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Contents

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Foreword

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

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

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2 presented to TSG for approval;

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

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

shall   indicates a mandatory requirement to do something

shall not   indicates an interdiction (prohibition) to do something

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

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

should   indicates a recommendation to do something

should not   indicates a recommendation not to do something

may   indicates permission to do something

need not   indicates permission not to do something

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

can   indicates that something is possible

cannot   indicates that something is impossible

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

will   indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

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

might   indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

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

In addition:

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

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

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

1 Scope

The present document specifies the stage 3 protocol and data model for the 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 9113: "HTTP/2".

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

[10]   IETF RFC 9457: "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".

ETSI

[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)".

[24]   3GPP TS 29.122: "T8 reference point for Northbound APIs".

[25]   void

[26]   3GPP TS 38.305: "NG Radio Access Network (NG-RAN); Stage 2 functional specification of User Equipment (UE) positioning in NG-RAN"

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
LPHAP	Low Power and High Accuracy Positioning
MBSR	Mobile Base Station Relay
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, NEF, NWDAF and LMF via the Ngmlc service based interface (see 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.273 [4]).

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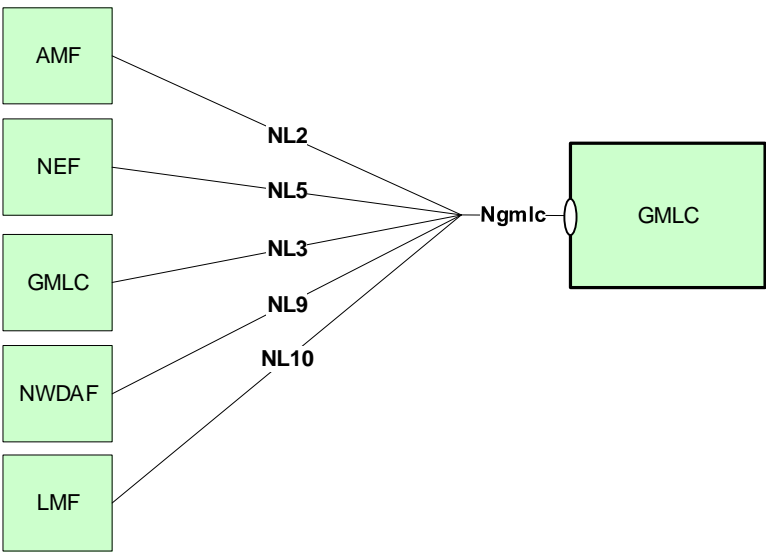
Figure 4-1: Reference model – GMLC

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	V-GMLC, H-GMLC, NEF, NWDAF, LMF, AMF
	LocationUpdate	Request/Response	AMF, V-GMLC
	LocationUpdateNotify	Notify	NEF
	CancelLocation	Request/Response	H-GMLC, NEF, NWDAF
	EventNotify	Notify	H-GMLC, NEF, NWDAF
	PrivacyCheckIdMapping	Request/Response	H-GMLC

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 or to request relative locations, distance, or direction between UEs. 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.

- Allow the consumer NF to perform privacy check and ID mapping of a UE for Ranging SL Positioning service.

- Allow the consumer NF to request the relative locations, distance, or direction between UEs.

5.2.2 Service Operations

5.2.2.1 Introduction

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

- ProvideLocation

- LocationUpdate

- CancelLocation

- EventNotify

- LocationUpdateNotify

- LocationUpdateSubscribe

- PrivacyCheckIdMapping

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 locations of a group of UEs

- Provide locations of a single UE relative to one or more related 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 and 6.1.4)

- Initiation and Reporting of Location Events (see 3GPP TS 23.273 [4], clause 6.3.1, clause 6.16.1)

- Unified Location Service Exposure Procedure without routing by a UDM (see 3GPP TS 23.273 [4], clause 6.5.1)

- Procedures with interaction between 5GC and EPC (see 3GPP TS 23.273 [4], clause 6.13)

- Procedures of SL-MT-LR involving LMF (see 3GPP TS 23.273 [4], clause 6.20.3)

- Procedures of SL-MT-LR for periodic, triggered Location Events (see 3GPP TS 23.273 [4], clause 6.20.4)

- 5GC-MT-LR Procedure using SL positioning (see 3GPP TS 23.273 [4], clause 6.20.5)

The ProvideLocation service operation is invoked by a NF Service Consumer, e.g. a NEF, GMLC NWDAF or LMF, 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.
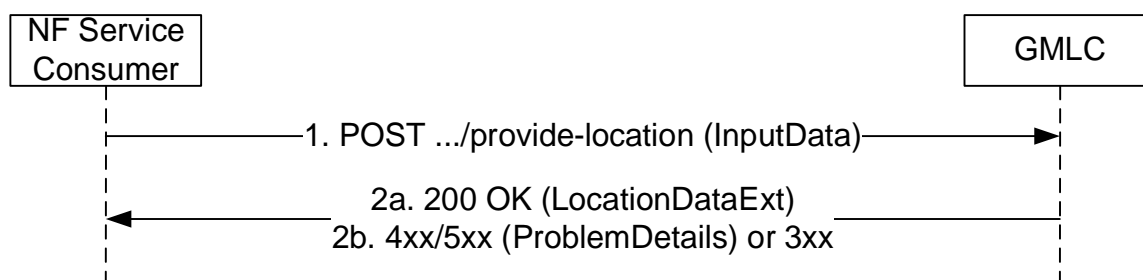

Figure 5.2.2.2.2-1: ProvideLocation Request/Response for a target UE

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, GPSI or Application Layer ID), required QoS, supported GAD shapes, LCS client type, external Service Identity, Codeword, service coverage, LDR type, serving AMF address, LDR reference, scheduled location time, LMF ID, LpHapType, Event Report Expected Area, reporting indication, integrity indication, LOS/NLOS measurement indication, requested ranging_SL location results, related UEs, …) may 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 GMLC, and NEF or NWDAF 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.

   If the request is to use a location reporting via user plane, an indication of the request of location reporting via user plane shall be included in the HTTP POST contents. If the indication of the request of location reporting via user plane is included in the HTTP POST contents, the endpoint address of the user plane for location reporting may be included in the HTTP POST contents. The criteria for sending cumulative event reports over control plane may be included in the contents when the request is sent from H-GMLC to V-GMLC.

   If Multiple Location QoS was requested, the H-GMLC as NF service consumer may perform the Location QoS mapping to obtain the location QoS that can be applicable to EPS based on the original multiple QoS (see clause 6.19 of 3GPP TS 23.273 [4]) and may include the mapped Location QoS applicable to EPS in the request to the V-GMLC as NF service producer.

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 or NWDAF, 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.
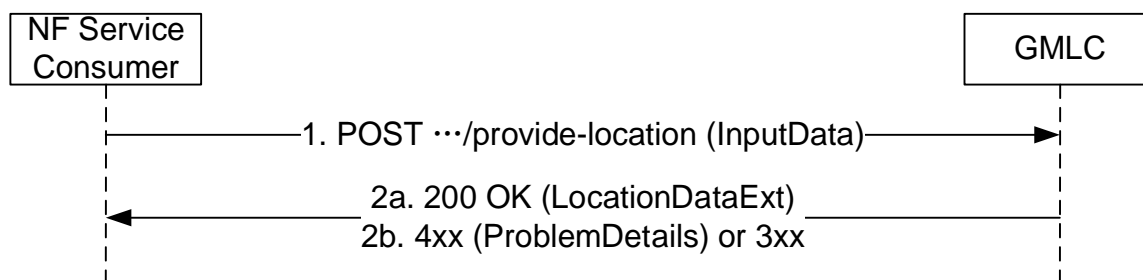

Figure 5.2.2.2.3-1: ProvideLocation Request/Response for a target group

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.

    If the request is to use a location reporting via user plane, an indication of the request of location reporting via user plane shall be included in the HTTP POST contents. If the indication of the request of location reporting via user plane is included in the HTTP POST contents, the endpoint address of the user plane for location reporting may be included in the HTTP POST contents. The criteria for sending cumulative event reports over control plane may be included in the contents when the request is sent from H-GMLC to V-GMLC.

    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)