



## TECHNICAL SPECIFICATION

**Digital cellular telecommunications system (Phase 2+) (GSM);  
Universal Mobile Telecommunications System (UMTS);  
LTE;  
Location Services (LCS);  
LCS Application Protocol (LCS-AP)  
between the Mobile Management Entity (MME)  
and Evolved Serving Mobile Location Centre (E-SMLC);  
SLs interface  
(3GPP TS 29.171 version 18.1.0 Release 18)**



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**Reference**RTS/TSGC-0429171v10

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**Keywords**GSM,LTE,UMTS

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# Foreword

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

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**shall not** indicates an interdiction (prohibition) to do something

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**should not** indicates a recommendation not to do something

**may** indicates permission to do something

**need not** indicates permission not to do something

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**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.

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# 1 Scope

The present document specifies the procedures and information coding for LCS Application Protocol (LCS-AP) that is needed to support the location services in E-UTRAN. The LCS-AP message set is applicable to the SLs interface between the E-SMLC and the MME. LCS-AP is developed in accordance to the general principles stated in TS 23.271 [3].

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# 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 36.305: "Stage 2 functional specification of User Equipment (UE) positioning in E-UTRAN".
- [3] 3GPP TS 23.271: "Functional stage 2 description of Location Services (LCS)".
- [4] IETF RFC 4960: "Stream Control Transmission Protocol".
- [5] TIA/EIA/IS-J-STD-036 (2000): "Wireless Enhanced Emergency Services".
- [6] 3GPP TS 23.032: "Universal Geographical Area Description (GAD)".
- [7] 3GPP TS 36.413: "S1 Application Protocol (S1AP)".
- [8] ITU-T Recommendation X.680 (07/2002): "Information Technology - Abstract Syntax Notation One (ASN.1): Specification of basic notation".
- [9] ITU-T Recommendation X.681 (07/2002): "Information Technology - Abstract Syntax Notation One (ASN.1): Information object specification".
- [10] 3GPP TS 22.071: "Location Services (LCS); Service Description; Stage1".
- [11] 3GPP TS 23.003: "Numbering, addressing and identification".
- [12] ITU-T Recommendation X.691 (07/2002): "Information Technology - ASN.1 encoding rules - Specification of Packed Encoding Rules (PER)".
- [13] IETF RFC 4119: "A Presence-based GEOPRIV Location Object Format".
- [14] IETF RFC 5139: "Revised Civic Location Format for Presence Information Data Format Location Object".
- [15] IETF RFC 6848: "Specifying Civic Address Extensions in the Presence Information Data Format Location Object (PIDF-LO)".
- [16] IETF RFC 5905: "Network Time Protocol Version 4: Protocol and Algorithms Specification".
- [17] 3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3".

- [18] IETF RFC 4776: "Dynamic Host Configuration Protocol (DHCPv4 and DHCPv6) Option for Civic Addresses Configuration Information".

## 3 Definitions 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].

**Elementary Procedure:** LCS-AP protocol consists of Elementary Procedures (EPs). An LCS-AP Elementary Procedure is a unit of interaction between the MME and the E-SMLC. An EP consists of an initiating message and possibly a response message. Two kinds of EPs are used:

- **Class 1:** Elementary Procedures with response (success or failure),
- **Class 2:** Elementary Procedures without response.

### 3.2 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].

CID	Cell-ID (positioning method)
E-CID	Enhanced Cell-ID (positioning method)
E-SMLC	Enhanced Serving Mobile Location Centre
E-UTRAN	Evolved Universal Terrestrial Radio Access Network
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
LCS	LoCation Services
LCS-AP	LCS Application Protocol
LPP	LTE Positioning Protocol
LPPa	LTE Positioning Protocol Annex
LTE	Long Term Evolution
MBS	Metropolitan Beacon System
MO-LR	Mobile Originated Location Request
MT-LR	Mobile Terminated Location Request
NI-LR	Network Induced Location Request
MME	Mobility Management Entity
OTDOA	Observed Time Difference Of Arrival
PDU	Protocol Data Unit
SCTP	Stream Control Transmission Protocol
SET	SUPL Enabled Terminal
SLP	SUPL Location Platform
SUPL	Secure User Plane Location
TA	Timing Advanced
UE	User Equipment
U-TDOA	Uplink Time Difference Of Arrival

## 4 Functional Overview

### 4.1 General

Figure 4.1-1 below shows the architecture applicable to the positioning of a UE with E-UTRAN access. The SLs interface is used to convey LCS-AP messages and parameters between the MME to the E-SMLC. It is also used for tunnelling LTE Positioning Protocols (LPP between the E-SMLC and the target UE, LPPa between the E-SMLC and the eNB), which are transparent to the MME as described in TS 36.305 [2].

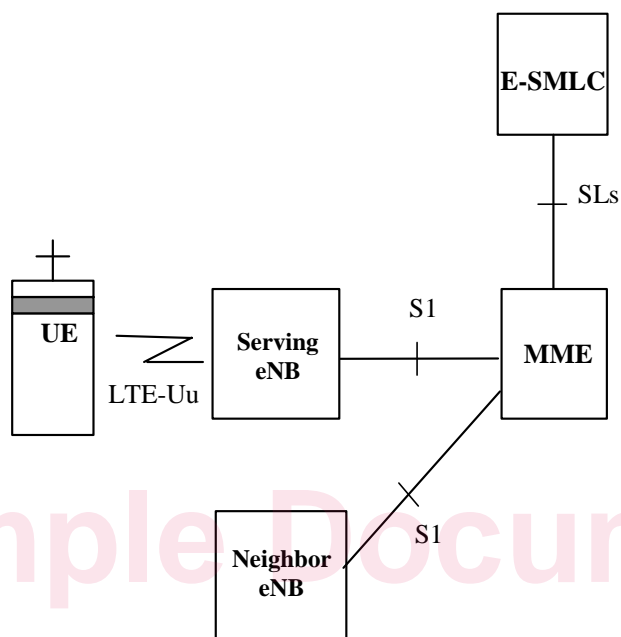


Figure 4.1-1 Positioning Interfaces in E-UTRAN

## 5 LCS-AP Message Transport

### 5.1 General

The LCS-AP is a logical interface between the MME and the E-SMLC. This clause specifies the standards for signaling transport to be used across LCS-AP.

### 5.2 Protocol Layering

Figure 5.2-1 below shows the protocol layering used to support the transfer of LCS-AP PDUs between an E-SMLC and a MME. The LTE Positioning Protocols (LPP and LPPa) can be carried in LCS-AP messages which are transparent to the MME.

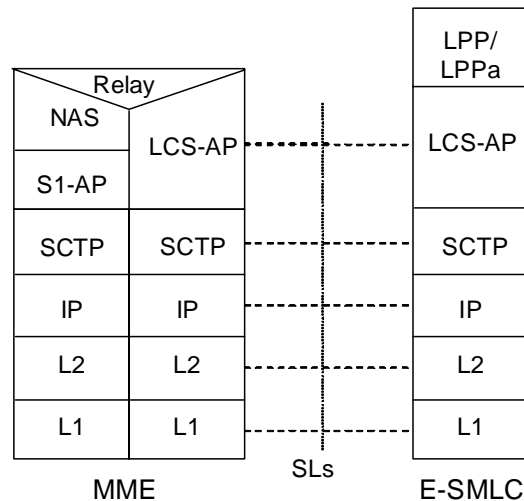


Figure 5.2-1 Protocol Layering for LCS-AP

## 5.3 Usage of SCTP Associations

SCTP (see IETF RFC 4960 [4]) shall be supported as the transport layer of LCS-AP messages.

Semi-permanent SCTP associations shall be established between MME and E-SMLC, i.e. the SCTP associations shall remain up under normal circumstances.

Local multi-homing should be supported. Remote multi-homing shall be supported.

Multiple local SCTP endpoints may be supported. Multiple remote SCTP endpoints shall be supported. When multiple local or remote SCTP endpoints are configured, several simultaneous SCTP associations shall be supported between MME and E-SMLC.

The MME shall establish the SCTP association. Since under normal operation there should always be an SCTP association established between an MME and an E-SMLC, if the E-SMLC needs to initiate a message towards an MME it shall do so over an existing SCTP association already established with that MME.

When an entity detects that an SCTP association has been lost, all resources for transactions open on that association shall be released.

The registered port number for LCS-AP is 9082. The registered payload protocol identifier for LCS-AP is 29.

# 6 LCS-AP Procedures

## 6.1 General

The LCS-AP interface can be divided into the following procedures:

- Location service request procedure
- Location information exchange procedure

The E-UTRAN positioning capabilities are intended to be forward compatible to other access types and other position methods, in an effort to reduce the amount of additional positioning support needed in the future.

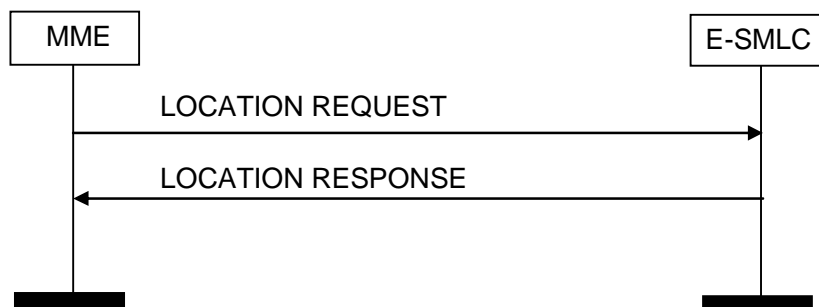
## 6.2 Procedures Applicable to LCS-AP

### 6.2.1 Location Service Request

#### 6.2.1.1 General

The purpose of the location service request procedure is to obtain the location estimate for a target UE in E-UTRAN.

#### 6.2.1.2 Successful Operation



**Figure 6.2.1.2-1 Location Service Request Procedure, Successful Operation**

The initiator (MME) of the location service request procedure sends a LCS-AP Location Request message to the E-SMLC associated with the current or last known serving cell for the target UE and starts the timer T3x01. The message contains the following mandatory (M), conditional (C) and optional (O) information, where conditional parameters are required if available.

- Correlation ID (M)
- Location Type (M)
- Cell Identifier (M)
- LCS Client Type (C)
- LCS Priority (C)
- LCS Service Type ID (C)
- LCS QoS (C)
- UE Positioning Capability (O)
- Include Velocity (O)
- IMSI of target UE (O)
- IMEI of target UE (O)
- APDU (O)
- RAT Type (O)
- Coverage Level (O)
- UE Country Determination Indication (O)

The Correlation ID is assigned by the MME and enables association of the location response with the location request when more than one location service request procedure is ongoing for the UE with the same E-SMLC.

The Location Type IE indicates the type of Location Information being requested. The following types are supported:

- Current geographic location estimate
- Location assistance data for the target UE
- Last known location estimate

If the location estimate is requested, the E-SMLC performs positioning procedure on the target UE using a particular position method or a combination of more than one positioning method based on the UE capability. If UE capability is unknown, the E-SMLC may request UE position capability through LPP as defined in TS 36.305 [2]. If the location estimate is requested and the UE Country Determination Indication is set to "required", the E-SMLC shall map the location estimate to the country or the area in the country or international area.

Alternatively, if assistance data was requested, the E-SMLC may provide positioning assistance data to the UE. The E-SMLC may invoke the following LCS-AP procedures to get assistance data:

- Connection Oriented Information Transfer
- Connectionless Information Transfer

Otherwise, if a last known location estimate is requested, the E-SMLC obtains a geographic location estimate using only the information provided in the LCS-AP Location Request message. The E-SMLC shall not attempt to obtain location information for the target UE from either the E-UTRAN or the target UE (e.g. because the UE may not be currently reachable).

If a location estimate or a last known location estimate was requested and was subsequently obtained, the E-SMLC shall return a LCS-AP Location Response to the initiator of the location request using the same SCTP association as the location request. This message contains the following mandatory (M), conditional (C) and optional parameters (O).

- Correlation ID (M)
- Location Estimate (M).
- Accuracy Fulfilment Indicator (O).
- Velocity estimate (C).
- Positioning Data (C).
- E-UTRAN Cell Identifier (O).
- Cell Portion ID (O).
- Civic Address (O).
- Barometric Pressure (O).
- UE Area Indication (O).

If assistance data was instead requested for an UE and the E-SMLC was able successfully to transfer this to the UE, the E-SMLC shall return a LCS-AP Location Response to the initiator of the location request (MME). This message shall contain no parameters. The absence of a LCS Cause parameter in this case implies that the transfer was successful.

If the MME receives the LCS-AP Location Response for corresponding request message, the MME shall stop the timer T3x01.

### 6.2.1.3 Unsuccessful Operation

If the E-SMLC is unable to obtain any of the location information requested or if requested LCS assistance data could not be transferred, the E-SMLC shall return a LCS-AP Location Response to the initiator of the Location Request carrying the following parameters:

- Correlation ID (M)
- LCS Cause (M)

- Positioning Data (O)

The E-SMLC shall use the same SCTP association for the Location Response as was used for the request.

If the MME receives the LCS-AP Location Response for corresponding request message, the MME shall stop the timer T3x01.

On the expiry of the timer T3x01, the MME shall abort the procedure, release any resources allocated for this location request procedure and notify the node that triggered the Location Request about the error.

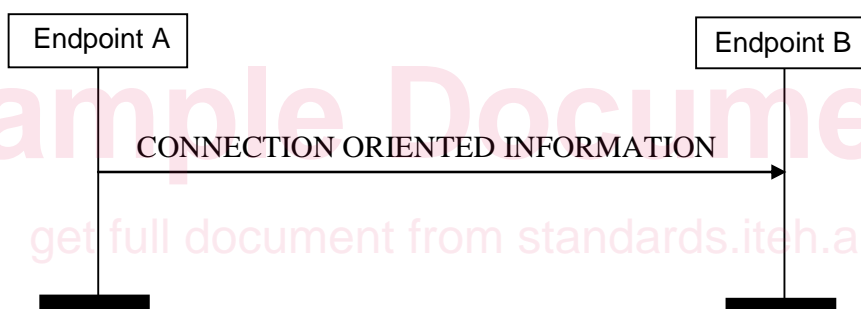
## 6.2.2 Location Information Exchange

### 6.2.2.1 Connection Oriented Information Transfer

#### 6.2.2.1.1 General

The Connection Oriented Information transfer procedure enables two-way transfer of LPP and LPPa messages between an E-SMLC and a MME. The procedure is only valid while a location request procedure for the target UE is ongoing. This procedure makes use of the same SCTP association as the location request procedure for the particular target UE.

#### 6.2.2.1.2 Successful Operation



**Figure 6.2.2.1.2-1 Connection Oriented Information, Successful Operation**

The initiator of the procedure (E-SMLC or MME) with a LPP or LPPa message to transfer concerning a particular target UE sends a LCS-AP Connection Oriented Information message to a recipient carrying the following parameters:

- Correlation ID (M)
- Payload Type (M)
- APDU (M);

The Correlation ID in this message is the Correlation ID used for the Location Request. It shall be present for a message transfer from the E-SMLC to the MME and for a message transfer from the MME to the E-SMLC.

The Payload Type shall be present to indicate the type of the APDU. The supported information types are LPP and LPPa.

The APDU shall contain an LPP APDU when communicating between the E-SMLC and the target UE or an LPPa APDU when communicating between the E-SMLC and serving eNB. The MME shall forward this to the serving eNB for the target UE.

If the intended recipient is the E-SMLC for a target UE, the message is terminated in the E-SMLC. The E-SMLC shall then perform interpretation of the APDU.