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**Digital cellular telecommunications system (Phase 2+) (GSM);
Universal Mobile Telecommunications System (UMTS);
LTE;
Location Services (LCS);
Evolved Packet Core (EPC) LCS Protocol (ELP)
between the Gateway Mobile Location Centre (GMLC)
and the Mobile Management Entity (MME);
SLg interface
(3GPP TS 29.172 version 12.6.0 Release 12)**

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Contents

Foreword

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1 Scope

The present document specifies the procedures and information coding for the EPC LCS Protocol (ELP) that is needed to support the location services in E-UTRAN, UTRAN and GERAN. The ELP message set is applicable to the SLg interface between the MME and the GMLC and the Lgd interface between the SGSN and the GMLC. ELP is developed in accordance to the general principles stated in 3GPP TS 23.271 [3].

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 23.271: "Functional stage 2 description of Location Services (LCS)".

[3] 3GPP TS 23.032: "Universal Geographical Area Description (GAD)".

[4] IETF RFC 3588: "Diameter Base Protocol".

[5] IETF RFC 2234: "Augmented BNF for syntax specifications".

[6] 3GPP TS 23.003: "Numbering, addressing and identification".

[7] 3GPP TS 29.171: "LCS Application Protocol (LCS-AP) between the MME and E-SMLC".

[8] 3GPP TS 29.274: "Evolved General Packet Radio Service (GPRS) Tunnelling Protocol for Control plane (GTPv2-C)".

[9] Void

[10] 3GPP TS 32.299: "Charging management; Diameter charging applications".

[11] 3GPP TS 29.272: "Evolved Packet System; MME and SGSN Related Interfaces Based on Diameter Protocol".

[12] 3GPP TS 29.329: "Sh Interface based on the Diameter protocol".

[13] 3GPP TS 33.210: "3G Security; Network Domain Security; IP Network Layer Security".

[14] IETF RFC 4960: "Stream Control Transmission Protocol".

[15] 3GPP TS 22.071: "Location Services (LCS); Service description".

[16] IETF RFC 5778: "Diameter Mobile IPv6: Support for Home Agent to Diameter Server Interaction".

[17] 3GPP TS 29.229: "Cx and Dx Interfaces based on the Diameter protocol; protocol details".

[18] 3GPP TS 29.173: "Location Services; Diameter-based SLh interface for Control Plane LCS".

[19] 3GPP TS 29.002: "Mobile Application Part (MAP) specification".

[20] 3GPP TS 49.031: "Location Services (LCS) – Base Station System Application Part LCS Extension – (BSSAP-LE)".

[21] 3GPP TS 25.413: "UTRAN Iu Interface RANAP signalling".

[22] 3GPP2 A.S0014-D v5.0: "Interoperability Specification (IOS) for cdma2000 Access Network Interfaces – Part 4 (A1, A1p, A2, and A5 Interfaces) UTRAN Iu Interface RANAP signalling".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 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 TR 21.905 [1].

EPC-MO-LR: EPC Mobile Originating Location Request

EPC-MT-LR: EPC Mobile Terminating Location Request

EPC-NI-LR: EPC Network Induced Location Request

PS-MO-LR: Packet Switched Mobile Originating Location Request

PS-MT-LR: Packet Switched Mobile Terminating Location Request

PS-NI-LR: Packet Switched Network Induced Location Request

LCS: LoCation Services

LCS Client: software and/or hardware entity that interacts with a LCS Server (in this case, the GMLC) for the purpose of obtaining location information for one or more Mobile Stations. LCS Clients subscribe to LCS in order to obtain location information. LCS Clients may or may not interact with human users. The LCS Client is responsible for formatting and presenting data and managing the user interface (dialogue). The LCS Client may reside in the Mobile Station (UE).

LCS QoS: The QoS class determines the degree of adherence to the quality of service information as required by the source of a location request.

Target: UE being positioned

3.2 Symbols

For the purposes of the present document, the following symbols apply:

SLg Interface between GMLC and MME
Lgd Interface between GMLC and SGSN

3.3 Abbreviations

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

GMLC Gateway Mobile Location Centre
EPC Enhanced Packet Core
IMEI International Mobile Equipment Identity
IMS IP Multimedia Subsystem
IMSI International Mobile Subscriber Identity
MME Mobility Management Entity
TTTP Transfer To Third Party
UE User Equipment, as defined in 3GPP TS 23.032 [3]

4 Functional Overview

4.1 General

This document defines the EPC LCS Protocol (ELP) used on the SLg interface between the GMLC and the MME and on the Lgd interface between the GMLC and the SGSN in the Evolved Packet Core (EPC).

The location of the SLg interface within the LCS logical architecture is shown in Figure 4.1-1.

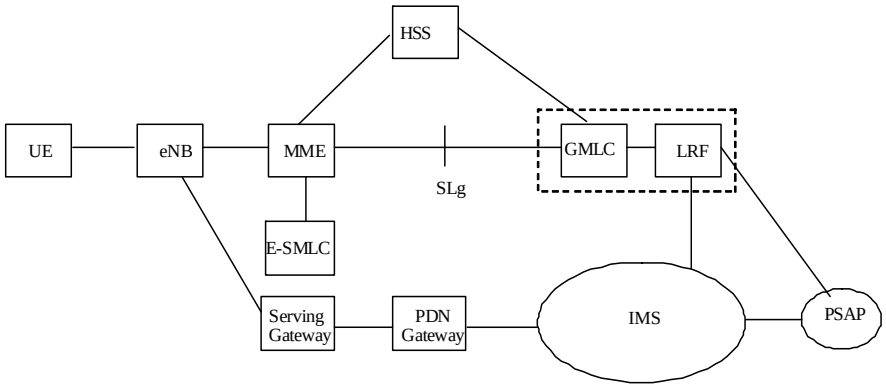

Figure 4.1-1 SLg interface in the LCS Architecture

The location of the Lgd interface within the LCS logical architecture is shown in Figure 4.1-2.

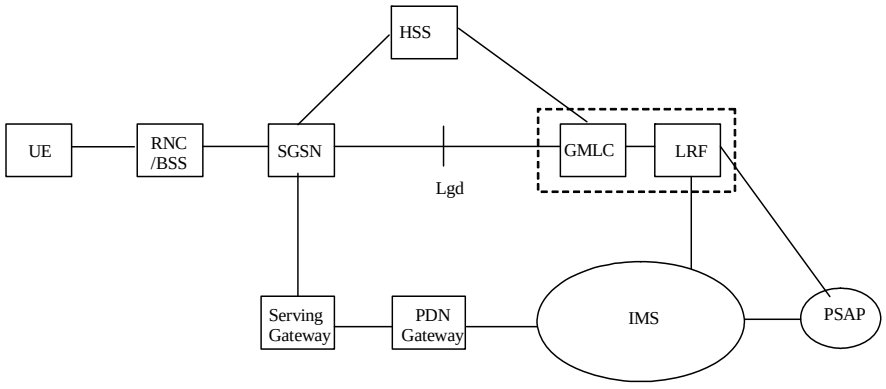

Figure 4.1-2 Lgd interface in the LCS Architecture

The high level functions of the ELP protocol are described in 3GPP TS 23.271 [2].

The main functions of the protocol are:

- To allow the GMLC to request position estimates for a particular target UE from the MME or SGSN in order to support the EPC-MT-LR or PS-MT-LR positioning procedures. This is achieved using the Provide Subscriber Location message;
- To allow the MME or SGSN to return a position estimate or an error report to the GMLC in response to a Provide Subscriber Location request as part of an EPC-MT-LR or PS-MT-LR positioning procedure;

- To allow the MME to forward an unsolicited position estimate to the GMLC as part of the EPC-MO-LR or EPC-NI-LR procedures. This is achieved using the Subscriber Location Report message;
- To allow the SGSN to forward an unsolicited position estimate to the GMLC as part of the PS-MO-LR, PS-NI-LR or periodic MO-LR TTTP procedures. This is achieved using the Subscriber Location Report message;
- To allow the GMLC to acknowledge receipt of an unsolicited position estimate as part of the EPC-MO-LR, EPC-NI-LR, PS-MO-LR, PS-NI-LR or periodic MO-LR TTTP procedures;
- To allow the GMLC to request position estimates for a particular target UE from the SGSN as part of the deferred MT-LR procedure. This is achieved using the Provide Subscriber Location message;

NOTE: The deferred MT-LR procedure is not applicable to MME in this version of the TS.

- To allow the SGSN to to acknowledge receipt of position estimate request to the GMLC as part of a deferred MT-LR procedure;
- To support the procedures for handover of an IMS emergency call with EPS/GPRS access.

5 ELP Message Transport

5.1 General

The ELP protocol is defined as a Vendor Specific diameter application (SLg application). It reuses the basic mechanisms defined by the diameter base protocol, and it defines a number of additional commands and AVPs to implement the SLg, Lgd specific procedures.

5.2 Use of Diameter base protocol

The Diameter Base Protocol as specified in IETF RFC 3588 [4] shall apply except as modified by the defined support of the methods and the defined support of the commands and AVPs, result and error codes as described in this specification. Unless otherwise specified, the procedures (including error handling and unrecognised information handling) shall be used unmodified.

5.3 Securing Diameter Messages

For secure transport of Diameter messages, see 3GPP TS 33.210 [13].

5.4 Accounting functionality

Accounting functionality (Accounting Session State Machine, related command codes and AVPs) shall not be used on the SLg, Lgd interfaces.

5.5 Use of sessions

Between the MME and the GMLC and between the SGSN and the GMLC, Diameter sessions shall be implicitly terminated. An implicitly terminated session is one for which the server does not maintain state information. The client shall not send any re-authorization or session termination requests to the server.

The Diameter base protocol includes the Auth-Session-State AVP as the mechanism for the implementation of implicitly terminated sessions.

The client (server) shall include in its requests (responses) the Auth-Session-State AVP set to the value NO_STATE_MAINTAINED (1), as described in IETF RFC 3588 [4]. As a consequence, the server shall not maintain any state information about this session and the client shall not send any session termination request. Neither the Authorization-Lifetime AVP nor the Session-Timeout AVP shall be present in requests or responses.

5.6 Transport protocol

Diameter messages over the SLg and Lgd interfaces shall make use of SCTP (see IETF RFC 4960 [14]).

5.7 Routing considerations

This clause specifies the use of the Diameter routing AVPs Destination-Realm and Destination-Host.

Destination-Realm AVP shall always be included in all diameter requests, and therefore is declared as mandatory in the ABNF for all commands.

When a request is initiated by the GMLC, the name of the MME or SGSN shall be determined by querying the HSS over the SLh interface, and retrieve the specific MME or SGSN that is currently serving the UE. Therefore, Destination-Host AVP shall always be included in the commands originated at the GMLC, and is declared as mandatory in the ABNF.

When a request is initiated by the MME or SGSN, the name of the GMLC may be either locally configured in the MME/SGSN (e.g., in the intra-domain scenario, when the GMLC belongs to the same PLMN as the MME/SGSN), or it is known from a previously received location procedure initiated at the GMLC. Therefore, the Destination-Host AVP is declared as mandatory in the ABNF of the commands originated at the MME or SGSN.

If the Vendor-Specific-Application-ID AVP is received in any of the commands, it may be ignored by the receiving node, and it shall not be used for routing purposes.

5.8 Advertising Application Support

The MME, SGSN and GMLC shall advertise support of the Diameter SLg Application by including the value of the application identifier in the Auth-Application-Id AVP within the Vendor-Specific-Application-Id grouped AVP of the Capabilities-Exchange-Request and Capabilities-Exchange-Answer commands.

The vendor identifier value of 3GPP (10415) shall be included in the Supported-Vendor-Id AVP of the Capabilities-Exchange-Request and Capabilities-Exchange-Answer commands, and in the Vendor-Id AVP within the Vendor-Specific-Application-Id grouped AVP of the Capabilities-Exchange-Request and Capabilities-Exchange-Answer commands.

The Vendor-Id AVP included in Capabilities-Exchange-Request and Capabilities-Exchange-Answer commands that is not included in the Vendor-Specific-Application-Id AVPs as described above shall indicate the manufacturer of the Diameter node as per RFC 3588 [4].

6 ELP Procedures

6.1 General

The ELP procedures, between the GMLC and the MME over SLg interface and between GMLC and SGSN over Lgd interface, are used to exchange messages related to location services. The ELP can be divided into the following sub-procedures.

- Provide Subscriber Location
- Subscriber Location Report

6.2 Provide Subscriber Location

6.2.1 General

The Provide Subscriber Location operation is used by a GMLC to request the location of a target UE from the MME or SGSN at any time, as part of EPC-MT-LR or PS-MT-LR positioning procedures. The response contains a location estimate of the target UE and other additional information.

The Provide Subscriber Location operation is also used by a GMLC to request the location of the target UE from the SGSN at any time, as part of deferred MT-LR procedure. The response contains the acknowledgment of the receipt of the request and other additional information.

6.2.2 Successful Operation

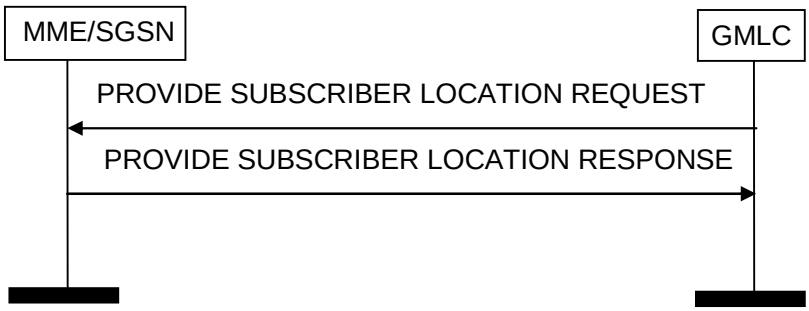

Figure 6.2.2-1: Provide Subscriber Location procedure. Successful operation.

The GMLC initiates the procedure by sending a PROVIDE SUBSCRIBER LOCATION REQUEST message to the MME or SGSN. This message carries the type of location information requested (e.g. current location and optionally, velocity), the UE subscriber's IMSI, LCS QoS information (e.g. accuracy, response time) and an indication of whether the LCS client has the override capability. For deferred MT-LR procedure, additionally, the message carries Deferred location type, LCS reference number, H-GMLC address, periodic LDR info etc.

Upon reception of PROVIDE SUBSCRIBER LOCATION REQUEST message, the MME or SGSN shall perform authentication privacy verification on the location request. After that, for EPC-MT-LR or PS-MT-LR procedures the MME or SGSN shall retrieve the location information of the target UE from E-UTRAN or UTRAN/GERAN according to the procedures described in 3GPP TS 23.271 [2].

The MME or SGSN returns a PROVIDE SUBSCRIBER LOCATION RESPONSE to the GMLC. For EPC-MT-LR or PS-MT-LR procedures, the message shall contain the location estimate, its age and obtained accuracy. If the MME or SGSN failed to get the current location and the LCS client is requesting the current or last known location, the MME or SGSN may return the last known location of the target UE if this is known.

If the GMLC has received indication from the HSS indicating the combined MME/SGSN node supporting the optimized LCS procedure (see 3GPP TS 29.173 [18] clause 5.2.1.2) and if the GMLC also supports optimized LCS procedure, the GMLC shall set the "Optimized-LCS-Proc-Req" bit within the PLR-Flags of the PROVIDE SUBSCRIBER LOCATION REQUEST message during EPC-MT-LR and/or PS-MT-LR procedures. When the combined MME/SGSN receives this message with "Optimized-LCS-Proc-Req" bit within the PLR-Flags set, the combined MME/SGSN shall perform EPC-MT-LR or PS-MT-LR procedure depending upon the knowledge of the current RAT type of the UE. E.g. if the UE is in active mode in E-UTRAN, the combined MME/SGSN shall perform only EPC-MT-LR procedure; if the ISR activated UE is in idle mode, the combined MME/SGSN shall perform the paging followed by either EPC-MT-LR or PS-MT-LR procedure (depending upon the RAT where the UE is active). Hence, the combined MME/SGSN shall perform optimized LCS procedure to retrieve the location information of the target UE from either E-UTRAN or UTRAN/GERAN.

The combined MME/SGSN shall return a PROVIDE SUBSCRIBER LOCATION RESPONSE, containing the location estimate, its age and obtained accuracy, to the GMLC. If the combined MME/SGSN failed to get the current location and the LCS client is requesting the current or last known location, the combined MME/SGSN should return the latest of the last known EPS or UTRAN/GERAN location of the target UE if this is known. In both the cases, the combined

MME/SGSN may set "Optimized-LCS-Proc-Performed" bit within PLA-Flags, if it has performed optimized LCS procedure.

This procedure is mapped to the commands Provide-Location-Request/Answer in the Diameter application specified in clauses 7.3.1 and 7.3.2.

Table 6.2.2-1: Provide Subscriber Location Request

Information element name	Mapping to Diameter AVP	Cat.	Description
Location Type	SLg-Location-Type	M	This Information Element shall contain the type of location measurement requested, such as current location, initial location, last known location, etc. (see 3GPP TS 22.071 [15]).
IMSI	User-Name	C	If present, this Information Element shall contain the IMSI of the user whose UE is to be positioned (see Note 1).
MSISDN	MSISDN	C	If present, this Information Element shall contain the MSISDN of the user whose UE is to be positioned (see Note 1).
IMEI	IMEI	C	If present, this Information Element shall contain the IMEI of the UE to be positioned (see Note 1).
Client Name	LCS-EPS-Client-Name	M	This Information Element shall contain the name of the LCS client issuing the positioning request.
Client Type	LCS-Client-Type	M	This Information Element shall contain the type of LCS client (Emergency, Lawful Interception …) issuing the positioning request (see 3GPP TS 23.271 [2] and 3GPP TS 32.299 [10]).
Requestor Name	LCS-Requestor-Name	O	If present, this Information Element contains the identity of the originating entity which has requested the location of the target UE from the LCS Client.
Priority	LCS-Priority	O	If present, this Information Element shall contain the priority of the LCS client issuing the positioning request.
QoS	LCS-QoS	O	If present, this Information Element shall contain the quality of service requested, such as the accuracy of the positioning measurement and the response time of the positioning operation.
Velocity Requested	Velocity-Requested	O	If present, this information element shall contain an indication of whether or not the Velocity of the target UE is requested.
Supported GAD Shapes	LCS-Supported-GAD-Shapes	O	If present, this Information Element shall contain the list of supported GAD shapes by the LCS client.
Service Type ID	LCS-Service-Type-ID	O	If present, this Information Element shall contain the service type associated for the particular positioning request (the meaning of the different service types is defined in 3GPP TS 22.071 [15]).
Codeword	LCS-Codeword	O	If present, this Information Element shall contain the Codeword to be used between an LCS client and a target UE in order to check and accept or reject the positioning request.
APN	Service-Selection	C	If present, this Information Element shall contain the Access Point Name (APN) Network Identifier of the LCS client, as used by the target UE. It shall only be included in session-related location requests.
Session-Related Privacy Check	LCS-Privacy-Check-Session	O	If present, this Information Element shall contain an indication of how the positioning operation should proceed in the relation to the checking of the session-related privacy settings of the user.
Non-Session-Related Privacy Check	LCS-Privacy-Check-Non-Session	O	If present, this Information Element shall contain an indication of how the positioning operation should proceed in the relation to the checking of the non-session-related privacy settings of the user.
Deferred Location Type	Deferred-Location-Type	O	If present, this Information Element shall contain the type of the event until when the location estimation is deferred. Various applicable event types are: UE available, UE entering or leaving or being in a pre-defined geographical area, periodic location. This Information Element is applicable only for the deferred MT-LR procedure and when the message is sent towards the SGSN or the SGSN part of the combined MME/SGSN
LCS-Reference Number	LCS-Reference-Number	O	If present, this Information Element shall contain reference number identifying a deferred location request. This Information Element is applicable only when the deferred MT-LR procedure is initiated and when the message is sent towards the SGSN or the SGSN part of the combined MME/SGSN.
Area Event Info	Area-Event-Info	O	If present, this Information Element shall contain area definition, type of area event, occurrence info and minimum interval time. This Information Element is applicable only when the deferred MT-LR is initiated for area event (UE entering or leaving or being in a pre-defined geographical area) and when the message is sent towards the SGSN or the SGSN part of the combined MME/SGSN.

H-GMLC Address	GMLC-Address	O	If present, this Information Element shall contain the address identifying the H-GMLC which initiated the deferred MT-LR procedure. This Information Element is applicable only when the deferred MT-LR procedure is performed and when the message is sent towards the SGSN or the SGSN part of the combined MME/SGSN.
PLR Flags	PLR-Flags	O	This Information Element contains a bit mask. See 7.4.52 for the meaning of the bits.
Periodic LDR Information	Periodic-LDR-Information	O	If present, this Information Element shall contain reporting amount and reporting interval of deferred periodic location. This Information Element is applicable only when the deferred MT-LR procedure is initiated for periodic location event and when the message is sent towards the SGSN or the SGSN part of the combined MME/SGSN.
Reporting PLMN List	Reporting-PLMN-List	O	If present, this Information Element shall contain a list of PLMNs in which the subsequent location estimates must be obtained by the UE as part of periodic MO-LR TTTP procedure. This Information Element is applicable only when the message is towards the SGSN or the SGSN part of the combined MME/SGSN.
Supported Features (See 3GPP TS 29.229 [17])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.
NOTE 1: At least one of these IEs shall be present in the message.			

Table 6.2.2-2: Provide Subscriber Location Answer

Information element name	Mapping to Diameter AVP	Cat.	Description
Result	Result-Code / Experimental-Result	M	This Information Element shall contain the result of the operation. The Result-Code AVP shall be used to indicate success / errors as defined in the Diameter Base Protocol. The Experimental-Result AVP shall be used for ELP errors. This is a grouped AVP which shall contain the 3GPP Vendor ID in the Vendor-Id AVP, and the error code in the Experimental-Result-Code AVP.
Location Estimate	Location-Estimate	O	If present, this Information Element shall contain an estimate of the location of the UE in universal coordinates and the accuracy of the estimate.
Accuracy Fulfilment Indicator	Accuracy-Fulfilment-Indicator	O	If present, this Information Element shall contain an indication of whether the requested accuracy (as indicated in the LCS-QoS IE in the request message) was fulfilled or not.
Age of Location Estimate	Age-of-Location-Estimate	O	If present, this Information Element shall contain an indication of how long ago the location estimate was obtained.
Velocity Estimate	Velocity-Estimate	O	If present, this Information Element shall contain an estimate of the velocity of the target UE, composed by horizontal speed, vertical speed, and their respective uncertainty (see 3GPP TS 23.032 [3]).
EUTRAN Positioning Data	EUTRAN-Positioning-Data	O	If present, this Information Element shall indicate the usage of each positioning method that was attempted to determine the location estimate, either successfully or unsuccessfully. The internal structure and encoding is defined in 3GPP TS 29.171 [7]. This Information Element is applicable only when the UE is attached to E-UTRAN access and when the message is sent by the MME or the combined MME/SGSN.
ECGI	ECGI	O	If present, this Information Element shall contain the current cell location of the target UE as delivered by the eNB to the MME. The E-UTRAN Cell Global Identifier (ECGI) is used to globally identify a cell. This Information Element is applicable only when the UE is attached to E-UTRAN access and when the message is sent by the MME or combined MME/SGSN.
GERAN Positioning Info	GERAN-Positioning-Info	O	If present, this Information Element shall indicate the usage of each positioning method that was attempted to determine the location estimate, either successfully or unsuccessfully. This Information Element is applicable only when the UE is attached to GERAN access and when the message is sent by the SGSN or combined MME/SGSN.
CGI	Cell-Global-Identity	O	If present, this Information Element shall contain the current cell location of the target UE. The Cell Global Identifier (CGI) is used to globally identify a cell. This Information Element is applicable only when the UE is attached to GERAN access and when the message is sent by the SGSN or combined MME/SGSN.
UTRAN Positioning Info	UTRAN-Positioning-Info	O	If present, this Information Element shall indicate the usage of each positioning method that was attempted to determine the location estimate, either successfully or unsuccessfully. This Information Element is applicable only when the UE is attached to UTRAN access and when the message is sent by the SGSN or combined MME/SGSN.
SAI	Service-Area-Identity	O	If present, this Information Element shall contain the current service area of the target UE. The Service Area Identifier (SAI) is used to globally identify a service area. This Information Element is applicable only when the UE is attached to UTRAN access and when the message is sent by the SGSN or combined MME/SGSN.
Target Serving Node Identity	Serving-Node	O	If present, this information element shall contain the address of the target side serving node for handover of an IMS Emergency Call.
PLA Flags	PLA-Flags	O	This Information Element contains a bit mask. See 7.4.53 for the meaning of the bits. If this Information Element is present and if it the bit corresponding to the "Deferred-MT-LR-Response-Indicator" is set, the "Location-Estimate" Information Element is ignored in this message.
E-SMLC provided Cell Info	ESMLC-Cell-Info	O	If present, this Information Element shall contain the current cell information of the target UE as known by E-SMLC.
Supported Features (See 3GPP TS 29.229 [17])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.

6.2.3 Unsuccessful Operation

On receipt of a PROVIDE SUBSCRIBER LOCATION RESPONSE with a Result-Code or Experimental-Result AVP indicating failure the GMLC considers the positioning request as failed.

If the GMLC receives "Optimized-LCS-Proc-Performed" bit within PLA-Flags set, it shall assume that the combined MME/SGSN has either performed EPC-MT-LR or PS-MT-LR procedure to retrieve the location of the target UE. And hence, it need not send another PROVIDE SUBSCRIBER LOCATION REQUEST message to the combined MME/SGSN.

6.3 Subscriber Location Report

6.3.1 General

The Subscriber Location Report operation is used by an MME or SGSN to provide the location of a target UE to a GMLC when a request for location has been implicitly issued.

6.3.2 Successful Operation

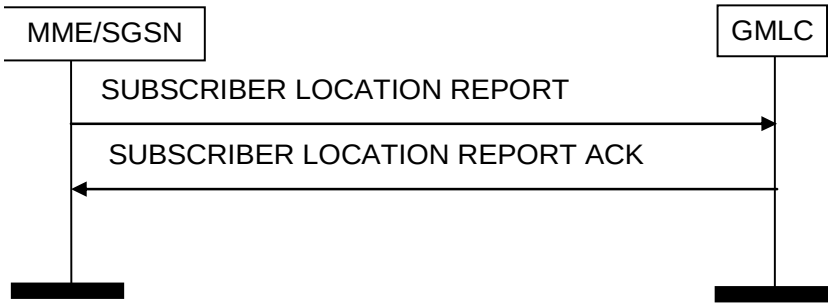

Figure 6.3.2-1: Subscriber Location Report procedure. Successful operation.

The MME or SGSN initiates the procedure by sending a SUBSCRIBER LOCATION REPORT message to the GMLC. The message may carry the identity of the UE, the location estimate and its age, and the event causing the location report.

Upon reception of SUBSCRIBER LOCATION REPORT message, the GMLC shall return a SUBSCRIBER LOCATION REPORT ACK to the MME or SGSN and process the location report accordingly, e.g. transfer of the location estimate to an external LCS Client according to procedure described in 3GPP TS 23.271 [2].

If the Location-Event indicates a DEFERRED_LR_RESPONSE then the Location-Estimate shall not be sent if the LCS-Supported-GAD-Shapes had been received in Provide Subscriber Location request and the shape encoded in Location-Estimate was not marked as supported in LCS-Supported-GAD-Shapes. In such a case Termination-Cause in Deferred-MT-LR-Data shall be present with value SHAPE_OF_LOCATION_ESTIMATE_NOT_SUPPORTED.

This procedure is mapped to the commands Location-Report-Request/Answer in the Diameter application specified in clauses 7.3.3 and 7.3.4.

Table 6.3.2-1: Subscriber Location Report

Information element name	Mapping to Diameter AVP	Cat.	Description
Location Event	Location-Event	M	This Information Element shall contain the type of event that caused the location procedure to be initiated.
IMSI	User-Name	C	If present, this Information Element shall contain the IMSI of the user whose UE is to be positioned (see Note 1).
MSISDN	MSISDN	C	If present, this Information Element shall contain the MSISDN of the user whose UE is to be positioned (see Note 1).
IMEI	IMEI	C	If present, this Information Element shall contain the IMEI of the UE to be positioned (see Note 1).
Client Name	LCS-EPS-Client-Name	O	If present, this Information Element shall contain the name of the LCS client where the result of the positioning operation should be sent.
Location Estimate	Location-Estimate	O	If present, this Information Element shall contain an estimate of the location of the UE in universal coordinates and the accuracy of the estimate.
Accuracy Fulfilment Indicator	Accuracy-Fulfilment-Indicator	O	If present, this Information Element shall contain an indication of whether the requested accuracy was fulfilled or not.
Age of Location Estimate	Age-of-Location-Estimate	O	If present, this Information Element shall contain an indication of how long ago the location estimate was obtained.
Velocity Estimate	Velocity-Estimate	O	If present, this Information Element shall contain an estimate of the velocity of the UE, composed by horizontal speed, vertical speed, and their respective uncertainty (see 3GPP TS 23.032 [3]).
EUTRAN Positioning Data	EUTRAN-Positioning-Data	O	If present, this Information Element shall indicate the usage of each positioning method that was attempted to determine the location estimate, either successfully or unsuccessfully. The internal structure and encoding is defined in 3GPP TS 29.171 [7]. This Information Element is applicable only when the UE is attached to E-UTRAN access and when the message is sent by the MME or the MME part of the combined MME/SGSN.
ECGI	ECGI	O	If present, this Information Element shall contain the current cell location of the target UE as delivered by the eNB to the MME. The E-UTRAN Cell Global Identifier (ECGI) is used to globally identify a cell. This Information Element is applicable only when the UE is attached to E-UTRAN access and when the message is sent by the MME or the MME part of the combined MME/SGSN.
GERAN Positioning Info	GERAN-Positioning-Info	O	If present, this Information Element shall indicate the usage of each positioning method that was attempted to determine the location estimate, either successfully or unsuccessfully. This Information Element is applicable only when the UE is attached to GERAN access and when the message is sent by the SGSN or the SGSN part of the combined MME/SGSN.
CGI	Cell-Global-Identity	O	If present, this Information Element shall contain the current cell location of the target UE. The Cell Global Identifier (CGI) is used to globally identify a cell. This Information Element is applicable only when the UE is attached to GERAN access and when the message is sent by the SGSN or the SGSN part of the combined MME/SGSN.
UTRAN Positioning Info	UTRAN-Positioning-Info	O	If present, this Information Element shall indicate the usage of each positioning method that was attempted to determine the location estimate, either successfully or unsuccessfully. This Information Element is applicable only when the UE is attached to UTRAN access and when the message is sent by the SGSN or the SGSN part of the combined MME/SGSN.
SAI	Service-Area-Identity	O	If present, this Information Element shall contain the current service area of the target UE. The Service Area Identifier (SAI) is used to globally identify a service area. This Information Element is applicable only when the UE is attached to UTRAN access and when the message is sent by the SGSN or the SGSN part of the combined MME/SGSN.
Service Type ID	LCS-Service-Type-ID	O	If present, this Information Element shall contain the service type associated for the particular positioning report identifying the service at the receiving LCS Client (the meaning of the different service types is defined in 3GPP TS 22.071 [15]).
Pseudonym Indicator	Pseudonym-Indicator	O	If present, this Information Element shall contain an indication of whether or not a pseudonym must be allocated by the network and transferred to the LCS client as the identity of the UE.

Supported Features (See 3GPP TS 29.229 [17])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.
LCS QoS Class	LCS-QoS-Class	O	If present, this Information Element shall contain the LCS-QoS-Class requested by the target UE.
Target Serving Node Identity	Serving-Node	O	If present, this information element shall contain the address of the target side serving node for handover of an IMS Emergency Call.
LRR Flags (See 7.4.35)	LRR-Flags	C	This Information Element contains a bit mask. See 7.4.35 for the meaning of the bits. It shall be present when the message is sent over Lgd interface.
LCS-Reference Number	LCS-Reference-Number	O	If present, this Information Element shall contain reference number identifying the deferred location request. This is same as the reference number included in the Provide Subscriber Location request for deferred MT-LR procedure or the reference number included in the Subscriber Location Report Ack for periodic MO-LR TTTP procedure. This Information Element shall be included if the Location-Event is set to "DEFERRED_MT_LR_RESPONSE" and when the message is sent by the SGSN or the SGSN part of the combined MME/SGSN.
Deferred MT-LR Data	Deferred-MT-LR-Data	O	If present, this Information Element is used to report the deferred location event type, the location information and reason why the serving node aborted monitoring the event to the GMLC. This Information Element shall be included when the Location-Event is set to "DEFERRED_MT_LR_RESPONSE" and when the message is sent by the SGSN or the SGSN part of the combined MME/SGSN.
H-GMLC Address	GMLC-Address	O	If present, this Information Element shall contain the address identifying the H-GMLC which should receive location estimates. This is same as the H-GMLC address included in Provide Subscriber Location request for deferred MT-LR procedure or the H-GMLC address included in the Subscriber Location Report Ack for periodic MO-LR TTTP procedure. This Information Element is applicable only when the message is sent by the SGSN or the SGSN part of the combined MME/SGSN.
Sequence Number	Reporting-Amount	O	If present, this parameter contains the number of the periodic location reports completed. The sequence number would be set to 1 in the first location report and increment by 1 for each new report. When the number reaches the reporting amount value, the H-GMLC (for a periodic MT-LR or a periodic MO-LR TTTP) will know the procedure is complete. This Information Element is applicable only when the message is sent by the SGSN or the SGSN part of the combined MME/SGSN.
Periodic LDR Information	Periodic-LDR-Information	O	If present, this Information Element shall contain the UE requested reporting amount and reporting interval of deferred periodic location reporting. This Information Element is applicable only when the periodic MO-LR TTTP procedure is initiated by the UE and when the message is sent by the SGSN or the SGSN part of the combined MME/SGSN.
E-SMLC provided Cell Info	ESMLC-Cell-Info	O	If present, this Information Element shall contain the current cell information of the target UE as known by E-SMLC.
1xRTT Reference Cell ID	1xRTT-RCID	O	If present, this Information Element shall contain the 1xRTT Reference Cell ID uniquely identifying of the target cell location for handover of an IMS ermergency call. This Information Element is applicable only when the UE is making handover toa cdma2000 1xRTT access and when the message is sent by the MME or the MME part of the combined MME/SGSN.

NOTE 1: At least one of these IEs shall be present in the message.

Table 6.3.2-2: Subscriber Location Report Ack

Information element name	Mapping to Diameter AVP	Cat.	Description
Result	Result-Code / Experimental-Result	M	This Information Element shall contain the result of the operation. The Result-Code AVP shall be used to indicate success / errors as defined in the Diameter Base Protocol. The Experimental-Result AVP shall be used for ELP errors. This is a grouped AVP which shall contain the 3GPP Vendor ID in the Vendor-Id AVP, and the error code in the Experimental-Result-Code AVP.
H-GMLC Address	GMLC-Address	O	If present, this Information Element shall contain the address identifying the H-GMLC which should receive location estimates as part of periodic MO-LR TTTP procedure. This Information Element is applicable only when the message is sent towards the SGSN or the SGSN part of the combined MME/SGSN.
LRA Flags	LRA-Flags	O	This Information Element contains a bit mask. See 7.4.56 for the meaning of the bits.
Reporting PLMN List	Reporting-PLMN-List	O	If present, this Information Element shall contain a list of PLMNs in which the subsequent location estimates must be obtained as part of periodic MO-LR TTTP procedure. This Information Element is applicable only when the message is sent towards the SGSN or the SGSN part of the combined MME/SGSN.
LCS Reference Number	LCS-Reference-Number	O	If present, this Information Element shall contain reference number identifying a deferred location request. This Information Element is applicable only when the message is sent towards the SGSN or the SGSN part of the combined MME/SGSN.
Supported Features (See 3GPP TS 29.229 [17])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.

6.3.3 Unsuccessful Operation

If for some reason the GMLC does not accept the SUBSCRIBER LOCATION REPORT APDU, the GMLC shall send a SUBSCRIBER LOCATION REPORT ACK message with a Result-Code or Experimental-Result AVP indicating failure.

7 ELP Messages and Message Formats

7.1 General

The Diameter Base Protocol as specified in IETF RFC 3588 [4] shall apply except as modified by the defined support of the methods and the defined support of the commands and AVPs, result and error codes as specified in this specification. Unless otherwise specified, the procedures (including error handling and unrecognised information handling) shall be used unmodified.

This clause specifies a Diameter application that allows a Diameter server and a Diameter client:

- to retrieve the location information of a target UE
- to report the location information of a target UE

The SLg/Lgd interface protocol is defined as an IETF vendor specific Diameter application, where the vendor is 3GPP. The vendor identifier assigned by IANA to 3GPP (http://www.iana.org/assignments/enterprise-numbers) is 10415.

The Diameter application identifier assigned to the SLg interface application is 16777255 (allocated by IANA).

The Lgd interface uses the Diameter application identifier defined for the SLg interface application.

7.2 Message Formats

This clause defines Command-Code values for the SLg interface application. These Command-Code values are applicable for the SLg and Lgd interfaces.

Every command is defined by means of the ABNF syntax IETF RFC 2234 [5], according to the rules in IETF RFC 3588 [4]. If the definition and use of an AVP is not specified in this document, the guidelines in IETF RFC 3588 [4] shall apply.

For these commands, the Application-ID field shall be set to16777255 (application identifier of the SLg interface application).

NOTE: For this release, the Vendor-Specific-Application-ID is included as an optional AVP in all commands in order to ensure interoperability with diameter agents following a strict implementation of IETF RFC 3588, by which messages not including this AVP will be rejected. IETF RFC 3588 indicates that the AVP shall be present in all proxiable commands, such as those specified here, dispite that the contents of this AVP are redundant since the Application ID is already present in the command header. This AVP may be removed in subsequent revisions of this specification, once the diameter base protocol is updated accordingly.

The following Command Codes are defined in this specification:

Table 7.2-1: Command-Code values

Command-Name	Abbreviation	Code	Clause
Provide-Location-Request	PLR	8388620	7.3.1
Provide-Location -Answer	PLA	8388620	7.3.2
Location-Report-Request	LRR	8388621	7.3.3
Location-Report-Answer	LRA	8388621	7.3.4

7.3 ELP Messages

7.3.1 Provide-Location-Request (PLR) Command

The Provide-Location-Request (PLR) command, indicated by the Command-Code field set to 8388620 and the 'R' bit set in the Command Flags field, is sent by the GMLC in order to request subscriber location to the MME or SGSN.

Message Format

Message Format

```
< Provide-Location-Request> ::= < Diameter Header: 8388620, REQ, PXY, 16777255 >
                                < Session-Id >
                                [ Vendor-Specific-Application-Id ]
                                { Auth-Session-State }
                                { Origin-Host }
                                { Origin-Realm }
                                { Destination-Host }
                                { Destination-Realm }
                                { SLg-Location-Type }
                                [ User-Name ]
                                [ MSISDN ]
                                [ IMEI ]
                                { LCS-EPS-Client-Name }
                                { LCS-Client-Type }
                                [ LCS-Requestor-Name ]
                                [ LCS-Priority ]
                                [ LCS-QoS ]
                                [ Velocity-Requested ]
                                [ LCS-Supported-GAD-Shapes ]
                                [ LCS-Service-Type-ID ]
```

[LCS-Codeword]
[LCS-Privacy-Check-Non-Session]
[LCS-Privacy-Check-Session]
[Service-Selection]
[Deferred-Location-Type]
[LCS-Reference-Number]
[Area-Event-Info]
[GMLC-Address]
[PLR-Flags]
[Periodic-LDR-Information]
[Reporting-PLMN-List]
*[Supported-Features]
*[AVP]
*[Proxy-Info]
*[Route-Record]

7.3.2 Provide-Location-Answer (PLA) Command

The Provide-Location-Answer (PLA) command, indicated by the Command-Code field set to 8388620 and the 'R' bit cleared in the Command Flags field, is sent by the MME or SGSN to the GMLC in response to the Provide-Location-Request command.

Message Format

< Provide-Location-Answer > ::= < Diameter Header: 8388620, PXY, 16777255 >
< Session-Id >
[Vendor-Specific-Application-Id]
[Result-Code]
[Experimental-Result]
{ Auth-Session-State }
{ Origin-Host }
{ Origin-Realm }
[Location-Estimate]
[Accuracy-Fulfilment-Indicator]
[Age-Of-Location-Estimate]
[Velocity-Estimate]
[EUTRAN-Positioning-Data]
[ECGI]
[GERAN-Positioning-Info]
[Cell-Global-Identity]
[UTRAN-Positioning-Info]
[Service-Area-Identity]
[Serving-Node]
[PLA-Flags]
[ESMLC-Cell-Info]
*[Supported-Features]
*[AVP]
*[Failed-AVP]
*[Proxy-Info]
*[Route-Record]

7.3.3 Location-Report-Request (LRR) Command

The Location-Report-Request (LRR) command, indicated by the Command-Code field set to 8388621 and the 'R' bit set in the Command Flags field, is sent by the MME or SGSN in order to provide subscriber location data to the GMLC.

Message Format

< Location-Report-Request> ::= < Diameter Header: 8388621, REQ, PXY, 16777255 >
< Session-Id >
[Vendor-Specific-Application-Id]
{ Auth-Session-State }

{ Origin-Host }
{ Origin-Realm }
{ Destination-Host }
{ Destination-Realm }
{ Location-Event }
[LCS-EPS-Client-Name]
[User-Name]
[MSISDN]
[IMEI]
[Location-Estimate]
[Accuracy-Fulfilment-Indicator]
[Age-Of-Location-Estimate]
[Velocity-Estimate]
[EUTRAN-Positioning-Data]
[ECGI]
[GERAN-Positioning-Info]
[Cell-Global-Identity]
[UTRAN-Positioning-Info]
[Service-Area-Identity]
[LCS-Service-Type-ID]
[Pseudonym-Indicator]
[LCS-QoS-Class]
[Serving-Node]
[LRR-Flags]
[LCS-Reference-Number]
[Deferred-MT-LR-Data]
[GMLC-Address]
[Reporting-Amount]
[Periodic-LDR-Information]
[ESMLC-Cell-Info]
[1xRTT-RCID]
*[Supported-Features]
*[AVP]
*[Proxy-Info]
*[Route-Record]

7.3.4 Location-Report-Answer (LRA) Command

The Location-Report-Answer (LRA) command, indicated by the Command-Code field set to 8388621 and the 'R' bit cleared in the Command Flags field, is sent by the GMLC to the MME or SGSN in response to the Location-Report-Request command.

Message Format

< Location-Report-Answer > ::= < Diameter Header: 8388621, PXY, 16777255>
< Session-Id >
[Vendor-Specific-Application-Id]
[Result-Code]
[Experimental-Result]
{ Auth-Session-State }
{ Origin-Host }
{ Origin-Realm }
[GMLC-Address]
[LRA-Flags]
[Reporting-PLMN-List]
[LCS-Reference-Number]
*[Supported-Features]
*[AVP]
*[Failed-AVP]
*[Proxy-Info]
*[Route-Record]

7.4 Information Elements

7.4.1 General

The following table describes the Diameter AVPs defined for the SLg interface protocol, their AVP Code values, types, possible flag values and whether the AVP may or not be encrypted.

Table 7.4.1-1: Diameter ELP Application AVPs

Attribute Name	AVP Code	Clause defined	Value Type	AVP Flag rules				
				Must	May	Should not	Must not	May Encrypt
SLg-Location-Type	2500	7.4.2	Enumerated	M, V				No
LCS-EPS-Client-Name	2501	7.4.3	Grouped	M, V				No
LCS-Requestor-Name	2502	7.4.4	Grouped	M, V				No
LCS-Priority	2503	7.4.5	Unsigned32	M, V				No
LCS-QoS	2504	7.4.6	Grouped	M, V				No
Horizontal-Accuracy	2505	7.4.7	Unsigned32	M, V				No
Vertical-Accuracy	2506	7.4.8	Unsigned32	M, V				No
Vertical-Requested	2507	7.4.9	Enumerated	M, V				No
Velocity-Requested	2508	7.4.10	Enumerated	M, V				No
Response-Time	2509	7.4.11	Enumerated	M, V				No
Supported-GAD-Shapes	2510	7.4.12	Unsigned32	M, V				No
LCS-Codeword	2511	7.4.13	UTF8String	M, V				No
LCS-Privacy-Check	2512	7.4.14	Enumerated	M, V				No
Accuracy-Fulfilment-Indicator	2513	7.4.15	Enumerated	M, V				No
Age-Of-Location-Estimate	2514	7.4.16	Unsigned32	M, V				No
Velocity-Estimate	2515	7.4.17	OctetString	M, V				No
EUTRAN-Positioning-Data	2516	7.4.18	OctetString	M, V				No
ECGI	2517	7.4.19	OctetString	M, V				No
Location-Event	2518	7.4.20	Enumerated	M, V				No
Pseudonym-Indicator	2519	7.4.21	Enumerated	M, V				No
LCS-Service-Type-ID	2520	7.4.22	Unsigned32	M, V				No
LCS-Privacy-Check-Non-Session	2521	7.4.23	Grouped	M, V				No
LCS-Privacy-Check-Session	2522	7.4.24	Grouped	M, V				No
LCS-QoS-Class	2523	7.4.27	Enumerated	M, V				No
GERAN-Positioning-Info	2524	7.4.29	Grouped	V			M	No
GERAN-Positioning-Data	2525	7.4.30	OctetString	V			M	No
GERAN-GANSS-Positioning-Data	2526	7.4.31	OctetString	V			M	No
UTRAN-Positioning-Info	2527	7.4.32	Grouped	V			M	No
UTRAN-Positioning-Data	2528	7.4.33	OctetString	V			M	No
UTRAN-GANSS-Positioning-Data	2529	7.4.34	OctetString	V			M	No
LRR-Flags	2530	7.4.35	Unsigned32	V			M	No
LCS-Reference-Number	2531	7.4.37	OctetString	V			M	No
Deferred-Location-Type	2532	7.4.36	Unsigned32	V			M	No
Area-Event-Info	2533	7.4.38	Grouped	V			M	No
Area-Definition	2534	7.4.39	Grouped	V			M	No
Area	2535	7.4.40	Grouped	V			M	No
Area-Type	2536	7.4.41	Unsigned32	V			M	No
Area-Identification	2537	7.4.42	Grouped	V			M	No
Occurrence-Info	2538	7.4.43	Enumerated	V			M	No
Interval-Time	2539	7.4.44	Unsigned32	V			M	No
Periodic-LDR-Information	2540	7.4.45	Grouped	V			M	No
Reporting-Amount	2541	7.4.46	Unsigned32	V			M	No
Reporting-Interval	2542	7.4.47	Unsigned32	V			M	No
Reporting-PLMN-List	2543	7.4.48	Grouped	V			M	No
PLMN-ID-List	2544	7.4.49	Grouped	V			M	No
PLR-Flags	2545	7.4.52	Unsigned32	V			M	No
PLA-Flags	2546	7.4.53	Unsigned32	V			M	No
Deferred-MT-LR-Data	2547	7.4.54	Grouped	V			M	No
Termination-Cause	2548	7.4.55	Unsigned32	V			M	No
LRA-Flags	2549	7.4.56	Unsigned32	V			M	No
Periodic-Location-Support-Indicator	2550	7.4.50	Enumerated	V			M	No
Prioritized-List-Indicator	2551	7.4.51	Enumerated	V			M	No
ESMLC-Cell-Info	2552	7.4.57	Grouped	V			M	No
Cell-Portion-ID	2553	7.4.58	Unsigned32	V			M	No
1xRTT-RCID	2554	7.4.59	OctetString	V			M	No

Note: The AVP header bit denoted as 'M', indicates whether support of the AVP is required. The AVP header bit denoted as 'V', indicates whether the optional Vendor-ID field is present in the AVP header. For further details, see IETF RFC 3588 [4].

Table 7.4.1-2: Diameter ELP Application reused AVPs

Attribute Name	AVP Code	Reference	Value Type	Comment
LCS-Format-Indicator	1237	3GPP TS 32.299 [10]	Enumerated	
LCS-Name-String	1238	3GPP TS 32.299 [10]	UTF8String	
LCS-Client-Type	1241	3GPP TS 32.299 [10]	Enumerated	
LCS-Requestor-Id-String	1240	3GPP TS 32.299 [10]	UTF8String	
Location-Estimate	1242	3GPP TS 32.299 [10]	OctetString	
IMEI	1402	3GPP TS 29.272 [11]	UTF8String	
MSISDN	701	3GPP TS 29.329 [12]	OctetString	
Service-Selection	493	3GPP TS 29.272 [11], IETF RFC 5778 [16]	UTF8String	It is used to define the APN
User-Name	1	IETF RFC 3588 [4]	UTF8String	It is used to include the user's IMSI
Supported-Features	628	3GPP TS 29.229 [17]	Grouped	
Feature-List-ID	629	3GPP TS 29.229 [17]	Unsigned32	See clause 7.4.25
Feature-List	630	3GPP TS 29.229 [17]	Unsigned32	See clause 7.4.26
Serving-Node	2401	3GPP TS 29.173 [18]	Grouped	See clause 6.4.3
Cell-Global-Identity	1604	3GPP TS 29.272 [11]	OctetString	See clause 7.3.119
Service-Area-Identity	1607	3GPP TS 29.272 [11]	OctetString	See clause 7.3.122
GMLC-Address	2405	3GPP TS 29.173 [18]	Address	See clause 6.4.7
Visited-PLMN-Id	1407	3GPP TS 29.272 [11]	OctetString	See clause 7.3.9

7.4.2 SLg-Location-Type

The SLg-Location-Type AVP is of type Enumerated. The following values are defined:

CURRENT_LOCATION (0)

CURRENT_OR_LAST_KNOWN_LOCATION (1)

INITIAL_LOCATION (2)

ACTIVATE_DEFERRED_LOCATION (3)

CANCEL_DEFERRED_LOCATION (4)

NOTIFICATION_VERIFICATION_ONLY (5)

NOTE: Values (3) and (4) are only applicable over Lgd interface. If received over SLg interface, these values are treated as reserved.

7.4.3 LCS-EPS-Client-Name

The LCS-EPS-Client-Name AVP is of type Grouped.

AVP format:

LCS-EPS-Client-Name ::= <AVP header: 2501 10415>

[LCS-Name-String]
[LCS-Format-Indicator]

The details of the LCS-Name-String AVP and the LCS-Format-Indicator AVP are described in 3GPP TS 32.299 [10].

7.4.4 LCS-Requestor-Name

The LCS-Requestor-Name AVP is of type Grouped.

AVP format:

LCS-Requestor-Name ::= <AVP header: 2502 10415>

[LCS-Requestor-Id-String]
[LCS-Format-Indicator]

The details of the LCS-Requestor-Id-String AVP and the LCS-Format-Indicator AVP are described in 3GPP TS 32.299 [10].

7.4.5 LCS-Priority

The LCS-Priority AVP is of type Unsigned32. It indicates the priority of the location request. The value 0 shall indicate the highest priority, and the value 1 shall indicate normal priority. All other values shall be treated as 1 (normal priority). For details, refer to 3GPP TS 22.071 [15].

7.4.6 LCS-QoS

The LCS-QoS AVP is of type Grouped.

AVP format:

LCS-QoS ::= <AVP header: 2504 10415>

[LCS-QoS-Class]
[Horizontal-Accuracy]
[Vertical-Accuracy]
[Vertical-Requested]
[Response-Time]

7.4.7 Horizontal-Accuracy

The Horizontal-Accuracy AVP is of type Unsigned32. Bits 6-0 corresponds to Uncertainty Code defined in 3GPP TS 23.032 [3]. The horizontal location error should be less than the error indicated by the uncertainty code with 67% confidence. Bits 7 to 31 shall be ignored.

7.4.8 Vertical-Accuracy

The Vertical-Accuracy AVP is of type Unsigned32. Bits 6-0 corresponds to Uncertainty Code defined in 3GPP TS 23.032 [3]. The vertical location error should be less than the error indicated by the uncertainty code with 67% confidence. Bits 7 to 31 shall be ignored.

7.4.9 Vertical-Requested

The Vertical-Requested AVP is of type Enumerated. The following values are defined:

VERTICAL_COORDINATE_IS_NOT REQUESTED (0)

VERTICAL_COORDINATE_IS_REQUESTED (1)

Default value if AVP is not present is: VERTICAL_COORDINATE_IS_NOT_REQUESTED (0).

7.4.10 Velocity-Requested

The Velocity-Requested AVP is of type Enumerated. The following values are defined:

VELOCITY_IS_NOT_REQUESTED (0)

VELOCITY_IS_REQUESTED (1)

Default value if AVP is not present is: VELOCITY_IS_NOT_REQUESTED (0).

7.4.11 Response-Time

The Response-Time AVP is of type Enumerated. The following values are defined:

LOW_DELAY (0)

DELAY_TOLERANT (1)

7.4.12 Supported-GAD-Shapes

The Supported-GAD-Shapes AVP is of type Unsigned32 and it shall contain a bitmask.

A node shall mark in the BIT STRING all Shapes defined in 3GPP TS 23.032 [3] it supports.

Bits 6-0 in shall indicate the supported Shapes defined in 3GPP TS 23.032 [3]. Bits 7 to 31 shall be ignored.

ellipsoidPoint (0)

ellipsoidPointWithUncertaintyCircle (1)

ellipsoidPointWithUncertaintyEllipse (2)

polygon (3)

ellipsoidPointWithAltitude (4)

ellipsoidPointWithAltitudeAndUncertaintyElipsoid (5)

ellipsoidArc (6)

7.4.13 LCS-Codeword

The LCS-Codeword AVP is of type UTF8String. It indicates the potential codeword string to send in a notification message to the UE.

7.4.14 LCS-Privacy-Check

The LCS-Privacy-Check AVP is of type Enumerated. The following values are defined:

ALLOWED_WITHOUT_NOTIFICATION (0)

ALLOWED_WITH_NOTIFICATION (1)

ALLOWED_IF_NO_RESPONSE (2)

RESTRICTED_IF_NO_RESPONSE (3)

NOT_ALLOWED (4)

Default value if AVP is not present is: ALLOWED_WITHOUT_NOTIFICATION (0).

7.4.15 Accuracy-Fulfilment-Indicator

The Accuracy-Fulfilment-Indicator AVP is of type Enumerated. The following values are defined:

REQUESTED_ACCURACY_FULFILLED (0)

REQUESTED_ACCURACY_NOT_FULFILLED (1)

7.4.16 Age-Of-Location-Estimate

The Age-Of-Location-Estimate AVP is of type Unsigned32. It indicates how long ago the location estimate was obtained in minutes, as indicated in 3GPP TS 29.002 [19].

7.4.17 Velocity-Estimate

The Velocity-Estimate AVP is of type OctetString. It is composed of 4 or more octets with an internal structure according to 3GPP TS 23.032 [3].

7.4.18 EUTRAN-Positioning-Data

The EUTRAN-Positioning-Data AVP is of type OctetString. It shall contain the encoded content of the "Positioning-Data" Information Element as defined in 3GPP TS 29.171 [7].

7.4.19 ECGI

The ECGI AVP is of type OctetString. It indicates the E-UTRAN Cell Global Identifier. It is coded according to clause 8.21.5, in 3GPP TS 29.274 [8].

7.4.20 Location-Event

The Location-Event AVP is of type Enumerated. The following values are defined:

EMERGENCY_CALL_ORIGINATION (0)

EMERGENCY_CALL_RELEASE (1)

MO_LR (2)

EMERGENCY_CALL_HANDOVER (3)

DEFERRED_MT_LR_RESPONSE (4)

DEFERRED_MO_LR_TTTP_INITIATION (5)

NOTE: Values (4) and (5) are only applicable over Lgd interface. The MME cannot use these values over SLg interface.

DEFERRED_MT_LR_RESPONSE is applicable to the delivery of a location estimate for an LDR initiated earlier by either the network (via an MT-LR activate deferred location) or the UE (via a periodic MO-LR TTTP initiation).

7.4.21 Pseudonym-Indicator

The Pseudonym-Indicator AVP is of type Enumerated. It defines if a pseudonym is requested. The following values are defined:

PSEUDONYM_NOT_REQUESTED (0)

PSEUDONYM_REQUESTED (1)

Default value if AVP is not present is: PSEUDONYM_NOT_REQUESTED (0).

7.4.22 LCS-Service-Type-ID

The LCS-Service-Type-ID is of type Unsigned32. It defines the identifier associated to one of the Service Types for which the LCS client is allowed to locate the particular UE.

7.4.23 LCS-Privacy-Check-Non-Session

The LCS-Privacy-Check-Non-Session AVP is of type Grouped.

AVP format:

LCS-Privacy-Check-Non-Session ::= <AVP header: 2521 10415>

{ LCS-Privacy-Check }

Default value if AVP is not present is that AVP LCS-Privacy-Check take value:
ALLOWED_WITHOUT_NOTIFICATION (0).

7.4.24 LCS-Privacy-Check-Session

The LCS-Privacy-Check-Session AVP is of type Grouped.

AVP format:

LCS-Privacy-Check-Session ::= <AVP header: 2522 10415>

{ LCS-Privacy-Check }

Default value if AVP is not present is that AVP LCS-Privacy-Check take value: NOT_ALLOWED (4).

7.4.25 Feature-List-ID

The syntax of this AVP is defined in 3GPP TS 29.229 [17]. For this release, the Feature-List-ID AVP value shall be set to 1.

7.4.26 Feature-List

The syntax of this AVP is defined in 3GPP TS 29.229 [17]. A null value indicates that there is no feature used by the application.

NOTE: There are no features defined for this release.

7.4.27 LCS-QoS-Class

The LCS-QoS-Class AVP is of the type Enumerated. The following values are defined.

ASSURED (0)

BEST EFFORT (1)

7.4.28 Serving-Node

The Serving-Node AVP is of type Grouped. This AVP shall contain the information about the network node serving the targeted user.

7.4.29 GERAN-Positioning-Info

The GERAN-Positioning-Info AVP is of type Grouped.

AVP format:

GERAN-Positioning-Info ::= <AVP header: 2524 10415>

[GERAN-Positioning-Data]

[GERAN-GANSS-Positioning-Data]

*[AVP]

7.4.30 GERAN-Positioning-Data

The GERAN-Positioning-Data AVP is of type OctetString. It shall contain the encoded content of the "Positioning Data" Information Element as defined in 3GPP TS 49.031 [20].

7.4.31 GERAN-GANSS-Positioning-Data

The GERAN-GANSS-Positioning-Data AVP is of type OctetString. It shall contain the encoded content of the "GANSS Positioning Data" Information Element as defined in 3GPP TS 49.031 [20].

7.4.32 UTRAN-Positioning-Info

The UTRAN-Positioning-Info AVP is of type Grouped.

AVP format:

UTRAN-Positioning-Info ::= <AVP header: 2527 10415>

[UTRAN-Positioning-Data]

[UTRAN-GANSS-Positioning-Data]

*[AVP]

7.4.33 UTRAN-Positioning-Data

The UTRAN-Positioning-Data AVP is of type OctetString. It shall contain the encoded content of the "positioningDataDiscriminator" and the "positioningDataSet" included in the "positionData" Information Element as defined in 3GPP TS 25.413 [21].

7.4.34 UTRAN-GANSS-Positioning-Data

The UTRAN-GANSS-Positioning-Data AVP is of type OctetString. It shall contain the encoded content of the "GANSS-PositioningDataSet" only, included in the "positionData" Information Element as defined in 3GPP TS 25.413 [21].

7.4.35 LRR-Flags

The LRR-Flags AVP is of type Unsigned32 and it shall contain a bit mask. The meaning of the bits shall be as defined in table 7.4.35/1:

Table 7.4.35/1: LRR-Flags

Bit	Name	Description
0	Lgd/SLg-Indicator	This bit, when set, indicates that the Location Report Request message is sent on the Lgd interface, i.e. the source node is an SGSN (or a combined MME/SGSN to which the UE is attached via UTRAN or GERAN). This bit, when cleared, indicates that the Location Report Request message is sent on the SLg interface, i.e. the source node is an MME (or a combined MME/SGSN to which the UE is attached via E-UTRAN).
1	MO-LR-ShortCircuit-Indicator	This bit, when set, indicates that the MO-LR short circuit feature is used by the UE for location estimate. This bit is applicable only when for deferred MT-LR procedure and when the message is sent over Lgd interface.
2	MO-LR-ShortCircuit-Requested	This bit, when set, indicates that the UE is requesting to use MO-LR short circuit feature for location estimate. This bit is applicable only when periodic MO-LR TTTP procedure is initiated by the UE and when the message is sent over Lgd interface.
NOTE1: Bits not defined in this table shall be cleared by the sending MME or SGSN and discarded by the receiving GMLC.		

7.4.36 Deferred-Location-Type

The Deferred-Location-Type AVP is of type Unsigned32 and it shall contain a bit mask. Each bit indicates a type of event, until when the location estimation is deferred. For details, please refer to 3GPP TS 23.271 [3] clause 4.4.2. The meaning of the bits shall be as defined in table 7.4.36/1:

Table 7.4.36/1: Deferred-Location-Type

Bit	Event Type	Description
0	UE-Available	Any event in which the SGSN has established a contact with the UE.
1	Entering-Into-Area	An event where the UE enters a pre-defined geographical area.
2	Leaving-From-Area	An event where the UE leaves a pre-defined geographical area.
3	Being-Inside-Area	An event where the UE is currently within the pre-defined geographical area.For this event, the value of Occurrence-Info AVP is always treated as set to "ONE_TIME_EVENT".
4	Periodic-LDR	An event where a defined periodic timer expires in the UE and activates a location report or a location request.

7.4.37 LCS-Reference-Number

The LCS-Reference-Number AVP is of type OctetString of length 1. It shall contain the reference number identifying the deferred location request.

7.4.38 Area-Event-Info

The Area-Event-Info AVP is of type Grouped.

AVP format:

Area-Event-Info ::= <AVP header: 2533 10415>

{ Area-Definition }

[Occurrence-Info]

[Interval-Time]

*[AVP]

If not included, the default value of Occurrence-Info shall be considered as "ONE_TIME_EVENT" (0). Interval-Time AVP is only applicable when the Occurrence-Info is set to "MULTIPLE_TIME_EVENT" (1).

7.4.39 Area-Definition

The Area-Definition AVP is of type Grouped.

AVP format:

Area-Definition ::= <AVP header: 2534 10415>

1*10{ Area }

*[AVP]

7.4.40 Area

The Area AVP is of type Grouped.

AVP format:

Area ::= <AVP header: 2535 10415>

{ Area-Type }

{ Area-Identification }

*[AVP]

7.4.41 Area-Type

The Area-Type AVP is of type Unsigned32. The following values are defined:

"Country Code" 0

"PLMN ID" 1

"Location Area ID" 2

"Routing Area ID" 3

"Cell Global ID" 4

"UTRAN Cell ID" 5

7.4.42 Area-Identification

The Area-Identification AVP is of type OctetString and shall contain the identification of the area applicable for the change of area event based deferred location reporting. Octets are coded as described in 3GPP TS 29.002 [24].

7.4.43 Occurrence-Info

The Occurrence-Info AVP is of type Enumerated. The following values are defined:

ONE_TIME_EVENT (0)

MULTIPLE_TIME_EVENT (1)

7.4.44 Interval-Time

The Interval-Time AVP is of type Unsigned32 and it contains minimum time interval between area reports, in seconds.

7.4.45 Periodic-LDR-Info

The Periodic-LDR-Info AVP is of type Grouped.

AVP format:

Periodic-LDR-Info ::= <AVP header: 2540 10415>

{ Reporting-Amount }

{ Reporting-Interval }

*[AVP]

Reporting-Interval x Rreporting-Amount shall not exceed 8639999 (99 days, 23 hours, 59 minutes and 59 seconds) for compatibility with OMA MLP and RLP.

7.4.46 Reporting-Amount

The Reporting-Amount AVP is of type Unsigned32 and it contains reporting frequency. Its minimum value shall be 1 and maximum value shall be 8639999.

7.4.47 Reporting-Interval

The Interval-Time AVP is of type Unsigned32 and it contains reporting interval in seconds. Its minimum value shall be 1 and maximum value shall be 8639999.

7.4.48 Reporting-PLMN-List

The Reporting-PLMN-List AVP is of type Grouped.

AVP format:

Reporting-PLMN-List ::= <AVP header: 2543 10415>

1*20{ PLMN-ID-List }

[Prioritized-List-Indicator]

*[AVP]

If not included, the default value of Prioritized-List-Indicator shall be considered as "NOT_PRIORITIZED" (0).

7.4.49 PLMN-ID-List

The PLMN-ID-List AVP is of type Grouped.

AVP format:

PLMN-ID-List ::= <AVP header: 2544 10415>

{ Visited-PLMN-Id }

[Periodic-Location-Support-Indicator]

*[AVP]

If not included, the default value of Periodic-Location-Support-Indicator shall be considered as "NOT_SUPPORTED" (0).

7.4.50 Periodic-Location-Support-Indicator

The Periodic-Location-Support-Indicator AVP is of type Enumerated and it indicates if the given PLMN-ID (indicated by Visited-PLMN-Id) supports periodic location or not. The following values are defined:

NOT_SUPPORTED (0)

SUPPORTED (1)

7.4.51 Prioritized-List-Indicator

The Prioritized-List-Indicator AVP is of type Enumerated and it indicates if the PLMN-ID-List is provided in prioritized order or not. The following values are defined:

NOT_PRIORITIZED (0)

PRIORITIZED (1)

7.4.52 PLR-Flags

The PLR-Flags AVP is of type Unsigned32 and it shall contain a bit mask. The meaning of the bits shall be as defined in table 7.4.52/1:

Table 7.4.52/1: PLR-Flags

Bit	Name	Description
0	MO-LR-ShortCircuit-Indicator	This bit, when set, indicates that the MO-LR short circuit feature is requested for the periodic location. This bit is applicable only when the deferred MT-LR procedure is initiated for a periodic location event and when the message is sent over Lgd interface.
1	Optimized-LCS-Proc-Req	This bit, when set, indicates that the GMLC is requesting the optimized LCS procedure for the combined MME/SGSN. This bit is applicable only when the MT-LR procedure is initiated by the GMLC. The GMLC shall set this bit only when the HSS indicates the combined MME/SGSN node supporting the optimized LCS procedure.
NOTE1: Bits not defined in this table shall be cleared by the sending GMLC and discarded by the receiving MME or SGSN.		

7.4.53 PLA-Flags

The PLA-Flags AVP is of type Unsigned32 and it shall contain a bit mask. The meaning of the bits shall be as defined in table 7.4.53/1:

Table 7.4.53/1: PLA-Flags

Bit	Name	Description
0	Deferred-MT-LR-Response-Indicator	This bit, when set, indicates that the message is sent in response to the deferred-MT location request. This bit is applicable only when the message is sent over Lgd interface.
1	MO-LR-ShortCircuit-Indicator	This bit, when set, indicates that the MO-LR short circuit feature is accepted by the UE, for periodic location reporting. This bit is applicable only when the message is sent over Lgd interface.
2	Optimized-LCS-Proc-Performed	This bit, when set, indicates that the combined MME/SGSN has performed the optimized LCS procedure to retrieve the location of the target UE. This bit is applicable only when the message is sent for the MT-LR procedure.
NOTE1: Bits not defined in this table shall be cleared by the sending MME or SGSN and discarded by the receiving GMLC.		

7.4.54 Deferred-MT-LR-Data

The Deferred-MT-LR-Data AVP is of type Grouped.

AVP format:

Deferred-MT-LR-Data ::= <AVP header: 2547 10415>

{ Deferred-Location-Type }

[Termination-Cause]

[Serving-Node]

*[AVP]

Serving-Node may be included only when the Termination-Cause is present indicating MT_LR_RESTART.

The Serving-Node refers to the node where the UE has moved to and shall be included, if available.

7.4.55 Termination-Cause

The Termination-Cause AVP is of type Unsigned32. The following values are defined:

"Normal" 0

"Error Undefined" 1

"Internal Timeout" 2

"Congestion" 3

"MT_LR_Restart" 4

"Privacy Violation" 5

"Shape of Location Estimate Not Supported" 6

"Subscriber Termination" 7

"UE Termination" 8

"Network Termination" 9

"MT_LR_Restart" cause code shall be used to trigger the GMLC to restart the location procedure, either because the sending node knows that the terminal has moved under coverage of another SGSN, or because the subscriber has been deregistered due to a Cancel Location received from HSS.

Any unrecognized value of Termination-Cause shall be treated the same as value 1 ("Error Undefined").

7.4.56 LRA-Flags

The LRA-Flags AVP is of type Unsigned32 and it shall contain a bit mask. The meaning of the bits shall be as defined in table 7.4.56/1:

Table 7.4.56/1: LRA-Flags

Bit	Name	Description
0	MO-LR-ShortCircuit-Indicator	This bit, when set, indicates that the MO-LR short circuit feature is used for obtaining location estimate. This bit is applicable only when the message is sent over Lgd interface.
NOTE1: Bits not defined in this table shall be cleared by the sending GMLC and discarded by the receiving MME or SGSN.		

7.4.57 ESMLC-Cell-Info

The ESMLC-Cell-Info AVP is of type Grouped.

AVP format:

ESMLC-Cell-Info ::= <AVP header: 2552 10415>

[ECGI]
[Cell-Portion-ID]
*[AVP]

7.4.58 Cell-Portion-ID

The Cell-Portion-ID AVP is of type Unsigned32. It indicates the current Cell Portion location of the target UE as provided by the E-SMLC. It shall contain the value of the "Cell Portion ID" Information Element as defined in 3GPP TS 29.171 [7].

7.4.59 1xRTT-RCID

The 1xRTT-RCID AVP is of type OctetString. It indicates the 1xRTT Reference Cell Id that consists of a Cell Identification Discriminator and a Cell Identification and shall be formatted according to octets 3 through the end of the

Cell Identifier element defined in clause 4.2.17 in 3GPP2 A.S0014-D [22]. The allowable cell discriminator values are "0000 0010", and "0000 0111".

7.5 Result-Code AVP and Experimental-Result AVP Values

7.5.1 General

This clause defines result code values that shall be supported by all Diameter implementations that conform to this specification.

7.5.2 Success

Result codes that fall within the Success category shall be used to inform a peer that a request has been successfully completed. The Result-Code AVP values defined in Diameter Base Protocol RFC 3588 [4] shall be applied.

7.5.3 Permanent Failures

Errors that fall within the Permanent Failures category shall be used to inform the peer that the request has failed, and should not be attempted again. The Result-Code AVP values defined in Diameter Base Protocol RFC 3588 [5] shall be applied. When one of the result codes defined here is included in a response, it shall be inside an Experimental-Result AVP and the Result-Code AVP shall be absent.

7.5.3.1 DIAMETER_ERROR_USER_UNKNOWN (5001)

This result code shall be sent by the MME/SGSN to indicate that the user is unknown. This error code is defined in 3GPP TS 29.229 [17]

7.5.3.2 DIAMETER_ERROR_UNAUTHORIZED_REQUESTING_NETWORK (5490)

This result code shall be sent by the MME/SGSN to indicate that the requesting GMLC's network is not authorized to request UE location information. This error code is defined in 3GPP TS 29.173 [18]

7.5.4 Transient Failures

Errors that fall within the transient failures category are those used to inform a peer that the request could not be satisfied at the time that it was received. The request may be able to be satisfied in the future.

7.5.4.1 DIAMETER_ERROR_UNREACHABLE_USER (4221)

This result code shall be sent by the MME/SGSN to indicate that the user could not be reached in order to perform positioning procedure.

7.5.4.2 DIAMETER_ERROR_SUSPENDED_USER (4222)

This result code shall be sent by the MME/SGSN to indicate that the user is suspended in the MME.

7.5.4.3 DIAMETER_ERROR_DETACHED_USER (4223)

This result code shall be sent by the MME/SGSN to indicate that the user is detached in the MME.

7.5.4.4 DIAMETER_ERROR_POSITIONING_DENIED (4224)

This result code shall be sent by the MME/SGSN to indicate that the positioning procedure was denied.

7.5.4.5 DIAMETER_ERROR_POSITIONING_FAILED (4225)

This result code shall be sent by the MME/SGSN to indicate that the positioning procedure failed.

7.5.4.6 DIAMETER_ERROR_UNKNOWN_UNREACHABLE LCS_CLIENT (4226)

This result code shall be sent by the GMLC to indicate that the LCS Client was not known or could not be reached.

Annex A (informative): Change history

Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	New
2010-03	CT#47	CP-100055			3GPP TS presented for approval in CT#47	9.0.0
2010-06	CT#48	CP-100286	0001		Velocity-Requested IE	9.1.0
2010-09	CT#49	CP-100463	0002	1	Addition of Command Codes	9.2.0
			0003	1	Notification Verification Only in Location Type	9.2.0
			0004	1	SLg for Inter Domain Scenarios	9.2.0
			0005		Editorial Updates	9.2.0
			0007		Definition of EUTRAN-Positioning-Data	9.2.0
2010-12	CT#50	CP-100681	0009		Clarification of LCS-priority AVP	9.3.0
			0010		Correction of error code assignment	9.3.0
			0011		Correction of bit numbering in Horizontal and Vertical Accuracy IEs in SLg	9.3.0
			0012		Units of Age of Location Estimate IE in SLg	9.3.0
2011-03	CT#51	CP-110054	0013	1	Add missing Vendor Specific Application Id	9.4.0
			0014	2	Essential correction on the value type of the ELP Application AVPs	9.4.0
2011-03					Update to Rel-10 version (MCC)	10.0.0
2011-09	CT#53	CP-110565	0015	2	Correction to references	10.1.0
2012-09	CT#57				Update to Rel-11 version (MCC)	11.0.0
2013-03	CT#59	CP-130156	0016	1	Definition of Lgd interface between SGSN and GMLC (Clause 1, 3, 4, 5)	12.0.0
			0017	1	Definition of Lgd interface between SGSN and GMLC (Clause 2, 6, 7)	12.0.0
2013-06	CT#60	CP-130291	0018	2	Support of deferred MT-LR and periodic MO-LR TTTP procedures over Lgd interface	12.1.0
2013-09	CT#61	CP-130458	0019	1	Addressing the editor's note of the Location-Event AVP	12.2.0
2013-12	CT#62	CP-130631	0024	1	Adding E-SMLC provided Cell info and Cell Portion	12.3.0
		CP-130624	0023	3	Optimized LCS procedure between GMLC and combined MME/SGSN	12.3.0
2014-03	CT#63	CP-140032	0025	2	E-SMLC provided Cell info and Cell Portion	12.4.0
2015-03	CT#67	CP-150015	0031	-	Renaming of Location-Type AVP	12.5.0
		CP-150018	0027	1	Location reporting in emergency 1xSRVCC	12.5.0
2019-12	CT#86	CP-193018	0043	-	Missing AVPs in Provide-Location-Request Command	12.6.0

History

Document history		
V12.4.0	October 2014	Publication
V12.5.0	April 2015	Publication
V12.6.0	January 2020	Publication