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procedures in the Evolved Packet System (EPS)
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650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
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Foreword

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

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- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document specifies the operations and information coding for the Non-access Stratum (NAS) layer protocol for supporting the Location Services (LCS) in the Evolved Universal Terrestrial Radio Access Network (E-UTRAN).

The present document is applicable to the User Equipment (UE) and to the Mobility Management Entity (MME) in the Evolved Packet System (EPS).

The present document is developed in accordance to the general principles stated in 3GPP TS 23.271 [1].

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 LCS".

[3] 3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS)".

[4] 3GPP TS 36.355: "LTE Positioning Protocol".

[5] 3GPP TS 24.080: "Mobile radio interface layer 3 supplementary services specification; Formats and coding ".

[6] 3GPP TS 24.030: "LCS Supplementary service operations; Stage 3".

[7] 3GPP TS 29.171: "Definition of SLs interface for Control Plane LCS".

[8] 3GPP TS 23.272: "Circuit Switched (CS) fallback in Evolved Packet System (EPS); Stage 2".

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].

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.272 [8] apply:

CS fallback

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].

EPS	Evolved Packet System
IE	Information Element
E-UTRAN	Evolved Universal Terrestrial Radio Access Network
LCS	Location Services
LPP	LTE Positioning Protocol
LTE	Long Term Evolution
MME	Mobility Management Entity
MO-LR	Mobile Originated Location Request
MT-LR	Mobile Terminated Location Request
NAS	Non-access Stratum
UE	User Equipment

4 General

4.1 Overview

4.1.1 NAS aspect

To enable transfer of application protocol messages between the MME and the UE, a generic "container" message is defined on the downlink (Downlink Generic NAS Transport message) and the uplink (Uplink Generic NAS Transport message). The message protocol and procedures are described in 3GPP TS 24.301 [3].

4.1.2 LCS aspect

Location Services (LCS) uses the generic containers provided by the NAS Generic Transport mechanism to transfer LCS signalling messages between the UE and the network.

Currently, container in the generic transport messages can carry the following LCS information:

- LTE Positioning Protocol (LPP) messages (Refer to 3GPP TS 36.355 [4])
  - Both downlink and uplink LPP messages are supported
  - A Routing Identifier is transported as the Additional Information IE in Uplink/Downlink Generic NAS Transport message for LPP messages (Refer to 3GPP TS 24.301 [3])
- Location services messages
  - Messages for MO-LR operations (Refer to 3GPP TS 24.080 [5])
  - Messages for MT-LR LCS location notification (Refer to 3GPP TS 24.080 [5])

4.2 LCS Support capabilities

4.2.1 UE support of LCS

The UE announces to the network its ability to support LCS notification mechanism and/or LPP messages using the UE Network Capability IE defined in 3GPP TS 24.301 [3].

4.2.2 MME support of LCS

The network announces to the UE its ability to support LCS MO-LR mechanism in E-UTRAN and GERAN/UTRAN using the EPS network feature support IE defined in 3GPP TS 24.301[3]. These information are taken into account by the UE, in addition to UE's LCS and CSFB capabilities for UE to determine whether to initiate EPC-MO-LR procedure or CS fallback procedure for CS-MO-LR in GERAN/UTRAN as specified in 3GPP TS 23.272 [8], subclause 8.3.1.

5 Support of LCS signaling

5.1 General

This clause defines the E-UTRAN LCS operations (subclause 5.2) and the format and coding of the messages (subclause 5.3).

The messages defined in this subclause can be transported in the Downlink Generic NAS Transport message and the Uplink Generic NAS Transport message defined in 3GPP TS 24.301 [3].

5.2 LCS operations

5.2.0 General

The operations defined in this subclause are for E-UTRAN LCS support only.

The MO-LR operation and the Location Notification operation for E-UTRAN LCS are similar to that for GERAN and UTRAN LCS. The operations for GERAN and UTRAN location signalling support are defined in 24.030 [6].

5.2.1 Network initiated location services operations

5.2.1.1 Location Notification

5.2.1.1.0 General

The Location Notification operation enables the MME to trigger the end-user notification verification process on the UE using NAS signaling. The NAS signaling (see 5.2.1.1.1) are transported using the Downlink Generic NAS Transport message and the Uplink Generic NAS Transport message defined in 3GPP TS 24.301 [3]. Figure 5.2.1.1.0-1 illustrates an example of the NAS signaling transport for an EPC-MT-LR session.

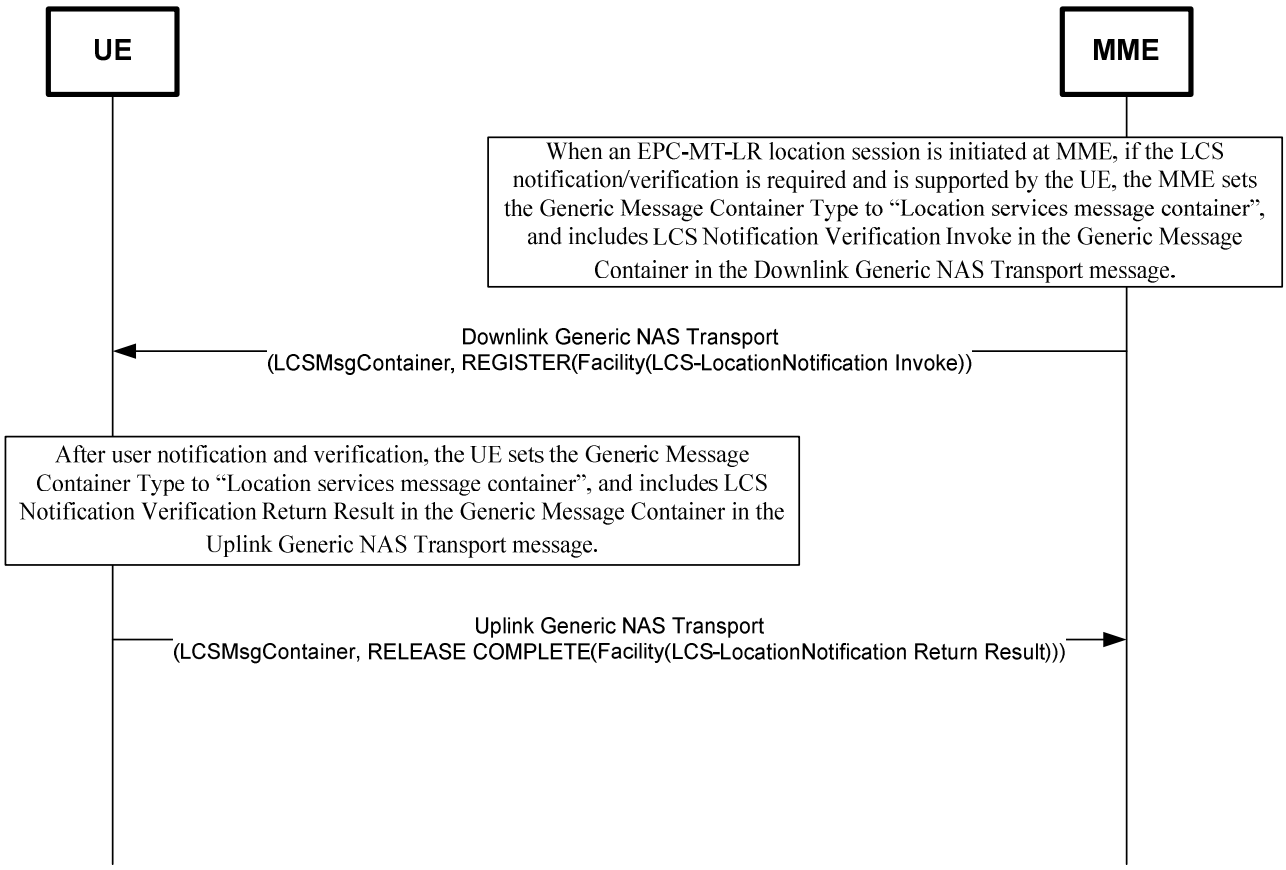

Figure 5.2.1.1.0-1: NAS signaling transport for Location Notification

NOTE: The optional Additional Information IE of the Downlink/Uplink Generic NAS Transport message is not used when the LCS Location Notification signaling are transported in the Generic Message Container.

5.2.1.1.1 Normal operation

The network invokes a location notification procedure by sending a REGISTER message containing a LCS-LocationNotification invoke component to the UE. This may be sent either to request verification for MT-LR or to notify about already authorized MT-LR.

In case of privacy verification the UE shall respond to the request by sending a RELEASE COMPLETE message containing the mobile subscriber's response in a return result component (see figure 5.2.1.1.1-1).

If the timer T(LCSN) expires in the network before any response from the UE (e.g. due to no response from the user), the network shall interpret this by applying the default treatment defined in TS 3GPP 23.271 [2] (i.e. disallow location if barred by subscription and allow location if allowed by subscription).

In the case of location notification no response is required from the UE, the UE shall terminate the dialogue by sending a RELEASE COMPLETE message containing a LocationNotification return result.

If the UE is unable to process the request received from the network, it shall return an error indication by sending a RELEASE COMPLETE message containing a return error component. Error values are specified in 3GPP TS 24.080 [5].

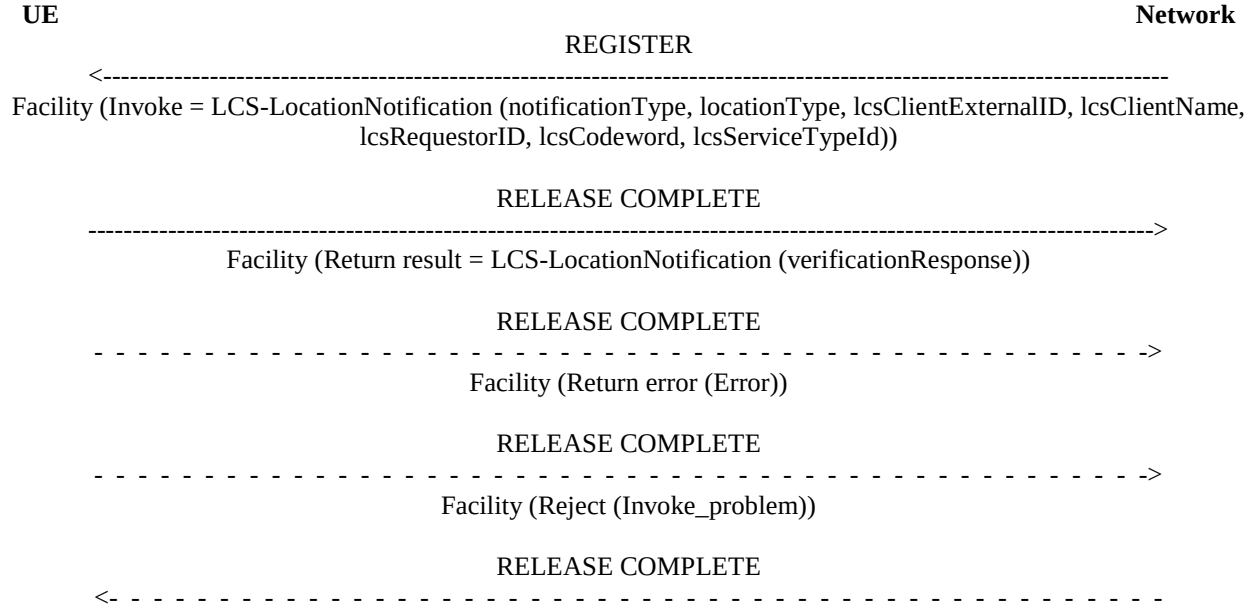

Figure 5.2.1.1.1-1: Location Notification

5.2.1.2 Network initiated Positioning Information Transport

The MME sends LPP message and the associated Routing Identifier in the Downlink Generic NAS Transport message (Refer to 3GPP TS 24.301 [3]). Figure 5.2.1.2-1: illustrates an example of the NAS signaling transport for downlink LPP messages.

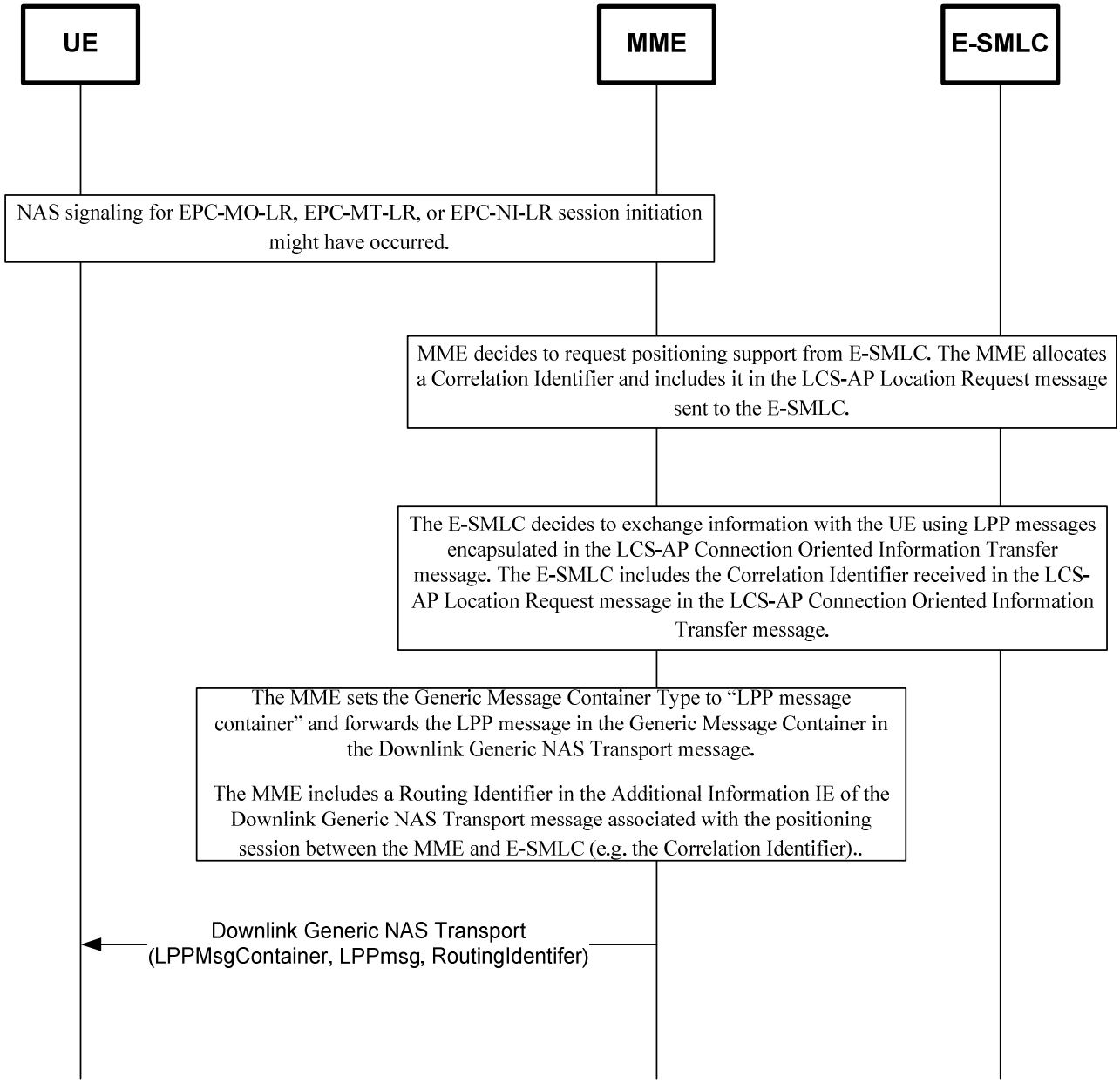

Figure 5.2.1.2-1: NAS signaling transport for downlink LPP messages

5.2.2 Mobile initiated location services operations

5.2.2.1 Mobile Originated Location Request (MO-LR)

5.2.2.1.0 General

The MO-LR operation enables the UE to launch MO positioning session using NAS signaling. The NAS signaling (see 5.2.2.1.1 and 5.2.2.1.2) are transported using the Downlink Generic NAS Transport message and the Uplink Generic NAS Transport message defined in 3GPP TS 24.301 [3]. Figure 5.2.2.1.0-1 illustrates an example of the NAS signaling transport for an EPC-MO-LR session.

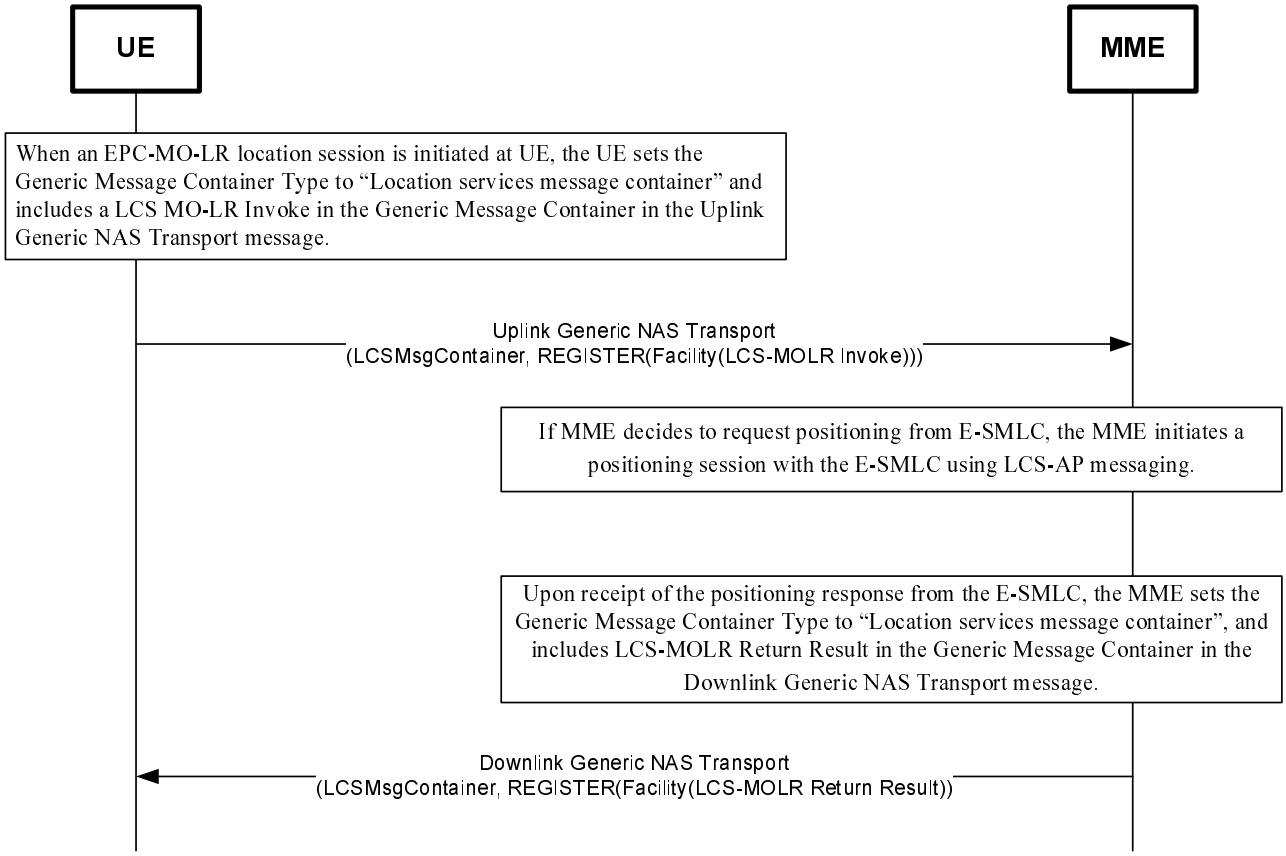

Figure 5.2.2.1.0-1: NAS signaling transport for MO-LR

NOTE: The optional Additional Information of the Downlink/Uplink Generic NAS Transport message is not used when the MO-LR signaling are transported in the Generic Message Container.

5.2.2.1.1 Normal operation

The UE invokes a MO-LR by sending a REGISTER message to the network containing a LCS-MOLR invoke component. SS Version Indicator value 1 or above shall be used.

The receiving network entity shall initiate the handling of location request in the network. The network shall pass the result of the location procedure to the UE by sending a FACILITY message to the UE containing a LCS-MOLR return result component. When location estimate is kept in the network entity and this information satisfies the requested accuracy and the requested maximum age of location, then the network may reuse this information and the positioning measurement procedure may be skipped.

The network shall pass the result of the location procedure to the UE only if the location estimate is given in a format that the UE supports, as indicated by either the presence (and content) or the absence of the parameter supportedGADShapes, which may be sent by the UE in the LCS-MOLR operation.

The UE may terminate the dialogue by sending a RELEASE COMPLETE message in the case of single location request (see figure 5.2.2.1.1-1). The UE may also initiate another location request operation by sending a FACILITY message to the network containing a LCS-MOLR invoke component (see figure 5.2.2.1.1-2). After the last location request operation the UE shall terminate the dialogue by sending a RELEASE COMPLETE message.

If the network is unable to successfully fulfil the request received from the UE (e.g. to provide a location estimate or location assistance information), it shall clear the transaction by sending a RELEASE COMPLETE message containing a return error component. Error values are specified in 3GPP TS 24.080 [5]. If the network is unable to provide a location estimate due to lack of support in the UE for the type of shape of the location estimate, then it shall use the error Facility Not Supported.

If the network has returned a result to the UE in a FACILITY message but, after some PLMN administered time period has elapsed, has not received either a new location request operation in a FACILITY message or a RELEASE

COMPLETE message from the UE, the network may clear the transaction by sending a RELEASE COMPLETE message.

During the MO-LR operation the UE shall run a timer T(LCSL). This timer is started when the operation is sent, and stopped when a response is received from the network. If this timer expires the UE shall assume that the operation has failed, and may terminate the dialogue by sending a RELEASE COMPLETE message, and shall inform the user of the failure.

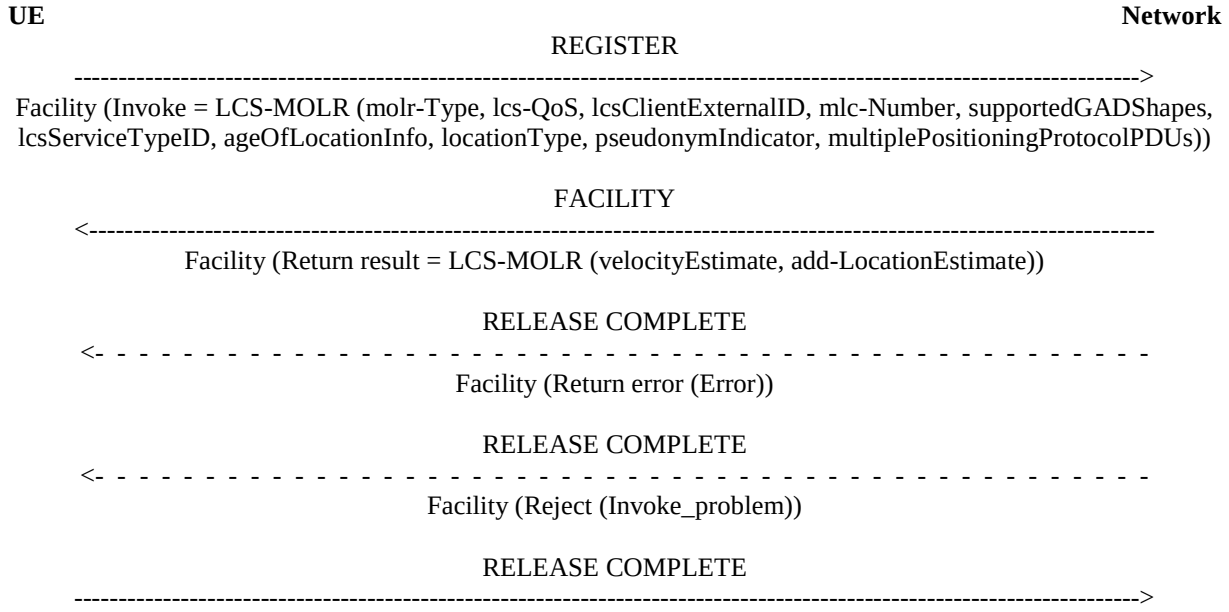

Figure 5.2.2.1.1-1: Single mobile originated location request

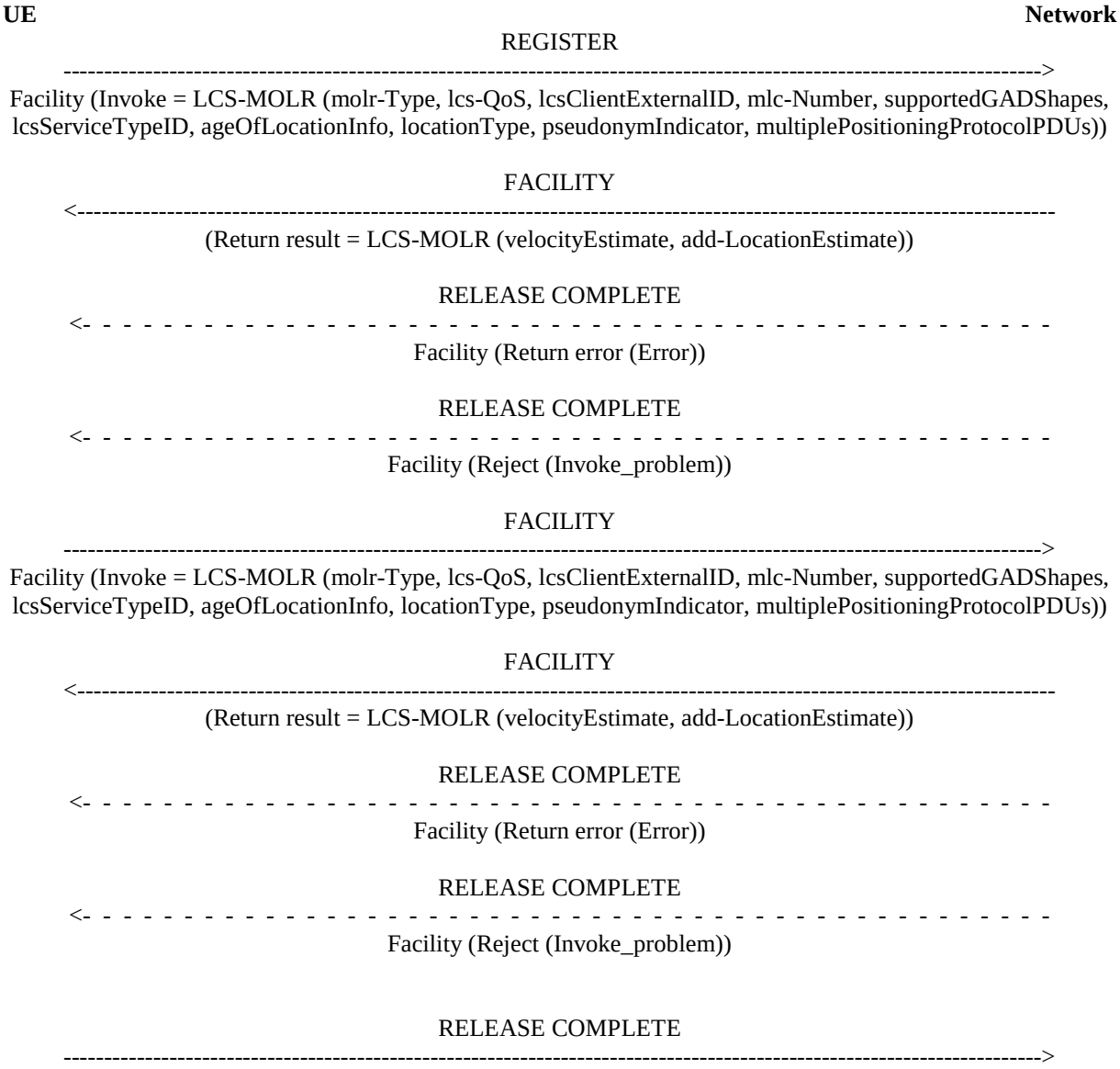

Figure 5.2.2.1.1-2: Multiple mobile originated location requests

NOTE: Only the following IEs defined in MO-LR Invoke in 3GPP TS 24.080 [5] are used for E-UTRAN LCS:

- molr-Type
- lcs-QoS
- lcsServiceTypeID
- ageOfLocationInformation
- locationType
- mlc-Number
- lcsClientExternalID
- pseudonymIndicator
- supportedGADShapes
- multiplePositioningProtocolPDUs

NOTE: multiplePositioningProtocolPDUs IE is added to the LCS-MOLR Invoke to allow for passing multiple UE positioning information LPP messages (e.g. UE location measurements or UE capabilities) to the E-SMLC for E-UTRAN LCS. Its ASN.1 description is given in 3GPP TS 24.080 [5].

5.2.2.2 Mobile initiated Positioning Information Transport

The UE sends LPP message and the associated Routing Identifier in the Uplink Generic NAS Transport message (Refer to 3GPP TS 24.301 [3]). Figure 5.2.2.2-1 illustrates an example of the NAS signaling transport for uplink LPP messages.

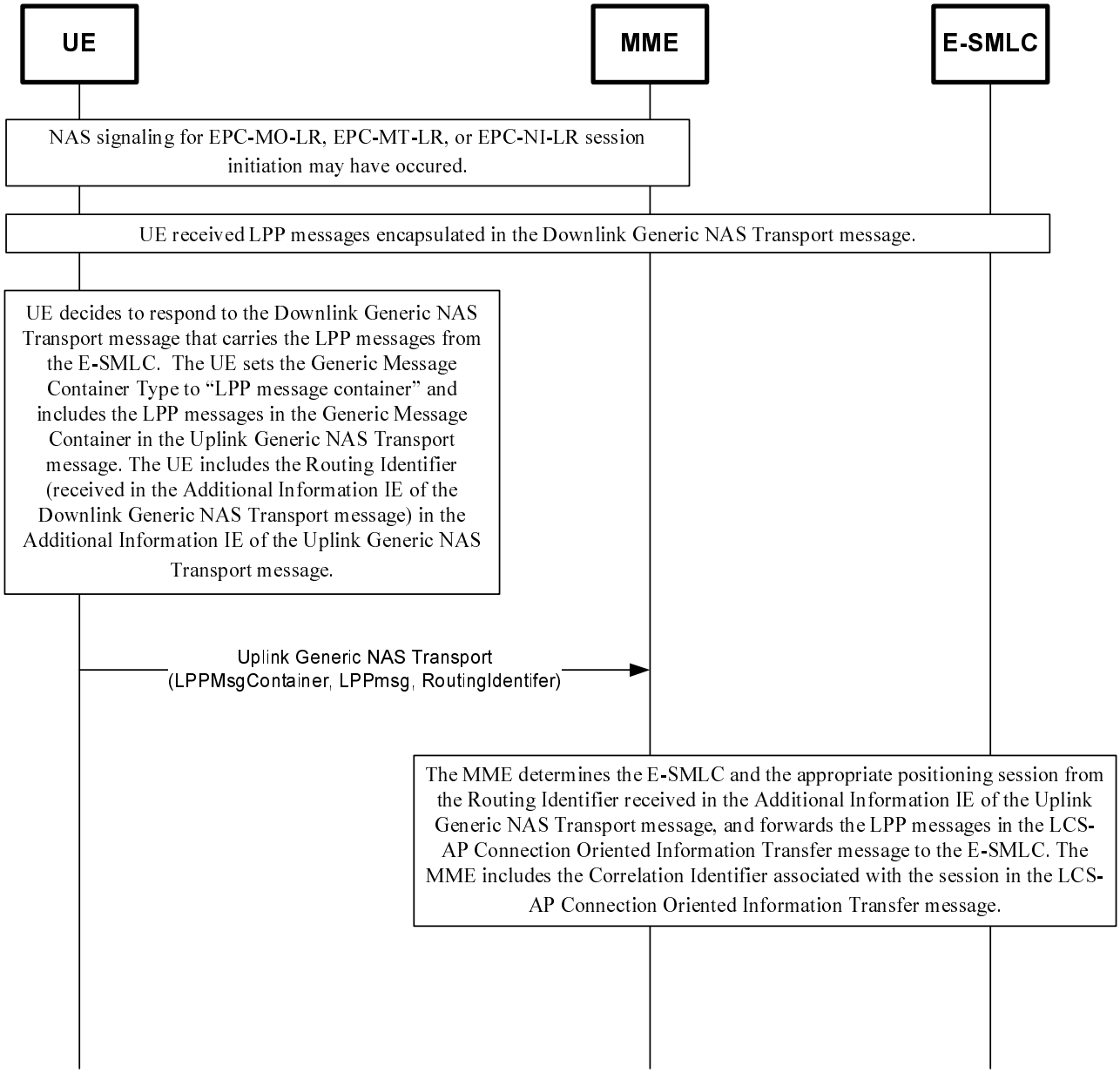

Figure 5.2.2.2-1: NAS signaling transport for uplink LPP messages

5.3 LCS messages and coding

5.3.1 Messages for common LCS operations

The LCS message format and information elements coding for the MO-LR and the Location Notification operations (subclause 5.2) are defined in 24.080 [5] for the following messages:

- Register message
- Facility message
- Release Complete message

5.3.2 Messages for E-UTRAN LCS operations only

5.3.2.1 LPP Messages

5.3.2.1.1 Downlink Positioning Information Transport using LPP messages

The MME shall set the Generic Message Container Type to "LPP message container" in the Downlink Generic NAS Transport message.

The MME includes a Routing Identifier in the Additional Information IE of the Downlink Generic NAS Transport message associated with the positioning session between the MME and E-SMLC.

The Routing identifier is the Correlation ID, which is defined in 3GPP TS 29.171 [7], so that the MME can map the Routing identifier to the Correlation identifier when the MME receives an S1-AP Transport Message.

5.3.2.1.2 Uplink Positioning Information Transport using LPP messages

The UE shall set the Generic Message Container Type to "LPP message container" in the Uplink Generic NAS Transport message.

The UE includes a Routing Identifier received in the Additional Information IE of the Downlink Generic NAS Transport message in the the Additional Information IE of the Uplink Generic NAS Transport message. (See editor's note below on Routing Identifier). This association of the Routing Identifier is provided at the LPP level: the UpLink Generic NAS Transport message carries an LPP message that is a response to or instigated by the LPP message in the Downlink Generic NAS Transport message.The Routing identifier is the Correlation ID, which is defined in 3GPP TS 29.171 [7], so that the MME can map the Routing identifier to the Correlation identifier when the MME receives an S1-AP Transport Message.

Annex A (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2010-03	CP#47	CP-100053			3GPP TS presented for approval in CT#47	2.0.0	9.0.0
2011-03	-	-	-	-	Update to Rel-10 version (MCC)	9.0.0	10.0.0
2012-09	-	-	-	-	Update to Rel-11 version (MCC)	10.0.0	11.0.0
2014-09	-	-	-	-	Update to Rel-12 version (MCC)	11.0.0	12.0.0
2015-12	-	-	-	-	Update to Rel-13 version (MCC)	12.0.0	13.0.0
2017-03	-	-	-	-	Update to Rel-14 version (MCC)	13.0.0	14.0.0
2018-06	CT#80	-	-	-	Update to Rel-15 version (MCC)	14.0.0	15.0.0
2020-07	CT#88e	-	-	-	Update to Rel-16 version (MCC)	15.0.0	16.0.0

History

Document history		
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