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TECHNICAL SPECIFICATION

**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

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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.

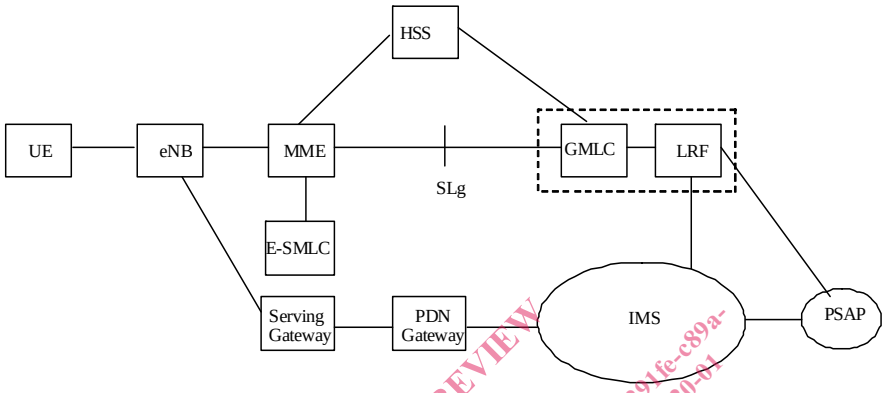

Figure 4.1-1 SLg interface in the LCS Architecture

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

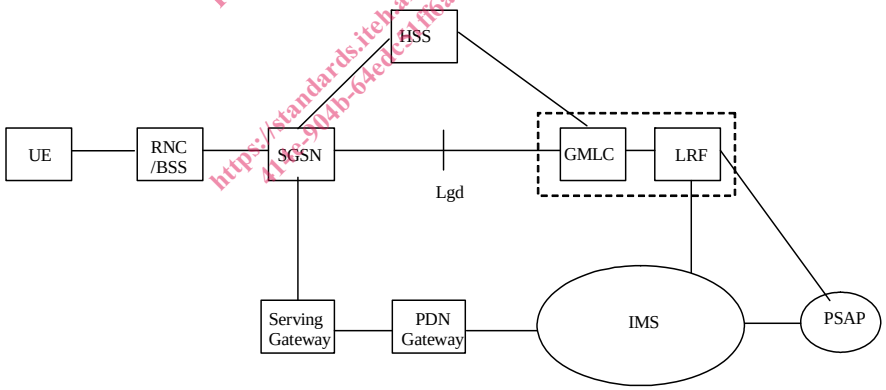

Figure 4.1-2 Lgd interface in the LCS Architecture

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

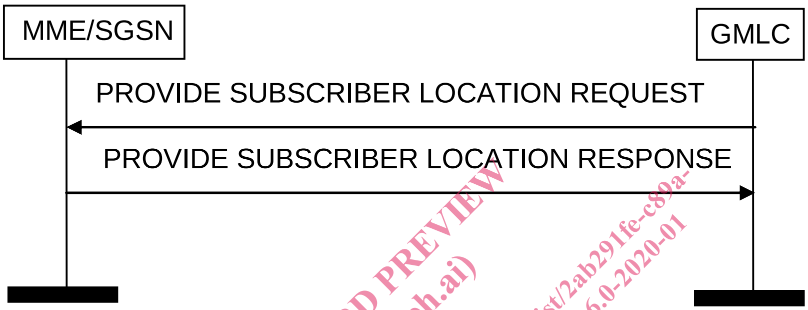

Figure 6.2.2-1: Provide Subscriber Location procedure. Successful operation.

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