	0..1	This IE may be present when requesting cancellation of LCS service for a single UE. When present, this IE shall contain the Subscription Permanent Identifier of the target UE. (NOTE).	
gpsi	Gpsi	O	0..1	This IE may be present when requesting cancellation of LCS service for a single UE. When present, this IE shall contain the Generic Public Subscription identifier of the target UE. (NOTE).	
extGroupId	ExternalGroupId	O	0..1	This IE may be present when requesting cancellation of LCS service for a group of target UEs. When present this IE shall contain the External Group ID (NOTE).	
intGroupId	GroupId	O	0..1	This IE may be present when requesting cancellation of LCS service for a group of target UEs. When present this IE shall contain the Internal Group ID (NOTE).	
hgmlcCallBackUri	Uri	M	1	Notification target address	
ldrReference	LdrReference	M	1	LDR Reference	
lmfIdentification	LmfIdentification	O	0..1	The latest LMF identification received	
amfId	AmfId	O	0..1	The identification of the serving AMF	
NOTE: If cancelling the location for a target UE, the UE identification (attributes gpsi and/or supi) shall be included, if cancelling the UE locations for a target group, the group identification (attributes extGroupId and/or intGroupId), UE identification and group identification shall be included exclusively.					

6.1.5.2.5 Type: LocUpdateData

Table 6.1.5.2.5-1: Definition of type LocUpdateData

Attribute name	Data type	P	Cardinality	Description	Applicability
supi	Supi	O	0..1	Subscription Permanent Identifier	
gpsi	Gpsi	O	0..1	Generic Public Subscription identitfier	
pseudonymIndicator	PseudonymIndicator	O	0..1	Pseudonym indicator	
locationRequestType	LocationRequestType	M	1	Event causing the location estimate (5GC-MO-LR)	
locationEstimate	GeographicArea	M	1	Geographic area of the target UE	
ageOfLocationEstimate	AgeOfLocationEstimate	M	1	Age of location estimate	
timestampOfLocationEstimate	DateTime	O	0..1	When present, this IE shall indicate the estimated UTC time when the location estimate corresponded to the UE location (i.e. when the location estimate and the actual UE location was the same).	
accuracyFulfilmentIndicator	AccuracyFulfilmentIndicator	M	1	The indication whether the obtained location estimate satisfies the requested accuracy or not	
civicAddress	CivicAddress	O	0..1	Civic address of the target UE	
lcsQosClass	LcsQosClass	M	1	The LCS QoS Class requested by the target UE	
externalClientIdentification	ExternalClientIdentification	O	0..1	Identity of the LCS client	
afId	string	O	0..1	Identity of the AF	
gmlcNumber	string	C	0..1	This IE shall be included by the AMF in the request to V-GMLC, if the "mlc-number" IE is received in MO request from the UE. When present, this IE shall contain the GMLC Number (in E.164 international number format) indicated in the "mlc-number" IE of the MO request from the UE. The V-GMLC may query NRF to obtain the H-GMLC using the GMLC Number. Pattern: "^[0-9]{5,15}$"	
lcsServiceType	LcsServiceTypeId	O	0..1	When present, this IE shall contain the LCS Service Type received from the UE, as specified in clause 6.2 of 3GPP TS 23.273 [4]. When received, the H-GMLC shall map the received LCS Service Type to the Service Identity in Location Update Notification.	

6.1.5.2.6 Type: EventNotifyData

Table 6.1.5.2.6-1: Definition of type EventNotifyData

Attribute name	Data type	P	Cardinality	Description	Applicability
supi	Supi	O	0..1	Subscription Permanent Identifier	
gpsi	Gpsi	O	0..1	Generic Public Subscription Identifier	
ldrReference	LdrReference	M	1	LDR Reference	
eventNotifyDataType	EventNotifyDataType	M	1	The type of event that triggers event notification	
locationEstimate	GeographicArea	O	0..1	Geographic area of the target UE	
civicAddress	CivicAddress	O	0..1	Civic address of the target UE	
localLocationEstimate	LocalArea	O	0..1	When present, this IE shall indicate a local area in renference system.	
ageOfLocationEstimate	AgeOfLocationEstimate	O	0..1	Age of location estimate	
timestampOfLocationEstimate	DateTime	O	0..1	When present, this IE shall indicate the estimated UTC time when the location estimate corresponded to the UE location (i.e. when the location estimate and the actual UE location was the same).	
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.	
lmfIdentification	LmfIdentification	O	0..1	LMF identification that stores the location context of the target UE	
amfId	AmfId	O	0..1	The identification of AMF that is serving the target UE	
terminationCause	TerminationCause	C	0..1	The IE shall be included if event reporting has been terminated	
velocityEstimate	VelocityEstimate	C	0..1	If present, this IE contain an estimate of the velocity of the target UE, composed by horizontal speed, vertical speed, and their respective uncertainty. This IE shall be sent from (V)GMLC to (H)GMLC if received by VGMLC from AMF when roaming.	
altitude	Altitude	C	0..1	If present, this IE indicates the altitude of the positioning estimate. This IE shall be sent from (V)GMLC to (H)GMLC if received by VGMLC from AMF when roaming.	

targetNode	NfInstanceId	C	0..1	For mobility of a UE with periodic or triggered location, this IE contains the address of the new serving node and shall be sent from (V)GMLC to (H)GMLC if received by VGMLC from AMF when roaming.	
accuracyFulfilmentIndicator	AccuracyFulfilmentIndicator	O	0..1	The indication whether the obtained location estimate satisfies the requested accuracy or not	
failureCause	FailureCause	C	0..1	This IE shall contain the failure cause for the UE if present. The IE shall be included if positioning has failed for the target UE in the target group.	
achievedQos	MinorLocationQoS	O	0..1	When present, this IE shall contain the achieved Location QoS Accuracy of the estimated location. This IE shall be present if received.	MUTIQOS
haGnssMetrics	HighAccuracyGnssMetrics	C	0..1	This IE should be included when received from LMF/AMF. When present, this IE shall indicate the high accuracy GNSS metrics for the location estimate.	
integrityResult	IntegrityResult	C	0..1	This IE should be present when the integrity requirements are present in the request. When present, this IE shall indicate the integrity result.	

6.1.5.2.7 Type: UePrivacyRequirements

Table 6.1.5.2.7-1: Definition of type UePrivacyRequirements

Attribute name	Data type	P	Cardinality	Description	Applicability
lcsServiceAuthInfo	LcsServiceAuth	O	0..1	When present, this IE shall contain an indication of privacy related notification or verification for the target UE. The default value of this parameter if not presents is "LOCATION_ALLOWED_WITHOUT_NOTIFICATION".	
codeWordCheck	boolean	O	0..1	When present, it shall indicate whether the Codeword parameter shall be checked in UE. (NOTE)	
NOTE: Checking of the Codeword in UE applies only when the Codeword parameter (specified in clause 6.1.5.2.2) is present and when the codeWordCheck parameter is present and set to TRUE.					

6.1.5.2.8 Void

6.1.5.2.9 Type: LocUpdateNotification

Table 6.1.5.2.9-1: Definition of type LocUpdateNotification

Attribute name	Data type	P	Cardinality	Description	Applicability
supi	Supi	O	0..1	Subscription Permanent Identifier	
gpsi	Gpsi	O	0..1	Generic Public Subscription identitfier	
locationRequestType	LocationRequestType	M	1	Event causing the location estimate (5GC-MO-LR)	
locationEstimate	GeographicArea	M	1	geographic area of the target UE	
ageOfLocationEstimate	AgeOfLocationEstimate	M	1	Age of location estimate	
timestampOfLocationEstimate	DateTime	O	0..1	When present, this IE shall indicate the estimated UTC time when the location estimate corresponded to the UE location (i.e. when the location estimate and the actual UE location was the same).	
accuracyFulfilmentIndicator	AccuracyFulfilmentIndicator	M	1	The indication whether the obtained location estimate satisfies the requested accuracy or not	
civicAddress	CivicAddress	O	0..1	Civic address of the target UE	
lcsQosClass	LcsQosClass	M	1	The LCS QoS Class requested by the target UE	
afId	string	O	0..1	Identity of the AF	
serviceIdentity	ServiceIdentity	O	0..1	When present, this IE shall contain Service Identity mapped from the LCS Service Type specified by the UE, as specified in clause 6.2 of 3GPP TS 23.273 [4].	

6.1.5.2.10 Type: LocUpdateSubs

Table 6.1.5.2.10-1: Definition of type LocUpdateSubs

Attribute name	Data type	P	Cardinality	Description	Applicability
nfInstanceId	NfInstanceId	M	1	Identity of the NF Instance creating the subscription.	
notifUri	Uri	M	1	The URI via which the NF service consumer wants to receive notifications related to this subscription.	
supi	Supi	C	0..1	SUPI of the UE concerned by the subscription. This attribute shall be present if the gpsi attribute is not present.	
gpsi	Gpsi	C	0..1	GPSI of the UE concerned by the subscription. This attribute shall be present if the supi attribute is not present.	

6.1.5.2.11 Type: EventNotifyDataAdditionalInfo

Table 6.1.5.2.11-1: Definition of type EventNotifyDataAdditionalInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
addEventDataList	array(EventNotifyData)	O	1..N	When present, this IE shall include a list of event reports of the additional UE(s) which belong to the target group.	

6.1.5.2.12 Type: EventNotifyDataExt

Table 6.1.5.2.12-1: Definition of type EventNotifyDataExt as a list of to be combined data

Data type	Cardinality	Description	Applicability
EventNotifyData	1	Event Notification Data	
EventNotifyDataAdditionalInfo	1	Additional information of the Event Notification Data	

6.1.5.2.13 Type: AreaEventInfoAddition

Table 6.1.5.2.13-1: Definition of type AreaEventInfoAddition

Attribute name	Data type	P	Cardinality	Description
geoAreaList	array(GeographicArea)	O	1..N	One or more geographic areas for location reporting event
ignoreAreaDefInd	boolean	O	0..1	Indicating whether the "areaDefinition" IE in AreaEventInfoExt combined data type shall be ignored or not: - true: the "areaDefinition" IE shall be ignored. - false (default)" the "areaDefinition" IE shall not be ignored.

6.1.5.2.14 Type: AreaEventInfoExt

Table 6.1.5.2.14-1: Definition of type AreaEventInfoExt as a list of to be combined data

Data type	Cardinality	Description	Applicability
AreaEventInfo	1	Area Event Information	
AreaEventInfoAddition	1	Addition information for Extended Area Event Information	

6.1.5.2.15 Type: IntegrityRequirements

Table 6.1.5.2.15-1: Definition of type IntegrityRequirements

Attribute name	Data type	P	Cardinality	Description
targetIntegrityRisk	TargetIntegrityRisk	O	0..1	This IE shall indicate Target Integrity Risk (TIR), as specified in 3GPP TR 37.355 [23].
timeToAlert	TimeToAlert	O	0..1	This IE shall indicate the Time-to-Alert (TTA).
alertLimit	AlertLimit	O	0..1	This IE shall indicate Alert Limit (AL), as specified in 3GPP TS 37.355 [23].

6.1.5.2.16 Type: AlertLimit

Table 6.1.5.2.16-1: Definition of type AlertLimit

Attribute name	Data type	P	Cardinality	Description
horizontalProtectionLevel	HorizontalProtectionLevel	M	1	This IE shall indicate the Horizontal Protection Level, as specified in 3GPP TS 37.355 [23].
verticalProtectionLevel	VerticalProtectionLevel	O	0..1	This IE shall indicate the Vertical Protection Level, as specified in 3GPP TS 37.355 [23].

6.1.5.2.17 Type: IntegrityProtectionLevel

Table 6.1.5.2.17-1: Definition of type IntegrityProtectionLevel

Attribute name	Data type	P	Cardinality	Description
horizontalProtectionLevel	HorizontalProtectionLevel	M	1	This IE shall indicate the Horizontal Protection Level, as specified in 3GPP TS 37.355 [23].
verticalProtectionLevel	VerticalProtectionLevel	O	0..1	This IE shall indicate the Vertical Protection Level, as specified in 3GPP TS 37.355 [23].

6.1.5.2.18 Type: IntegrityResult

Table 6.1.5.2.18-1: Definition of type IntegrityResult

Attribute name	Data type	P	Cardinality	Description
computingEntity	IntegrityComputingEntity	O	0..1	When present, this IE shall indicate the entity(ies) who calculated (and determined) the integrity result.
portectionLevel	IntegrityProtectionLevel	C	0..1	When present, this IE shall indicate the calculated PL, based on the measurement, assistance information and TIR. (NOTE)
integrityReqMetInd	boolean	C	0..1	When present, this IE shall indicate whether the integrity requirements in the request are met or not: - true: the integrity requirements were met. - false: the integrity requiremesnt were not met. (NOTE)
achievedTir	TargetIntegrityRisk	O	0..1	The IE may be present when the integrityReqMetInd IE is present with the value false. When present, this IE shall indicate the achieved Target Integrity Risk (TIR).
NOTE: Either the "protectionLevel" IE or the "integrityReqMetInd" IE shall be present.				

6.1.5.3 Simple data types and enumerations

6.1.5.3.1 Introduction

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

6.1.5.3.2 Simple data types

The simple data types defined in table 6.1.5.3.2-1 shall be supported.

Table 6.1.5.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability
ServiceIdentity	string	Service identity	
ExternalClientIdentification	string	External LCS client identification	
CodeWord	string	codeword	
E164CountryCodeOfGeographicArea	string	The combination of one, two or three digits identifying a specific country, countries in an integrated numbering plan, or a specific geographic area	
LcsServiceTypeId	integer	LCS Service Type Id, as specified clause 7.6.11.15 of 3GPP TS 29.002 [xx]. Minimum = 0. Maximum = 127	
TimeToAlert	integer	Time-to-Alert Minimum = 1. Maximum = 300	
TargetIntegrityRisk	integer	Target Integrity Risk Minimum = 10. Maximum = 90	
HorizontalProtectionLevel	integer	Horizontal Protection Level Minimum = 0. Maximum = 50000	
VerticalProtectionLevel	integer	Vertical Protection Level Minimum = 0. Maximum = 50000	

6.1.5.3.3 Enumeration: PseudonymIndicator

The enumeration PseudonymIndicator represents whether pseudonym should be used as the identity of the target UE. It shall comply with the provisions defined in table 6.1.5.3.3-1.

Table 6.1.5.3.3-1: Enumeration PseudonymIndicator

Enumeration value	Description	Applicability
"PSEUDONYM_REQUESTED"	A pseudonym is requested	
"PSEUDONYM_NOT_REQUESTED"	A pseudonym is not requested	

6.1.5.3.4 Enumeration: LocationRequestType

The enumeration LocationRequestType represents how the location request is triggered. It shall comply with the provisions defined in table 6.1.5.3.4-1.

Table 6.1.5.3.4-1: Enumeration LocationRequestType

Enumeration value	Description	Applicability
"NI-LR"	Network induced location request	
"MT-LR"	Mobile terminated location request	
"MO-LR"	Mobile originated location request	

6.1.5.3.5 Enumeration: LocationTypeRequested

The enumeration LocationTypeRequested represents the requested type of location which is only applicable to location immediate request. It shall comply with the provisions defined in table 6.1.5.3.5-1.

Table 6.1.5.3.5-1: Enumeration LocationTypeRequested

Enumeration value	Description	Applicability
"CURRENT_LOCATION"	Requesting the current location of the target UE	
"CURRENT_OR_LAST_KNOWN_LOCATION"	Requesting the current or last known location of the target UE	
"INITIAL_LOCATION"	Requesting the initial location of the target UE	
"NOTIFICATION_VERIFICATION_ONLY"	Requesting notification verification only	

6.1.5.3.6 Enumeration: EventNotifyDataType

The enumeration EventNotifyDataType represents the type of event notification. It shall comply with the provisions defined in table 6.1.5.3.6-1.

Table 6.1.5.3.6-1: Enumeration EventNotifyDataType

Enumeration value	Description	Applicability
"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	
"MAXIMUM_INTERVAL_EXPIRATION_EVENT"	Expiration of maximum reporting interval event	
"LOCATION_CANCELLATION_EVENT"	Cancellation of location reporting event	
"ACTIVATION_OF_DEFERRED_LOCATION"	A confirmation that periodic or triggered location was successfully activated in the target UE	
"UE_MOBILITY_FOR_DEFERRED_LOCATION"	Mobility of the target UE to a different NF	
"5GC_MT_LR"	Report of immediate 5GC mobile terminated location. It is used for 5GC_MT_LR request targeting to a group of UE procedure.	

6.1.5.3.7 Enumeration: FailureCause

The enumeration FailureCause represents the cause of positioning failure. It shall comply with the provisions defined in table 6.1.5.3.7-1.

Table 6.1.5.3.7-1: Enumeration FailureCause

Enumeration value	Description	Applicability
"POSITIONING_DENIED"	Positioning is denied	
"UNSUPPORTED_BY_UE"	Positioning is not supported by UE	
"NOT_REGISTED_UE"	UE doesn't register	
"UNSPECIFIED"	Unspecified	

6.1.5.3.8 Enumeration: SuccessType

The enumeration SuccessType represents the type of success. It shall comply with the provisions defined in table 6.1.5.3.8-1.

Table 6.1.5.3.8-1: Enumeration SuccessType

Enumeration value	Description	Applicability
"SUCCESS_COMPLETELY"	It is completely successful.	
"SUCCESS_PARTIALLY"	It is partially successful.	

6.1.5.3.9 Enumeration: IntegrityComputingEntity

The enumeration IntegrityComputingEntity represents the entity who calculated (and determined) the integrity result. It shall comply with the provisions defined in table 6.1.5.3.9-1.

Table 6.1.5.3.9-1: Enumeration IntegrityComputingEntity

Enumeration value	Description
"UE"	Indicates that the Integrity result was calculated (and determined) by the UE.
"LMF"	Indicates that the Integrity result was calculated (and determined) by the LMF.
"BOTH"	Indicates that the Integrity result was calculated (and determined) by both the UE and the LMF.

6.1.6 Error Handling

6.1.6.1 General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [5].

6.1.6.2 Protocol Errors

Protocol errors handling shall be supported as specified in clause 5.2.7 of 3GPP TS 29.500 [5].

6.1.6.3 Application Errors

The application errors defined for the Ngmlc_Location service are listed in Table 6.1.6.3-1.

Table 6.1.6.3-1: 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	the position request for periodic or triggered location is not supported by the target UE
LOCATION_SESSION_UNKNOWN	403 Forbidden	the location context was not found
UNREQUESTED_BY_UE	403 Forbidden	the UE did not request transfer of its location to an LCS Client or AF
UNKOWN_EXTERNAL_CLIENT_OR_AF	403 Forbidden	the external LCS client or AF is unknown
UNREACHABLE_EXTERNAL_CLIENT_OR_AF	403 Forbidden	the external LCS client or AF is unreachable
DETACHED_USER	403 Forbidden	the user is deregistered in the AMF
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
PEER_NOT_RESPONDING	504 Gateway Timeout	No response is received from a remote peer, i.e., 1) The response from the serving AMF wasn't received by (V)GMLC, or; 2) (V)GMLC received HTTP status code 504 with PEER_NOT_RESPONDING from AMF.

6.1.7 Feature negotiation

The optional features in table 6.1.7-1 are defined for the Ngmlc_Location API.

Table 6.1.7-1: Supported Features

Feature number	Feature Name	Description
1	MUTIQOS	Support of Multiple Location QoSes. This feature bit indicates whether the GMLC support that more than one Location QoSes during consuming location service are required.

6.1.8 Security

As indicated in 3GPP TS 33.501 [15], the access to the Ngmlc_Location API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [16]), using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [17]) plays the role of the authorization server.

If Oauth2 authorization is used, an NF Service Consumer, prior to consuming services offered by the Ngmlc_Location API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [17], 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 Ngmlc_Location service.

The Ngmlc_Location API defines scopes for OAuth2 authorization as specified in 3GPP TS 33.501 [15]; it defines a single scope consisting on the name of the service (i.e., "ngmlc-loc"), and it does not define any additional scopes at resource or operation level.

6.1.9 HTTP redirection

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

An SCP that reselects a different GMLC producer instance will return the NF Instance ID of the new GMLC 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 GMLC within an GMLC set redirects a service request to a different GMLC of the set using an 307 Temporary Redirect or 308 Permanent Redirect status code, the identity of the new GMLC 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 Ngmlc_Location service. It consists of OpenAPI 3.0.0 specifications, in YAML format.

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

NOTE: 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 [6] clause 5.3.1 and 3GPP TR 21.900 [19] clause 5B).

A.2 Ngmlc_Location API

```
openapi: 3.0.0
info:
  version: '1.1.4'
  title: 'Ngmlc_Location'
  description: |
    GMLC Location Service.
    © 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: 3GPP TS 29.515 V17.10.0; 5G System; Gateway Mobile Location Services; Stage 3
  url: 'https://www.3gpp.org/ftp/Specs/archive/29_series/29.515/'

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

security:
  - {}
  - oAuth2ClientCredentials:
      - ngmlc-loc

paths:
  /provide-location:
    post:
      summary: Request Location of an UE
      operationId: RequestLocation
      tags:
        - Request 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'
        '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/EventNotifyDataExt'
          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:
              $ref: 'TS29571_CommonData.yaml#/components/responses/default'
    EventNotifyNef:
      '{$request.body#/eventNotificationUri}':
        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-update:
    post:
      summary: update UE location information
      operationId: UpdateLocation
      tags:
```

```
      - Update Location
    requestBody:
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/LocUpdateData'
      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'
  /loc-update-subs:
    post:
      summary: subscribe to notifications of UE location information
      operationId: LocationUpdateSubcribe
      tags:
        - UE location information Subscription creation
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/LocUpdateSubs'
        required: true
      responses:
        '204':
          description: Expected response to successful UE location information subscription
        '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:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
      callbacks:
        LocationUpdateNotify:
          '{$request.body#/notifUri}':
            post:
              requestBody:
                description: Location Update Notification
                content:
                  application/json:
                    schema:
                      $ref: '#/components/schemas/LocUpdateNotification'
              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'

components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            ngmlc-loc: Access to the Ngmlc_Location API

  schemas:
#
# COMPLEX TYPES
#
    InputData:
      description: Contains the input parameters in ProvideLocation service operation
      type: object
      required:
        - externalClientType
      properties:
        gpsi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        extGroupId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ExternalGroupId'
        intGroupId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/GroupId'
        externalClientType:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/ExternalClientType'
        locationQoS:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/LocationQoS'
        supportedGADShapes:
```

```
        type: array
        items:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/SupportedGADShapes'
        minItems: 1
      serviceIdentity:
        $ref: '#/components/schemas/ServiceIdentity'
      serviceCoverage:
        type: array
        items:
          $ref: '#/components/schemas/E164CountryCodeOfGeographicArea'
        minItems: 1
      ldrType:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/LdrType'
      periodicEventInfo:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/PeriodicEventInfo'
      areaEventInfo:
        $ref: '#/components/schemas/AreaEventInfoExt'
      motionEventInfo:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/MotionEventInfo'
      ldrReference:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/LdrReference'
      hgmlcCallBackUri:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
      eventNotificationUri:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
      externalClientIdentification:
        $ref: '#/components/schemas/ExternalClientIdentification'
      afId:
        type: string
      uePrivacyRequirements:
        $ref: '#/components/schemas/UePrivacyRequirements'
      lcsServiceType:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/LcsServiceType'
      velocityRequested:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/VelocityRequested'
      priority:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/LcsPriority'
      locationTypeRequested:
        $ref: '#/components/schemas/LocationTypeRequested'
      maximumAgeOfLocationEstimate:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/AgeOfLocationEstimate'
      amfId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/AmfId'
      codeWord:
        $ref: '#/components/schemas/CodeWord'
      scheduledLocTime:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      reliableLocReq:
        type: boolean
        default: false
      integrityRequirements:
        $ref: '#/components/schemas/IntegrityRequirements'



    LocationData:
      description: Contains the response parameters in ProvideLocation service operation
      type: object
      properties:
        gpsi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        locationEstimate:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/GeographicArea'
        civicAddress:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/CivicAddress'
        localLocationEstimate:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/LocalArea'
        ageOfLocationEstimate:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/AgeOfLocationEstimate'
        timestampOfLocationEstimate:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        positioningDataList:
          type: array
          items:
            $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/PositioningMethodAndUsage'
          minItems: 1
```

```
      gnssPositioningDataList:
        type: array
        items:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/GnssPositioningMethodAndUsage'
        minItems: 1
      accuracyFulfilmentIndicator:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/AccuracyFulfilmentIndicator'
      ueVelocity:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/VelocityEstimate'
      ldrReference:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/LdrReference'
      altitude:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/Altitude'
      servingLMFIdentification:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/LMFIdentification'
      locationPrivacyVerResult:
        $ref: 'TS29518_Namf_Location.yaml#/components/schemas/LocationPrivacyVerResult'
      successType:
        $ref: '#/components/schemas/SuccessType'
      achievedQos:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/MinorLocationQoS'
      acceptedPeriodicEventInfo:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/PeriodicEventInfo'
      haGnssMetrics:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/HighAccuracyGnssMetrics'
      integrityResult:
        $ref: '#/components/schemas/IntegrityResult'

    CancelLocData:
      description: Contains the input parameters in CancelLocation service operation
      type: object
      required:
        - hgmlcCallBackUri
        - ldrReference
      properties:
        gpsi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        extGroupId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ExternalGroupId'
        intGroupId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/GroupId'
        hgmlcCallBackUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        ldrReference:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/LdrReference'
        lmfIdentification:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/LMFIdentification'
        amfId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/AmfId'

    LocUpdateData:
      description: Contains the input parameters in LocationUpdate service operation
      type: object
      required:
        - locationRequestType
        - locationEstimate
        - ageOfLocationEstimate
        - accuracyFulfilmentIndicator
        - lcsQosClass
      properties:
        gpsi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        pseudonymIndicator:
          $ref: '#/components/schemas/PseudonymIndicator'
        locationRequestType:
          $ref: '#/components/schemas/LocationRequestType'
        locationEstimate:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/GeographicArea'
        ageOfLocationEstimate:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/AgeOfLocationEstimate'
        timestampOfLocationEstimate:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        accuracyFulfilmentIndicator:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/AccuracyFulfilmentIndicator'
```

```
        civicAddress:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/CivicAddress'
        lcsQosClass:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/LcsQosClass'
        externalClientIdentification:
          $ref: '#/components/schemas/ExternalClientIdentification'
        afId:
          type: string
        gmlcNumber:
          type: string
          pattern: '^[0-9]{5,15}$'
        lcsServiceType:
          $ref: '#/components/schemas/LcsServiceTypeId'

    EventNotifyData:
      description: Contains the input parameters for the target UE in EventNotify Notification
service operation
      type: object
      required:
        - eventNotifyDataType
        - ldrReference
      properties:
        gpsi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        ldrReference:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/LdrReference'
        eventNotifyDataType:
          $ref: '#/components/schemas/EventNotifyDataType'
        locationEstimate:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/GeographicArea'
        civicAddress:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/CivicAddress'
        localLocationEstimate:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/LocalArea'
        ageOfLocationEstimate:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/AgeOfLocationEstimate'
        timestampOfLocationEstimate:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        positioningDataList:
          type: array
          items:
            $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/PositioningMethodAndUsage'
          minItems: 1
        gnssPositioningDataList:
          type: array
          items:
            $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/GnssPositioningMethodAndUsage'
          minItems: 1
        lmfIdentification:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/LMFIdentification'
        amfId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/AmfId'
        terminationCause:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/TerminationCause'
        velocityEstimate:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/VelocityEstimate'
        altitude:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/Altitude'
        targetNode:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
        accuracyFulfilmentIndicator:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/AccuracyFulfilmentIndicator'
        failureCause:
          $ref: '#/components/schemas/FailureCause'
        achievedQos:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/MinorLocationQoS'
        haGnssMetrics:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/HighAccuracyGnssMetrics'
        integrityResult:
          $ref: '#/components/schemas/IntegrityResult'

    UePrivacyRequirements:
      description: UE privacy requirements from (H)GMLC to the serving AMF or VGMLC(in the roaming
case) for the target UE
      type: object
      properties:
```

```
      lcsServiceAuthInfo:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/LcsServiceAuth'
      codeWordCheck:
        type: boolean

  LocUpdateNotification:
    description: Location Update Notification
    type: object
    required:
      - locationRequestType
      - locationEstimate
      - ageOfLocationEstimate
      - accuracyFulfilmentIndicator
      - lcsQosClass
    properties:
      gpsi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
      supi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
      locationRequestType:
        $ref: '#/components/schemas/LocationRequestType'
      locationEstimate:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/GeographicArea'
      ageOfLocationEstimate:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/AgeOfLocationEstimate'
      timestampOfLocationEstimate:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      accuracyFulfilmentIndicator:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/AccuracyFulfilmentIndicator'
      civicAddress:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/CivicAddress'
      lcsQosClass:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/LcsQosClass'
      afId:
        type: string
      serviceIdentity:
        $ref: '#/components/schemas/ServiceIdentity'

  LocUpdateSubs:
    description: UE location information subscription
    type: object
    required:
      - nfInstanceId
      - notifURI
    properties:
      nfInstanceId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
      notifURI:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
      gpsi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
      supi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'

  EventNotifyDataExt:
    description: Extended Event Notify Data for UEs of a target group
    allOf:
    - $ref: '#/components/schemas/EventNotifyData'
    - $ref: '#/components/schemas/EventNotifyDataAdditionalInfo'

  EventNotifyDataAdditionalInfo:
    description: Additional information to Event Notify Data
    type: object
    properties:
      addEventDataList:
        type: array
        items:
          $ref: '#/components/schemas/EventNotifyData'
        minItems: 1
  AreaEventInfoAddition:
    description: Additional information for Extended Area event information
    type: object
    properties:
      geoAreaList:
        type: array
        items:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/GeographicArea'
        minItems: 1
```

```
        ignoreAreaDefInd:
          type: boolean
          default: false

    AreaEventInfoExt:
      description: Extended Area Event Information
      allOf:
        - $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/AreaEventInfo'
        - $ref: '#/components/schemas/AreaEventInfoAddition'

    IntegrityRequirements:
      description: integrity requirements.
      type: object
      properties:
        timeToAlert:
          $ref: '#/components/schemas/TimeToAlert'
        targetIntegrityRisk:
          $ref: '#/components/schemas/TargetIntegrityRisk'
        alertLimit:
          $ref: '#/components/schemas/AlertLimit'

    AlertLimit:
      description: Alert Limit.
      type: object
      required:
        - horizontalProtectionLevel
      properties:
        horizontalProtectionLevel:
          $ref: '#/components/schemas/HorizontalProtectionLevel'
        verticalProtectionLevel:
          $ref: '#/components/schemas/VerticalProtectionLevel'

    IntegrityProtectionLevel:
      description: Integrity Protection Level.
      type: object
      required:
        - horizontalProtectionLevel
      properties:
        horizontalProtectionLevel:
          $ref: '#/components/schemas/HorizontalProtectionLevel'
        verticalProtectionLevel:
          $ref: '#/components/schemas/VerticalProtectionLevel'

    IntegrityResult:
      description: Integrity Result.
      type: object
      properties:
        computingEntity:
          $ref: '#/components/schemas/IntegrityComputingEntity'
        protectionLevel:
          $ref: '#/components/schemas/IntegrityProtectionLevel'
        integrityReqMetInd:
          type: boolean
        achievedTir:
          $ref: '#/components/schemas/TargetIntegrityRisk'

#
# SIMPLE TYPES
#
    ServiceIdentity:
      description: Contains the service identity
      type: string
    ExternalClientIdentification:
      description: Contains the external client identification
      type: string
    CodeWord:
      description: Contains the codeword
      type: string
    E164CountryCodeOfGeographicArea:
      description: Contains the E.164 country codes for geographic areas
      type: string
    LcsServiceTypeId:
      description: LCS Service Type Id.
      type: integer
      minimum: 0
      maximum: 127
    TimeToAlert:
      description: Contains the time-to-alert
```

```
      type: integer
      minimum: 1
      maximum: 300
    TargetIntegrityRisk:
      description: Contains the target integrity risk
      type: integer
      minimum: 10
      maximum: 90
    HorizontalProtectionLevel:
      description: Contains the Horizontal Protection Level
      type: integer
      minimum: 0
      maximum: 50000
    VerticalProtectionLevel:
      description: Contains the Vertical Protection Level
      type: integer
      minimum: 0
      maximum: 50000
#
# ENUMS
#
    PseudonymIndicator:
      description: It defines if a pseudonym is requested
      anyOf:
        - type: string
          enum:
            - PSEUDONYM_REQUESTED
            - PSEUDONYM_NOT_REQUESTED
        - type: string
    LocationRequestType:
      description: NI-LR, MT-LR or MO-LR
      anyOf:
        - type: string
          enum:
            - NI_LR
            - MT_LR
            - MO_LR
        - type: string
    LocationTypeRequested:
      description: Contains the location type requested by the LCS client
      anyOf:
        - type: string
          enum:
            - CURRENT_LOCATION
            - CURRENT_OR_LAST_KNOWN_LOCATION
            - INITIAL_LOCATION
            - NOTIFICATION_VERIFICATION_ONLY
        - type: string
    EventNotifyDataType:
      description: Contains the type of event that triggers event notification
      anyOf:
        - type: string
          enum:
            - UE_AVAILABLE
            - PERIODIC
            - ENTERING_INTO_AREA
            - LEAVING_FROM_AREA
            - BEING_INSIDE_AREA
            - MOTION
            - MAXIMUM_INTERVAL_EXPIRATION_EVENT
            - LOCATION_CANCELLATION_EVENT
            - ACTIVATION_OF_DEFERRED_LOCATION
            - UE_MOBILITY_FOR_DEFERRED_LOCATION
            - 5GC_MT_LR
        - type: string
    FailureCause:
      description: Positioning failure cause
      anyOf:
        - type: string
          enum:
            - POSITIONING_DENIED
            - UNSUPPORTED_BY_UE
            - NOT_REGISTED_UE
            - UNSPECIFIED
        - type: string

    SuccessType:
      description: Success Type to indicate full or partial success
```

```
      anyOf:
        - type: string
          enum:
            - SUCCESS_COMPLETELY
            - SUCCESS_PARTIALLY
        - type: string

    IntegrityComputingEntity:
      description: Integrity Computing Entity
      anyOf:
        - type: string
          enum:
            - UE
            - LMF
            - BOTH
        - type: string
```

Annex B (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2019-04	CT4#90	C4-191340				Initial Draft of Gateway Mobile Location Services	0.1.0
2019-05	CT4#91	C4-192485				V0.2.0	0.2.0
2019-09	CT4#93	C4-193845				Implementation of pCRs agreed at CT4#93	0.3.0
2019-10	CT4#94	C4-194555				Implementation of pCRs agreed at CT4#94	0.4.0
2019-11	CT4#95	C4-195413, C4-195409, C4-195296				Implementation of pCRs agreed at CT4#95	0.5.0
2019-12	CT#86	CP-193065				TS presented for information	1.0.0
2020-03	CT4#96e	C4-200725, C4-200727, C4-200943, C4-200993, C4-200995, C4-201286				Implementation of pCRs agreed at CT4#96e	1.1.0
2020-03	CT#87e	CP-200060				TS presented for approval	2.0.0
2020-03	CT#87e					Approved at CT87e	16.0.0
2020-04	CT#87e	C4-202409	0001	1	F	Correct the errors	16.1.0
2020-04	CT#87e	C4-202325	0003	-	F	Miscellaneous corrections on TS 29.515	16.1.0
2020-04	CT#87e	C4-202326	0004	-	F	Removing pseudonym of UE	16.1.0
2020-04	CT#87e	C4-202532	0005	1	F	UE Privacy Requirements Corrections	16.1.0
2020-06	CT#88e	C4-203181	0006	-	F	Error corrections	16.1.0
2020-06	CT#88e	C4-203540	0007	1	F	Storage of YAML files in ETSI Forge	16.1.0
2020-06	CT#88e	C4-203524	0008	1	F	Correct the Example Consumer(s) in Table 5.1-1	16.1.0
2020-06	CT#88e	C4-203269	0010	-	F	LDRreference	16.1.0
2020-06	CT#88e	C4-203360	0003	1	F	Miscellaneous corrections on TS 29.515	16.1.0
2020-06	CT#88e	C4-203645	0011	-	F	3GPP TS 29.515 API Version Update	16.1.0
2020-09	CT#89e	CP-202112	0012	1	F	API name correction	16.2.0
2020-09	CT#89e	CP-202112	0014	1	F	Correction of CodeWord Checking for UE Notification and Verification	16.2.0
2020-09	CT#89e	CP-202112	0015	1	F	Correction of Notification or Verification only for UE Positioning	16.2.0
2020-09	CT#89e	CP-202112	0016	1	F	Corrections on EventNotify service operation	16.2.0
2020-09	CT#89e	CP-202112	0017	1	F	Corrections on Application Errors in provide-location response	16.2.0
2020-09	CT#89e	CP-202112	0018	1	F	Corrections on LocationData	16.2.0
2020-09	CT#89e	CP-202139	0020	2	F	Essential correction to OpenAPI specification for LocationUpdateNotify service operation	16.2.0
2020-09	CT#89e	CP-202096	0021	-	F	API version and External doc update	16.2.0
2020-11	CT#90e	CP-203050	0022	1	F	CancelLocation for a group of UEs	16.3.0
2020-11	CT#90e	CP-203050	0023	2	F	EventNotify for UEs in a group	16.3.0
2020-11	CT#90e	CP-203050	0024	1	F	Provide Locations of a group of UEs	16.3.0
2020-11	CT#90e	CP-203050	0028	-	F	Essential corrections	16.3.0
2020-11	CT#90e	CP-203050	0029	-	F	Storage of YAML files in 3GPP Forge	16.3.0
2020-11	CT#90e	CP-203050	0030	-	F	API version and External doc update	16.3.0
2021-03	CT#91e	CP-210037	0033	1	F	HTTP 3xx redirection	16.4.0
2021-03	CT#91e	CP-210041	0032	1	F	Geographic Area	16.4.0
2021-03	CT#91e	CP-210054	0035	-	F	29.515 Rel-16 API version and External doc update	16.4.0
2021-03	CT#91e	CP-210034	0034	1	F	OpenAPI Reference	17.0.0
2021-06	CT#92e	CP-211026	0036	2	B	Add Local Address	17.1.0
2021-06	CT#92e	CP-211028	0047	-	F	Data Types Descriptions	17.1.0
2021-06	CT#92e	CP-211050	0050	-	F	29.515 Rel-17 API version and External doc update	17.1.0
2021-06	CT#92e	CP-211059	0040	1	A	3xx description correction for SCP	17.1.0
2021-06	CT#92e	CP-211059	0046	1	A	Redirect Responses	17.1.0
2021-06	CT#92e	CP-211063	0038	1	A	LCS Service Type and External Client Type	17.1.0
2021-06	CT#92e	CP-211063	0044	-	A	Remove LcsServiceType	17.1.0
2021-06	CT#92e	CP-211063	0048	-	A	Wrong data type name	17.1.0
2021-09	CT#93e	C4-214712	0056	1	A	LCS Service Type	17.2.0
2021-09	CT#93e	C4-214826	0054	1	B	Multiple QoS Class	17.2.0
2021-09	CT#93e	C4-214766	0057	-	F	29.515 Rel-17 API version and External doc update	17.2.0
2021-12	CT#94e	C4-215455	0059	-	B	Higher Resolution Timestamp for Location Estimates	17.3.0
2021-12	CT#94e	C4-216164	0063	-	A	Correct the table name of SuccessType	17.3.0
2021-12	CT#94e	C4-216520	0065	1	A	Add the missing pseudonymIndicator IE in OpenAPI	17.3.0
2021-12	CT#94e	C4-216534	0067	1	A	Information for HGMLC Discovery	17.3.0
2021-12	CT#94e	CP-213174	0069	2	A	LCS Service Type in MO-LR	17.3.0
2021-12	CT#94e	C4-216481	0070	-	F	29.515 Rel-17 API version and External doc update	17.3.0
2022-03	CT#95e	C4-220339	0074	1	F	Editorial corrections	17.4.0
2022-03	CT#95e	C4-220368	0072	1	B	Schedule location time for GMLC	17.4.0
2022-03	CT#95e	C4-221352	0076	-	F	Editorial corrections	17.4.0
2022-03	CT#95e	C4-221603	0077	-	F	29.515 Rel-17 API version and External doc update	17.4.0
2022-06	CT#96	CP-221022	0079	-	B	Scheduled location time for bulk operation	17.5.0
2022-06	CT#96	CP-221051	0081	-	F	29.515 Rel-17 API version and External doc update	17.5.0

2022-09	CT#97e	CP-222036	0082	1	F	Indication of Network Assisted Positioning method	17.6.0
2022-09	CT#97e	CP-222058	0083	-	F	29.515 Rel-17 API version and External doc update	17.6.0
2023-06	CT#100	CP-231075	0102	1	F	Missing finer periodicities than 1s and an infinite reporting amount	17.7.0
2023-06	CT#100	CP-231085	0115	-	F	29.515 Rel-17 API version and External doc update	17.7.0
2023-09	CT#101	CP-232063	0118	-	F	Missed HA GNSS Metrics Support over SBI	17.8.0
2023-09	CT#101	CP-232062	0123	1	F	Add GNSS integrity requirement	17.8.0
2023-09	CT#101	CP-232074	0126	-	F	29.515 Rel-17 API version and External doc update	17.8.0
2023-12	CT#102	CP-233072	0135	-	A	Incomplete CR implementation	17.9.0
2024-06	CT#104	CP-241056	0165	-	F	Integrity Result	17.10.0
2024-06	CT#104	CP-241063	0185	-	F	29.515 Rel-17 API version and External doc update	17.10.0

History

Document history		
V17.4.0	May 2022	Publication
V17.5.0	July 2022	Publication
V17.6.0	October 2022	Publication
V17.7.0	July 2023	Publication
V17.8.0	September 2023	Publication
V17.9.0	January 2024	Publication
V17.10.0	July 2024	Publication