CR-Form-v7

CHANGE REQUEST

| ⌘ | **23.271** CR | **155** | ⌘**rev** | **11** | ⌘ | Current version: | **6.3.0** | ⌘ |

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ **X**   ME **X** Radio Access Network ☐ Core Network **X**

Title: ⌘	Addition of mobile based change of area event to deferred location request	
Source: ⌘	Nokia, Vodafone, NEC, Lucent, Telecommunication Systems, Siemens	
Work item code:⌘	LCS2	***Date:*** ⌘ 10.6.2003
Category: ⌘ **B**		***Release:*** ⌘ REL-6

Use one of the following categories:
   F (correction)
   A (corresponds to a correction in an earlier release)
   B (addition of feature),
   C (functional modification of feature)
   D (editorial modification)
Detailed explanations of the above categories can
be found in 3GPP TR 21.900.

Use one of the following releases:
2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change: ⌘	According to LCS stage 1, 22.071, the LCS client shall be able to issue a deferred location request for the new event "change of area". This CR introduces support for the deferred MT-LR at the change of area event.
Summary of change:⌘	Description of change of area event type is added to the message flow diagram and a new clause is added to the describe the Location Deferred Request (LDR) for Change of Area.
Consequences if not approved: ⌘	The change of area event as described in LCS Stage 1 would not be supported.

Clauses affected: ⌘	3.1 3.3 4.4.2 5.2 5.4 5.5 5.6 6.2 7.1.1 9.1.8 New 9.1.9 11.1 11.2 New Annex F

Other specs Affected: ⌘		Y	N		⌘	
		X		Other core specifications	⌘	TS 29.002, 24.030, 24.080, 24.008
			X	Test specifications		
			X	O&M Specifications		

Other comments: ⌘	This CR also incorporates the changes of CR#184 Rev3 (tdoc S2-031793) in sub-clause 9.1.9

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

<< First changed clause >>

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

….

Deferred location request: location request where the location response (responses) is (are) ~~not~~ required <u>after a specific event has occurred. The event may or may not occur</u> immediately

….

<u>**Target area:** geographical area which is used for change of area type deferred location request. The target area is defined by LCS client and is expressed as geographical area using a shape defined in TS 23.032, as a geographical area using local coordinate system, as a country code, as a PLMN identity or as a geopolitical name of the area (e.g. London).</u>

<< Next modified clause >>

3.3   Abbreviations

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

…

LSCTF   Location System Co-ordinate Transformation Function

…

<< Next modified clause >>

4.4.2 Deferred Location Request

Request for location contingent on some current or future events where the response from the LCS Server to the LCS Client may occur some time after the request was sent.
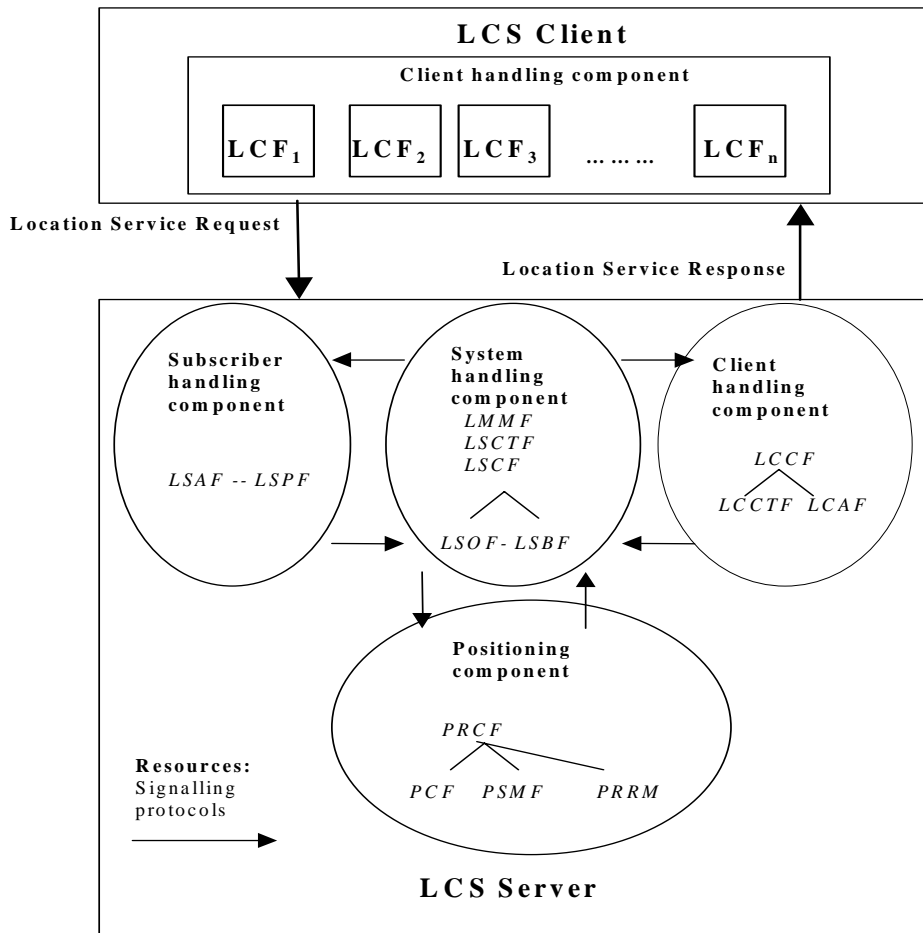
4.4.2.1 Types of event

a) UE available: Any event in which the MSC/SGSN has established a contact with the UE. Note, this event is considered to be applicable when the UE is temporarily unavailable due to inaction by the UE user, temporarily loss of radio connectivity or IMSI detach and so on. Note that IMSI detach is only applicable in the case UE has previously been registered and information is still kept in the node.

b) Change of Area: An event where the UE enters or leaves a pre-defined geographical area or if the UE is currently within the pre-defined geographical area. The LCS client defines the target area as a geographical area, as a country code, as a PLMN identity or as a geopolitical name of the area. The LCS server may translate and define the target area as the identities of one or more radio cells, location areas, routing areas, country code or PLMN identity. The target UE must not give the target UE user access to the area definitions and network identities. The change of area event may be reported one time only, or several times. The area event report must not be repeated more often than allowed by the LCS client. The change of area event report shall contain an indication of the event occurrence. The location estimate may be included in the report.

c) b) Other events are FFS (Release 5)

<< Next modified clause >>

5.2   LCS Functional diagram, high level functions

TS 22.071 [4] describes LCS services from the LCS client point of view. In the present document, a more detailed description of LCS is given. The LCS functional diagram shown in figure 5.2 depicts the interaction of the LCS client and the LCS server within the PLMN. The PLMN uses the various LCS components within the LCS server to provide the target UE Location Information to the LCS client.
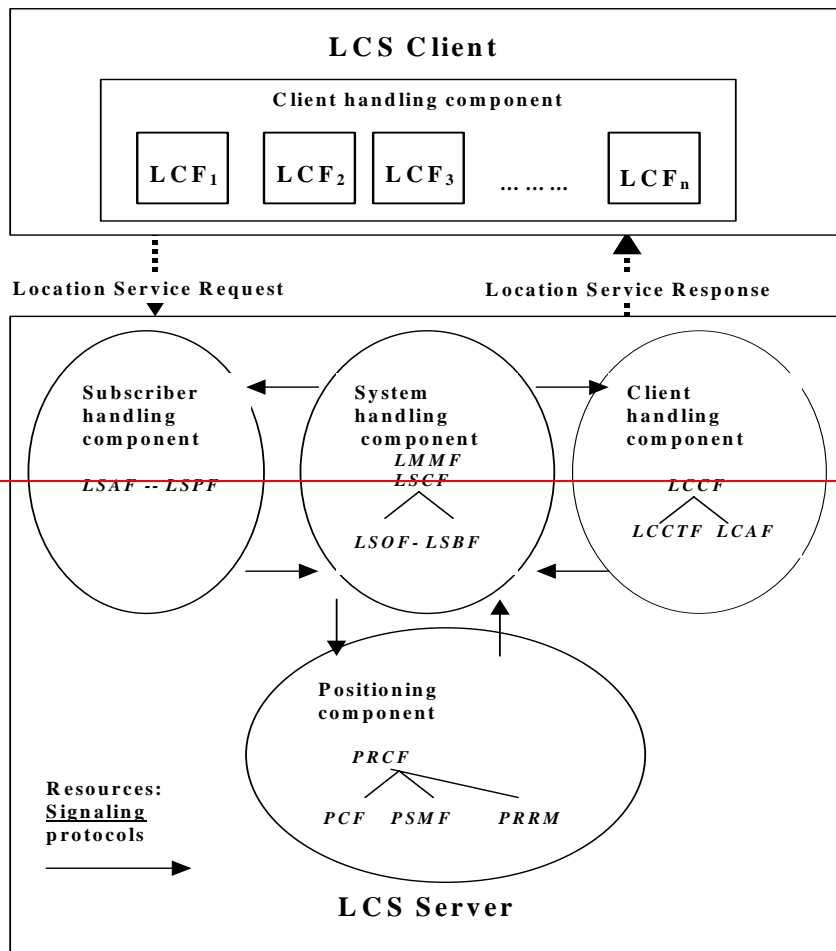
LCS Client

Client handling component

LCF₁   **LCF₂**   **LCF₃**   ... ...   **LCFₙ**

Location Service Request   Location Service Response

Subscriber handling component

LSAF -- LSPF

System handling component
LMMF
LSCF

LSOF - LSBF

Client handling component

LCCF

LCCTF LCAF

Positioning component

PRCF

PCF   PSMF   PRRM

Resources:
Signaling protocols

LCS Server

Figure 5.2: LCS capability server Functional Diagram

<< Next modified clause >>

5.4   LCS Server functional group

The LCS server functional group consists of the functions that are needed for GSM and UMTS to support Location Services.

5.4.1   Client handling component

5.4.1.1   Location Client Control Function (LCCF)

The Location Client Control Function (LCCF) manages the external interface towards LCF. The LCCF identifies the LCS client by requesting client verification and authorization (i.e. verifies that the LCS client is allowed to position the subscriber) through interaction with the Location Client Authorization Function (LCAF). The LCCF handles mobility management for location services (LCS) e.g., forwarding of positioning requests to VMSC or SGSN. The LCCF determines if the final positioning estimate satisfies the QoS for the purpose of retry/reject. The LCCF provides flow control of positioning requests between simultaneous positioning requests. It may order the Location Client Co-ordinate Transformation Function (LCCTF) to perform a transformation to local co-ordinates. It may also order a transformation of local co-ordinates to network identities via the Location System Co-ordinate Transformation Function (LSCTF). It also generates charging and billing related data for LCS via the Location System Billing Function (LSBF).

<< Next modified clause >>

5.4.1.3 Location Client Co-ordinate Transformation Function (LCCTF)

The Location Client Co-ordinate Transformation Function (LCCTF) provides conversion of a location estimate expressed according to a universal latitude and longitude system into an estimate expressed according to a local geographic system understood by the LCF and known as location information. The local system required for a particular LCF will be either known from subscription information or explicitly indicated by the LCF. The LCCTF also provides the conversion of a target area to either a shape as defined in TS23.032, a PLMN, or country code. This is performed only if target area information is received from the LCS Client.

<< Added clause >>

5.4.2.5   Location System Co-ordinate Transformation Function (LSCTF)

The Location System Co-ordinate Transformation Function (LSCTF) provides the conversion of an area definition, expressed in a geographic shape as defined in TS23.032, to network identities recognised only within a PLMN (such as Cell Identity, Location Area Identity). The area definition may convert to more than one network identity such as a collection of Cell Global Identities.

<< Next modified clause >>

5.5   Information Flows between Client and Server

Other types of national specific information flows may be supported in addition to the information flow specified here.

Any of the information flows here indicated may not be externally realized if the information does not flow over an open interface. On the other hand, if a flow goes over an open interface, it shall abide to a well-defined protocol, e.g. LIF TS 101 [31], Location Inter-Operability Forum 2001.

5.5.1   Location Service Request

Via the Location Service Request, the LCS client communicates with the LCS server to request for the location information of one or more than one UE within a specified quality of service. There exist two types of location service requests:

- Location Immediate Request (LIR); and

- Location Deferred Request (LDR).

The attributes for the information exchange between the LCS Client and the LCS Server have been standardized by LIF based on requirements set by TS 22.071 and TS 23.271.

The following attributes are identified for Location Service Request information flow:

- Target UE identity (either verinym or pseudonym);

- LCS Client identity;

- Service identity, if needed;

- Codeword, if needed;

- Requestor identity, if needed (and type of Requestor identity if available);

- Number dialled by the target mobile user or APN-NI, if the request is call or session related ;

- Type of Event definition, i.e. UE available or change of area, applicable to deferred location requests only;

- Definitions for change of area type deferred location requests. Following parameters may be defined, if needed;

    a) Indication for event trigger, i.e. UE enters, leaves or is within requested target area;

    b) Indication of either a single event report or multiple event reports;

    c) Start time, stop time and minimum interval time between area event reports, if multiple event reports is requested;

- Start time, stop time and interval, applicable to periodical and deferred requests only;

- Requested Quality of Service information, if needed;

- Requested type of location, i.e. current location or last known location applicable to LIR only (current location is only available for LDR);

- Priority, if needed;

- Service coverage (i.e. country codes), if needed;

- Requested maximum age of location, if needed;

- Local coordinate reference system, if needed;

- Geographical area, if needed.

- Target area, i.e. geographical area expressed as one of the following format, if needed.

    a) a shape defined in TS 23.032

b)   local coordinate system

c)   country code

d)   PLMN identity

e)   geopolitical name of the area (e.g. London)

Some of the information may be stored in GMLC and the LCS client does not need to include such information in the location service request.

5.5.2   Location Service Response

The LCS server (GMLC) sends the Location Service Response to the LCS client either as an:

-    Immediate Response; or a

-    Deferred Response, these deferred responses can be either single or periodic.

The following attributes are identified for the Location Service Response information flow:

-    Location indication of UE in geographical coordinates expressed as a shape as defined in TS 23.032 or local coordinate system;

-    Time stamp of location estimate;

-    Indication when UE enters, is within or leaves the Geographical area, if needed;

-    Acknowledgement for a deferred location request, if needed.

In addition the information attributes of the location service request may be used also in the location service response.

<< Next modified clause >>

5.6 Information Flows between LCS Servers

Other types of national specific information flows may be supported in addition to the information flow specified here.

Any of the information flows here indicated may not be externally realized if the information does not flow over an open interface. On the other hand, if a flow goes over an open interface, it shall abide to a well-defined protocol, which will be further specified in other relevant specifications.

When the LCS server's associated GMLC uses the Lr interface then this interface shall conform to the protocol as specified in (reference to be added) and the procedures defined in clause 9 of the current specification.

5.6.1 Location Service Request

Via the Location Service Request, the source LCS server communicates with the destination LCS server to request for the location information of one UE within a specified quality of service. There exist two types of location service requests:

- Location Immediate Request (LIR); and

- Location Deferred Request (LDR).

The following attributes are identified for Location Service Request information flow:

- Target UE identity, (either one or both of MSISDN and IMSI, or pseudonym);

- LCS Client identity, i.e. LCS client external identity or internal identity;

- LCS Client type, (i.e. Value added, Emergency, PLMN operator or Lawful interception);

- LCS Client name, if needed (and type of LCS client name if available);

- Service type, if needed;

- Codeword, if needed;

- Requestor identity, if needed (and type of Requestor identity if available);

- Number dialled by the target mobile user or APN-NI, if the request is call or session related ;

- Type of Event definition, i.e. UE available or change of area, applicable to deferred location requests only;

- Definitions for change of area type deferred location requests. Following parameters may be defined, if needed;

    a) Indication for event trigger, i.e. UE enters, leaves or is within requested target area;

    b) Indication of either a single event report or multiple event reports;

    c) Minimum interval time between area event reports;

- Requested Quality of Service information, if needed;

- Requested type of location, i.e. "current location", "current or last known location" or "initial location" applicable to LIR only (current location is only available for LDR);

- Priority, if needed;

- Requested maximum age of location, if needed;

- Privacy override indicator, if needed;

- Service coverage (i.e. country codes), if needed;

- Indicator of privacy check related actions, if needed;

- Supported GAD shapes, if needed;

- Identity of the source LCS server of the Location Service Request, i.e. R-GMLC address;

- HPLMN LCS server address, i.e. H-GMLC address, if needed;

- VPLMN LCS server address, i.e. V-GMLC address, if needed;

- Network address of Privacy Profile Register, if needed;

- Network numbers of serving nodes;

- LCS capability sets of serving nodes, if needed.

- Target area, i.e. geographical area expressed as one of the following format, if needed.

    a) a shape defined in TS 23.032

    b) country code

    c) PLMN identity

- LDR reference number, if needed.

5.6.2   Location Service Response

The Location Service Response is sent to the source LCS server as the result of the Location Service Request by the destination LCS Server:

- Immediate Response; or a

- Deferred Response, these deferred responses can be either single or periodic.

The following attributes are identified for the Location Service Response information flow:

- Location indication of UE in geographical coordinates expressed as a shape as defined in TS 23.032 or local coordinate system;

- Indication when UE enters, is within or leaves the geographical area, if needed;

- Acknowledgement for a deferred location request, if needed.

In addition the information attributes of the location service request may be used also in the location service response.

<< Next modified clause >>

6.2 Allocation of LCS functions to network elements

Table 6.1 shows a summary of the Functional Groups and Functional Blocks for Location services. Table 6.2 and figure 6.2 show the generic configuration for LCS and the distribution of LCS functional blocks to network elements. Different positioning methods, including network-based, mobile-based, mobile-assisted and network-assisted positioning methods may be used. With this configuration both the network and the mobiles are able to measure the timing of signals and compute the mobile's location estimate. Depending on the applied positioning method it is possible to utilise the corresponding configuration containing all needed entities. For instance, if network-based positioning is applied, the entities that are involved in measuring the mobile's signal and calculating its location estimate are allocated to the network elements of the access stratum. On the other hand, in case mobile-based or network-assisted methods are used these entities should be allocated to the UE.

LCS is logically implemented on the network structure through the addition of one network node, the Mobile Location Center (MLC). It is necessary to name a number of new interfaces. The LCS generic architecture can be combined to produce LCS architecture variants.

Table 6.1: Summary of Functional Groups and Functional Blocks for Location services

Funct. Group	Functional component	Full name of Functional Block	Abbrev.
Loc. Client	Location Client Component	(External) Location Client Function	LCF
		Internal Location Client Function	LCF -internal
LCS Server in PLMN	Client handling component	Location Client Control Function	LCCF
		Location Client Authorization Function	LCAF
		Location Client Co-ordinate Transformation Function	LCCTF
	System handling component	Location System Control Function	LSCF
		Location System Billing Function	LSBF
		Location System Operations Function	LSOF
		Location System Co-ordinate Transformation Function	LSCTF
	Subscr. Handling component	Location Subscriber Authorization Function	LSAF
		Location Subscriber Privacy function	LSPF
	Positioning component	Positioning Radio Control Function	PRCF
		Positioning Calculation Function	PCF
		Positioning Signal Measurement Function	PSMF
		Positioning Radio Resource Management	PRRM

Table 6.2 and figure 6.2 illustrate the allocation of functional entities in the reference configuration of LCS. It is assumed that the CS and PS have either their own independent mobility management or use the joint mobility management through the optional Gs interface.

It is also seen that LCS may take benefit of the Iur interface between RNCs, when uplink radio information and measurement results are collected.

The functional model presented in the figure includes functional entities for both CS and PS related LCS. In addition, it consists of all the entities needed for different positioning methods, i.e. network based, mobile based, mobile assisted, and network assisted positioning, exploiting either uplink or downlink measurements. It is noted that the UE may use e.g. the GPS positioning mechanism, but still demand e.g. auxiliary measurements from the serving network. RAN specific functional entities are specified in TS 25.305 [1] for UTRAN and in TS 43.059 [16] for GERAN.

Table 6.2: Allocation of LCS functional entities to network elements

	UE	RAN	GMLC	SGSN	MSC/MSC Server	HLR/HSS	PPR	PMD	Client
Location client functions									
LCF	X			X	X				X
LCF Internal	Ffs	X							
Client handling functions									
LCCTF			X						
LCCF			X						
LCAF			X						
System handling functions									
LSCF		X		X	X				
LSBF			X	X	X				
LSOF	X	X	X	X	X				
LSCTF			X						
Subscriber handling functions									
LSAF			X	X	X		X		
LSPF			X	X	X	X	X		
LSTF								X	
Positioning functions									
PRCF		X							
PCF	X	X							
PSMF	X	X							
PRRM		X							
	UE	RAN	GMLC	SGSN	MSC/MSC Server	HLR/HSS	PPR	PMD	Client
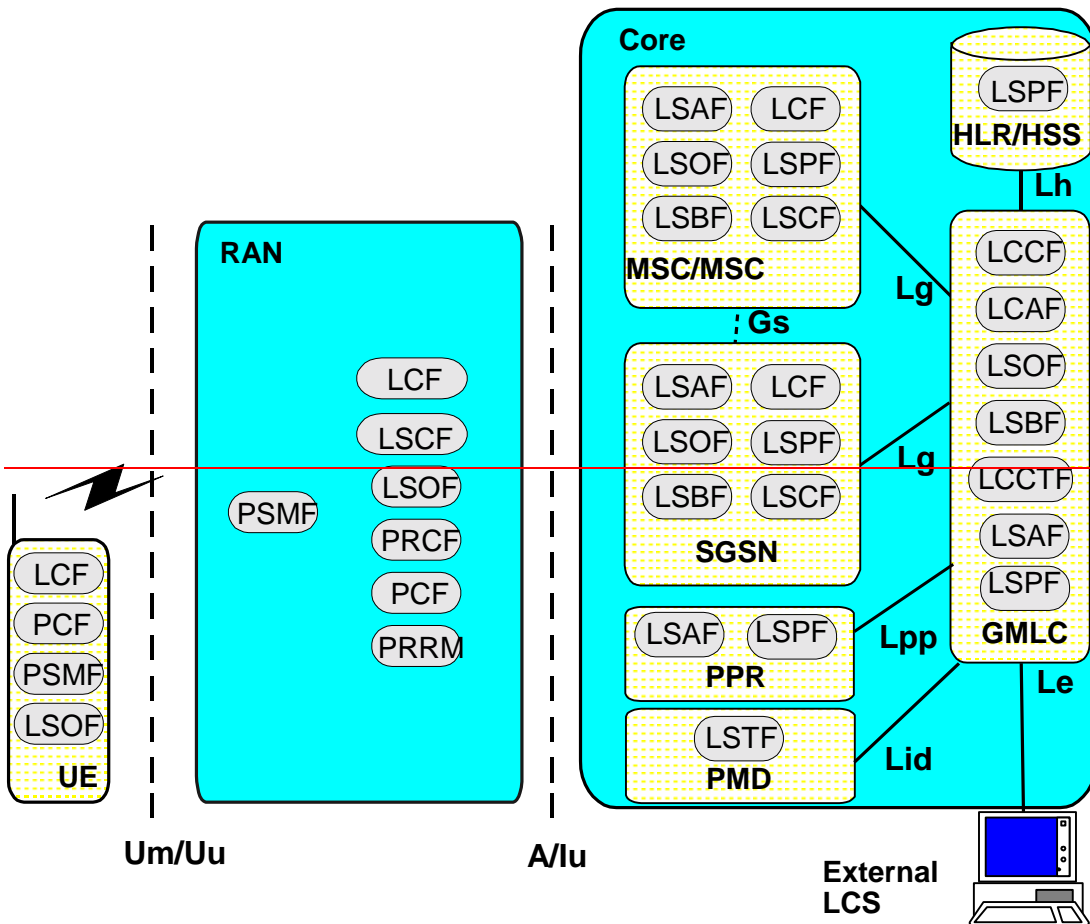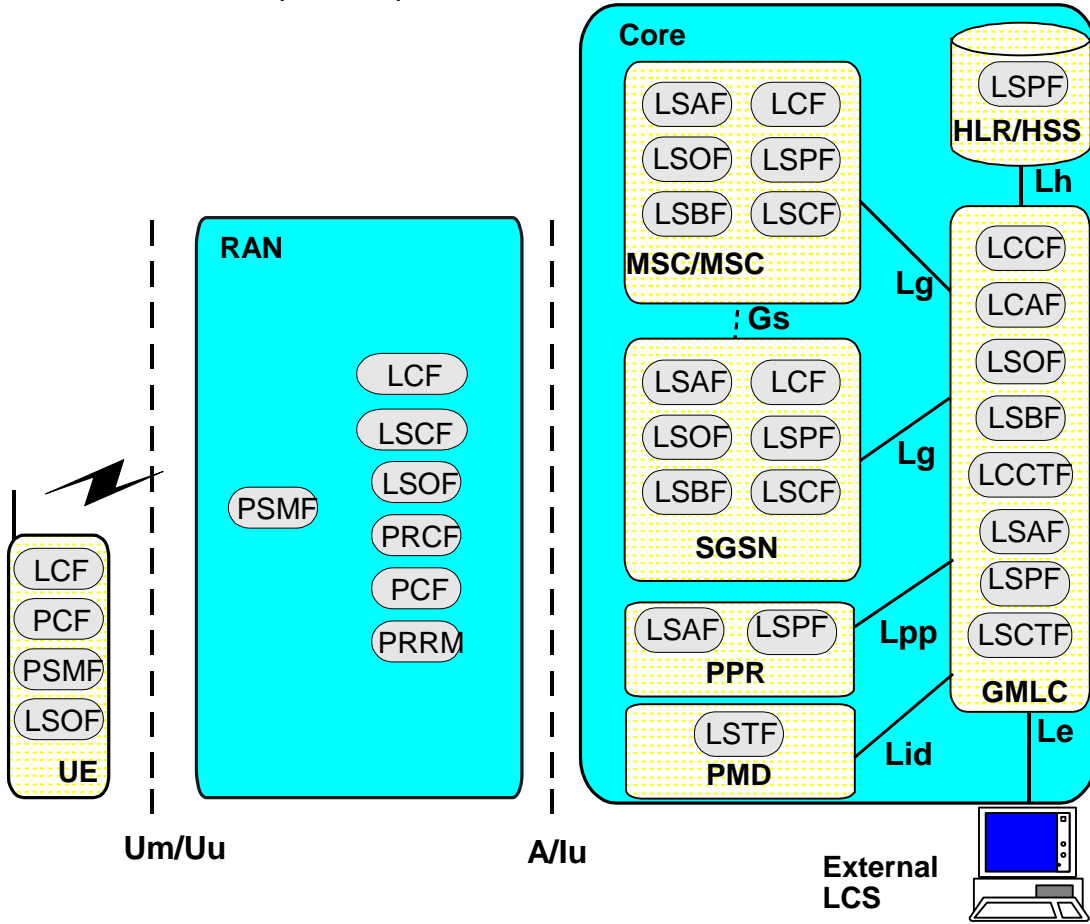
<< Next modified clause >>

7.1.1   Core network Location Request

The core network request for a location estimate of a target UE shall contain sufficient information to enable location of the Target UE according to the required QoS using any positioning method supported by the PLMN and, where necessary, UE. For location services the core network may request the geographical co-ordinates of the Target UE.

In Iu mode~~UMTS~~ the core network may also request in which Service Area the Target UE is located. The Service Area information may be used for routing of corresponding Emergency calls, or for CAMEL services. (The MSC Server or SGSN shall not send the Service Area Identity to GMLC).
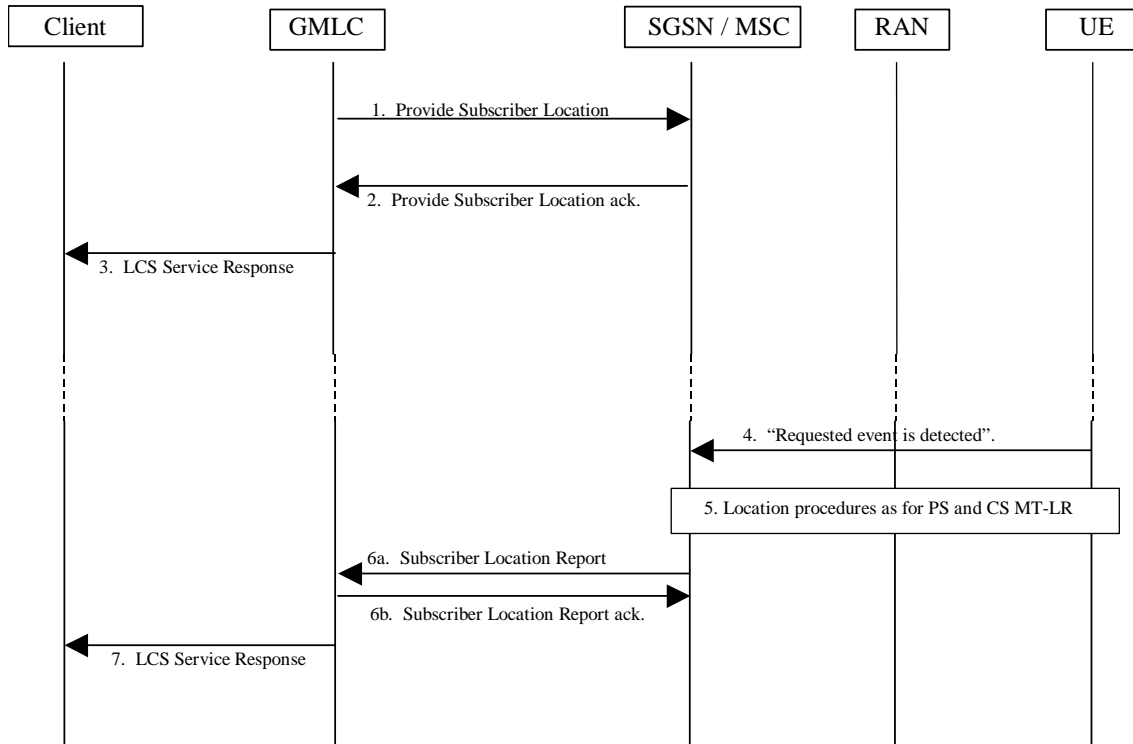
In A/Gb mode~~GSM~~ this corresponds to the usage of Cell ID in the core network.

<< Next modified clause >>

<< Next modified clause >>

9.1.8   Mobile Terminating Deferred Location Request – UE available event

Figure 9.6a illustrates the procedures for a Deferred Location Request, where the Location Report is returned based on a UE available event.

Figure 9.6a: General Network Positioning for a Deferred MT-LR with UE available event

9.1.8.1   Deferred Location Request Procedure

1) GMLC assigns a reference number to Provide Subscriber Location. Provide Subscriber Location is received in SGSN/MSC as described in 9.1.2/9.1.6. In addition, the Deferred Location Request includes the reference number and the event that shall trigger the sending of Location Report.

   Note: The GMLC shall send the Provide Subscriber Location for the UE regardless of the ongoing previous MT-LR for the same UE.

2) If the SGSN/MSC cannot support the deferred location request for the specified event (for temporary or permanent reasons), a Provide Subscriber Location return error shall be returned with a suitable cause. If the SGSN/MSC can support the deferred location request for the specified event, a Provide Subscriber Location ack. shall be returned to the GMLC without a location estimate.

3) The GMLC then returns the LCS Service Response to the LCS Client via H-GMLC and R-GMLC to notify whether the request was successfully accepted or not.

9.1.8.2   Location Report Procedure

4) Immediately following step 3, the SGSN/MSC shall verify if the requested event is already satisfied (e.g. UE available inferred from a current transaction) or can be invoked immediately (e.g. by paging the UE and receiving a page response). If requested event is not existing the SGSN/MSC waits until it has occurred or until some maximum time has expired.

   => In case the SGSN/MSC receives an indication that the UE has moved to another SGSN/MSC while it is waiting for the requested event to happen, a Subscriber Location Report is directly sent to the GMLC with the reference

number that was included in the Provide Subscriber Location and the information that MT-LR must be re-initiated against the new SGSN/MSC. The address of the new SGSN/MSC is included in Subscriber Location Report if available. (If new SGSN/MSC address was included, the GMLC continues at step 1 above, otherwise it continues with an interrogation against HLR as described in 9.1.1.)

If V-GMLC is noticed that the UE has moved to another PLMN while it is waiting for the requested event to happen, a location report message shall be sent to the H-GMLC from V-GMLC with the information that MT-LR must be re-initiated against the new VPLMN. The H-GMLC continues with an interrogation against HLR/HSS as described in 9.1.1.

5) When the requested event is detected, the SGSN/MSC will proceed with the location request as described in 9.1.2/9.1.6.

If either security or privacy check related action fails, a Subscriber Location Report with the reference number that was included in the Provide Subscriber Location is returned with appropriate error cause indicating termination of the deferred location request.

6) When location information has been obtained from the RAN, the SGSN/MSC returns the Subscriber Location Report. The report shall indluced the reference number that was included in the Provide Subscriber Location and an indication that this is a response to a previously sent deferred location request.

If the location information could not be obtained, or the SGSN/MSC for some other reason decides to not wait any longer for the requested event to occur (ex. timer expires), the Subscriber Location Report with the reference number that was included in the Provide Subscriber Location will be returned with an appropriate error cause indicating termination of the deferred location request.

7) GMLC then returns the LCS Service Response to the LCS Client via H-GMLC and R-GMLC as in 9.1.1.

9.1.8.3 Combined Periodical/Deferred ~~Mobile Terminating~~ Location Request with UE available event

Figure 9.6b illustrates the procedures for a Combined Periodical/Deferred Mobile Terminating Location Request with UE available event, where the response to the LCS client is returned periodically and based on the event.

Note: In the current specification, it is assumed the LCS client issues the Periodical/Deferred MT-LR with only the location estimate type of "current location".
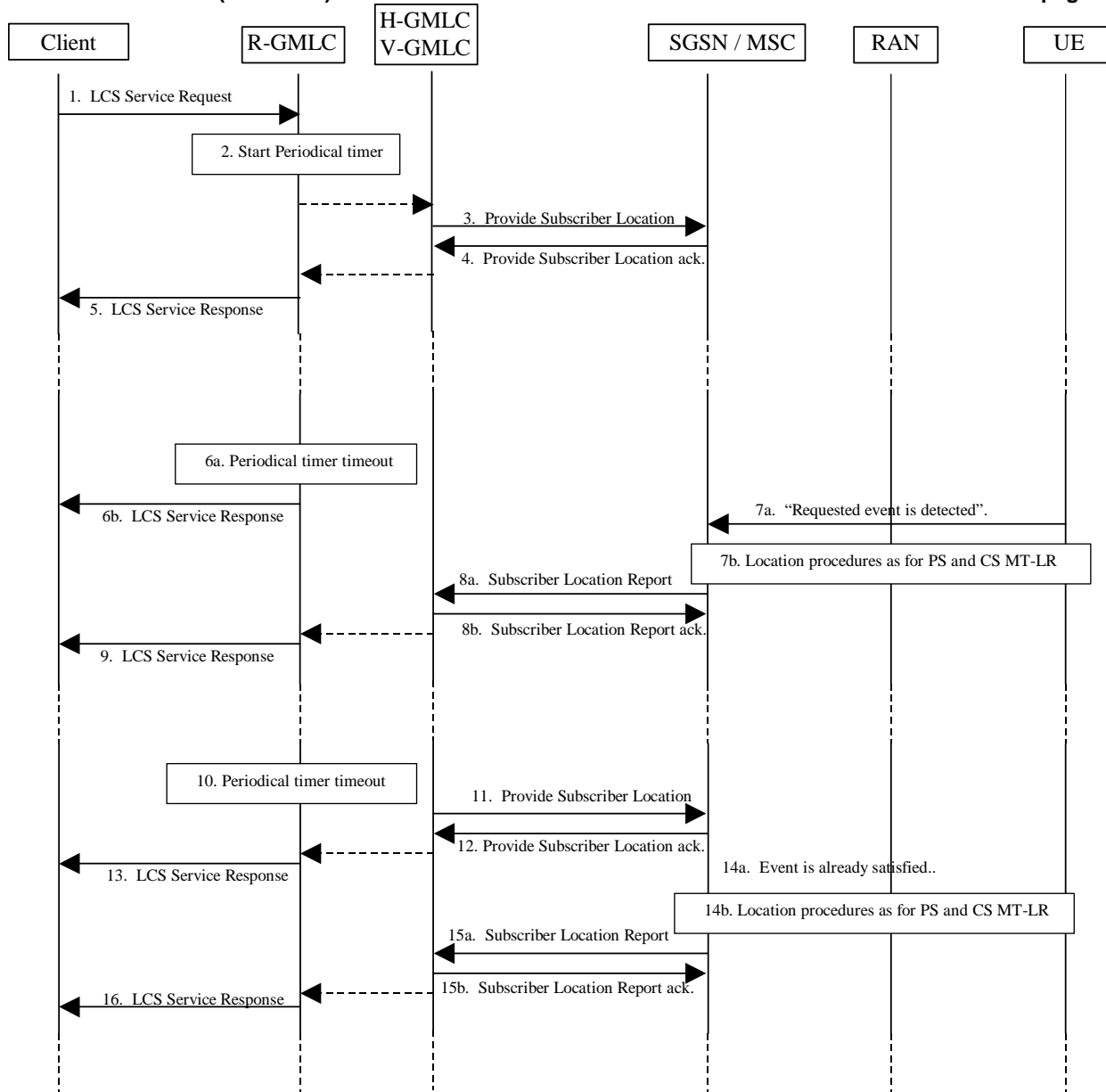
Figure 9.6b: General Network Positioning for a Combined Periodical/Deferred MT-LR

1) When a R-GMLC receives a LCS Service Request from a LCS client, the R-GMLC verifies the identity of the LCS client as described in 9.1.1.

2) The GMLC starts the periodical timer, and initiates the common LCS procedures as described in 9.1.1.

3) The GMLC sends a Deferred Location Request to the SGSN/MSC by means of Provide Subscriber Location as described in 9.1.2/9.1.6. In addition, the Deferred Location Request includes the reference number assigned by the GMLC and the event that shall trigger the sending of Subscriber Location Report.

4) If the SGSN/MSC cannot support the deferred location request for the specified event or the LCS client is not allowed to position the requested UE according to subscription information, a Provide Subscriber Location error is returned to the GMLC. If the SGSN/MSC can support the deferred location request for the specified event and the privacy checks are satisfied, a Provide Subscriber Location ack shall be returned to the GMLC without a location estimate.

5) The GMLC then returns the LCS Service Response to the LCS Client via H-GMLC and R-GMLC to notify whether the request was successfully accepted or not.

6) When the periodical timer expires, if the R-GMLC is still waiting for the event, the R-GMLC shall send a LCS Service Response to the LCS client, indicating that the location is not available at that moment.

7) When the requested event is detected, the SGSN/MSC will proceed with the location request as described in 9.1.2/9.1.6.

8) When location information has been obtained from the RAN, the SGSN/MSC returns the Subscriber Location Report. The report shall include the reference number included in the previously sent Provide Subscriber Location and an indication that this is a response to a previously sent deferred location request.

   If the location information could not be obtained, or the SGSN/MSC for some other reason decides to not wait any longer for the requested event to occur (ex. timer expires), the Subscriber Location Report with the reference number included in the previously sent Provide Subscriber Location will be returned with an appropriate error cause indicating termination of the deferred location request.

9) The GMLC then returns the LCS Service Response to the LCS Client via H-GMLC and R-GMLC as in 9.1.2/9.1.6.

10) When the timer expires, if the R-GMLC is not waiting for the event, the R-GMLC initiates the common LCS procedures as described in 9.1.1.
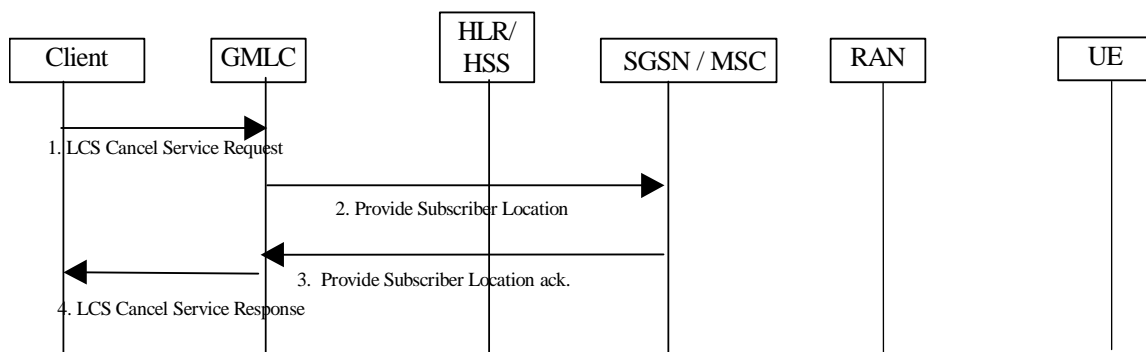
11) Same as step 3.

12) Same as step 4.

13) Same as step 5.

14) If the requested event is already satisfied, the SGSN/MSC will proceed with the location request as described in 9.1.2/9.1.6.

15) Same as step 8.

16) Same as step 9.

9.1.8.4   Cancellation of a Deferred Location Request – UE available event

Figure 9.6c: Cancellation of a Deferred MT-LR – UE available event procedure

1) The LCS Client requests the cancellation of a previously requested Deferred Location Request. The cancellation could be initiated by the GMLC itself for some reasons (e.g. implementation dependent timer in the GMLC expired). If the UE's privacy profile stored in the H-GMLC or in the PPR was changed, any outstanding Deferred Location Request, which would not have been authorized with the new profile, shall be cancelled or the requested action for the VPLMN shall be changed. The H-GMLC initiates the cancellation and may send a new Deferred Location Request to the VPLMN. The event type to cancel must be indicated in the Cancellation procedure.

   If the previously requested Deferred Location Request was forwarded to other GMLC (H-GMLC or V-GMLC), the cancellation request from the LCS client shall be forwarded to the other GMLC.

   Note: The GMLC shall know that the UE subscribers privacy profile has been changed in the PPR when the LCS Privacy Profile Update has been send from PPR to GMLC as described in 9.1.1.2.

2) The GMLC will indicate this cancellation request in the Provide Subscriber Location toward the SGSN/MSC. The Provide Subscriber Location shall include the reference number that was included in the previously sent Provide Subscriber Location.

3) When the SGSN/MSC completes the cancellation procedure, it notifies it to the GMLC in the Provide Subscriber Location Ack (with no location estimate included).

   If the cancellation request was forwarded to other GMLC (H-GMLC or V-GMLC), the GMLC (H-GMLC or V-GMLC) informs the GMLC (R-GMLC or H-GMLC) that the cancellation procedure has been successfully completed.

4) The GMLC informs the LCS Client that the cancellation procedure has been successfully completed.

<< New added clause >>

9.1.9 Deferred Location Request Procedure for the change of area event

Figure 9-6d illustrates the procedures for a Deferred Location Request where the Location Report is returned to the network by the UE following a change of area event. An change of area event occurs when the UE leaves, enters or is within a target area as defined by geographical area, PLMN identity, country code or geopolitical name of the area. Details of the target area are contained in the LCS Service Request message, see clause 5.5.1.

The PLMN operator may choose to use another mechanism (such as SIM Application Toolkit) for the transfer and detection mechanism of the Area Definition and change of area event information to the UE. In this case, the GMLCs handle steps 2 to 7 and 11 to 14 differently from that shown below. An alternative mechanism is detailed in Annex F
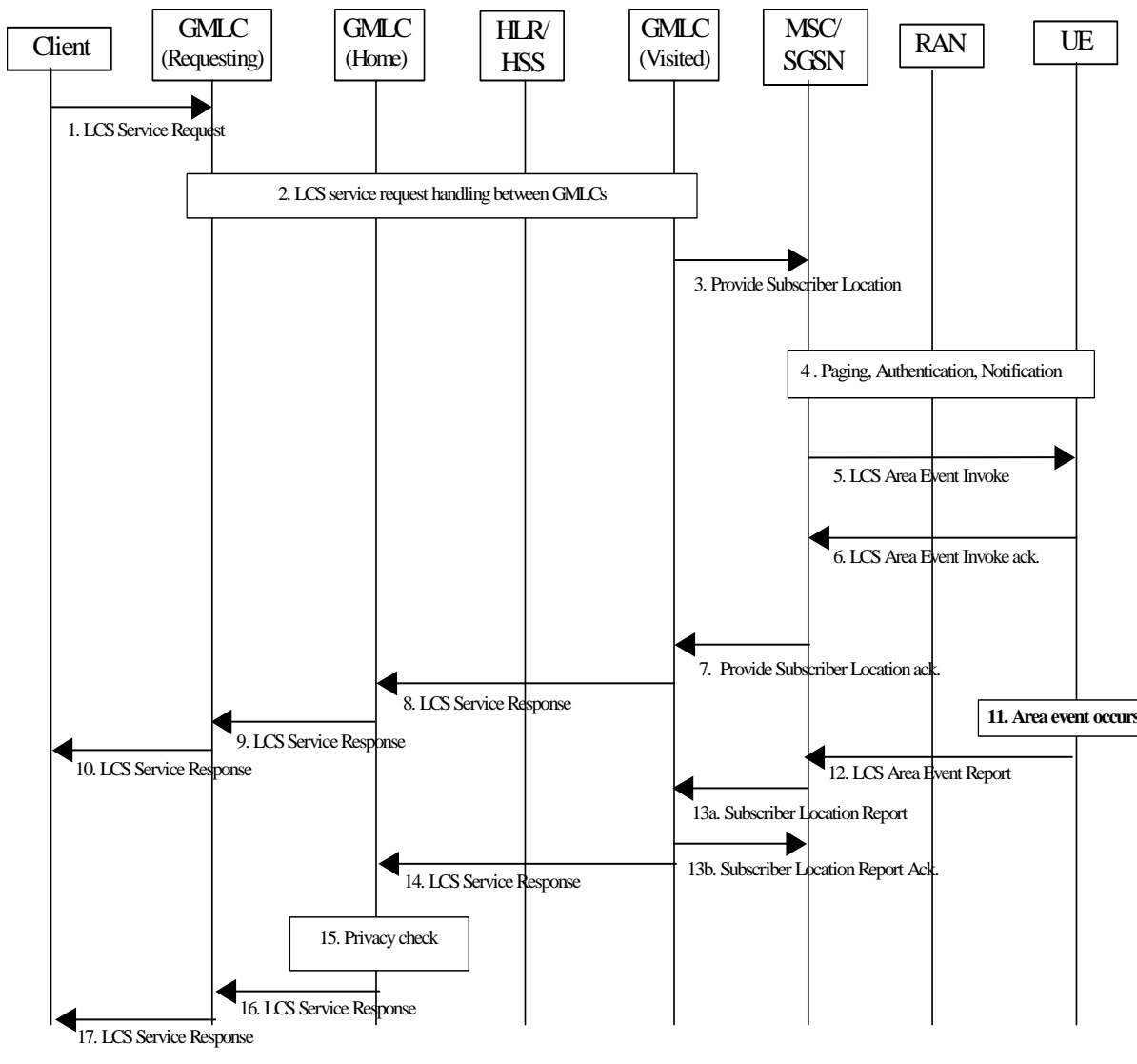
Figure 9.6d: Deferred MT-LR procedure for the Area event

1) The LCS Service Request contains the change of area type deferred location request information, i.e. details of the target area and the nature of the event, whether the event to be reported is the UE being inside, entering into or leaving the target area. The LCS service request may specify the validity time, i.e. start time and stop time, for the deferred location request and R-GMLC shall cancel the deferred location request as described in clause 9.1.9.1, when it is no longer valid. The LCS Service Request shall contain an indication of the minimum interval time between area event reports, if applicable. The LCS service request shall contain the information whether the deferred area event may be reported one time only, or several times. If the change of area event is reported one time only, the Location Service request shall be completed after the first area event has occurred. The R-GMLC assigns a LDR reference number to this LCS Service request. If the target area is expressed by

local coordinate system or geopolitical name, the R-GMLC shall convert the target area to geographical area expressed by a shape defined in TS23.032. In addition to the target area definition, the LCS Client may include the country code of the target area in the area event request.

2) LCS service request handling between GMLCs as described in clause 9.1.1. The information received by the R-GMLC is transferred to the V-GMLC via the H-GMLC, including the LDR reference number, the R-GMLC address and the H-GMLC address.

    If the H-GMLC notices that the current visited PLMN does not serve the target area, it may generate a modified deferred LCS service request in order to get notified when the target UE enters a PLMN that serves the target area. The modified target area event is that the target UE enters one of the PLMNs that serve the original target area. Note that the new area event may include multiple PLMNs (identified by PLMN IDs) if there are more than one PLMN that serves the original target area, based on the stored PLMN list and the corresponding estimated coverage. The H-GMLC then generates a new location request with the new defined area event and the same rest of the information in the original request.

    The new location request is sent to the target UE via the current V-GMLC. The H-GMLC keeps the original area event location service request pending for as long as determined by the validity time of the request. When the UE enters one of the pre-defined PLMNs, it sends an area event location report to H-GMLC. The H-GMLC then sends the original area event location service request to the UE via the new V-GMLC. If the H-GMLC cannot derive a list of PLMNs that may cover the target area, and the current visited network does not cover the target area, the H-GMLC may reject the request.

    Editor's Note: There is an issue related to the scenario that, after the original area event was download to the target the UE, the UE may switch to a different network that also serves the target area. Solution to resolve this issue is for further study.

3) If the received target area is expressed by a shape defined in TS23.032, V-GMLC converts the target area into an Area Definition consisting of the corresponding list of cell identities, location areas or routing area. If the V-GMLC is not able to translate the target area into network identities, it shall reject the request and send an LCS service response to H-GMLC with the appropriate error cause.
    If the received target area is expressed by country code or PLMN identity, the V-GMLC shall use the country code or PLMN identity as the Area Definition.
    The V-GMLC sends the Area Definition to MSC/SGSN in the Provide Subscriber Location request (deferred) and includes the LDR reference number, the R-GMLC address and the H-GMLC address in the request.
    The message shall define whether the event to be reported is the UE being inside, entering into or leaving the area. The message shall also include the minimum interval time between area event reports, the information whether the deferred area event may be reported one time only or several times, if applicable.

4) The MSC/SGSN verifies the UE capabilities with regard to the change of area event. If either the MSC/ SGSN or the UE does not support the deferred location request for the change of area event (for temporary or permanent reasons), a Provide Subscriber Location return error shall be returned with a suitable cause in step 7. If the UE is in idle mode, the core network performs paging, authentication and ciphering. If privacy notification/verification is requested, the MSC/SGSN sends an LCS Location Notification Invoke message to the target UE indicating the change of area type deferred location request and whether privacy verification is required. LCS Location Notification is further specified in clauses 9.1.2 and 9.1.6. If privacy verification was requested, the UE returns an LCS Location Notification Return Result to the MSC/SGSN indicating whether permission is granted or denied.

5) The MSC/SGSN sends the LCS Area Event Invoke to the UE carrying the Area Definition, other area event information, the LDR reference number, the R-GMLC address and the H-GMLC address. The message shall also define whether the event to be reported is the UE being inside, entering into, leaving the area. The message shall also include the minimum interval time between area event reports and the information whether the deferred area event may be reported one time only, or several times, if applicable.

6) If the LCS Area Event Invoke is successfully received by the UE and the UE supports the change of area type deferred location request, the UE sends acknowledgement to MSC/SGSN and begins monitoring for the change of area event. The UE shall determine whether it is inside, entering into or leaving the target area by comparing the current serving cell identity, location area, routing area, PLMN identity or country code to the Area Definition received from the MSC/SGSN. In case of soft handover, it is sufficient if one of the cells belongs to the target area. In case the Area Definition consists of a location or routing area, PLMN or country identity the UE shall check for the area event during the normal location or routing area update procedure. The change of area event detection mechanism must not influence on the normal UE cell selection and reselection procedures. If the UE does not support the deferred location request (for temporary or permanent reasons), it shall send the LCS Area Event Invoke ack. with the appropriate error cause.

7) If either the MSC/ SGSN or the UE does not support the deferred location request for the change of area event (for temporary or permanent reasons), a Provide Subscriber Location return error shall be returned to the V-GMLC with a suitable cause. If both of the SGSN/MSC and UE supports the deferred location request for the change of area event, a Provide Subscriber Location ack. shall be returned to the V-GMLC without a location estimate. MSC/SGSN shall include the result of the notification/verification in the response to the V-GMLC, if the notification/verification is needed. The response message shall include the LDR reference number, the R-GMLC address and the H-GMLC address. The change of area event invoke result shall be also included, if necessary. After sending the Provide Subscriber Location ack to the V-GMLC, the deferred location request shall be completed in the MSC/SGSN.

8) to 10) V-GMLC returns the LCS Service Response via H-GMLC and R-GMLC to the LCS Client to notify whether the request was successfully accepted or not. After sending the LCS Service Response to the H-GMLC, the deferred location request shall be completed in the V-GMLC.

11) UE detects that the requested area event has occurred.

12) Before sending the LCS Area Event Report the UE shall establish either a CS radio connection or PS signalling connection as specified in clauses 9.2.1 and 9.2.2. The UE sends the LCS Area Event Report to the VMSC/SGSN including the original LDR reference number, the R-GMLC address and the H-GMLC address. The report shall also include the result of the notification/verification procedure, if the notification/verification is needed.
If the UE was requested to report the change of area event one time only, the deferred location request shall be completed. In case multiple reports were requested, the UE must not send a repeated LCS Area Event Report more often than the requested minimum interval indicated in the LCS Area Event Invoke.

Editor's Note: It could be useful to have MSC/SGSN repeat the notification procedure with the target UE after the UE has reported the change of area event, but this is for further study.

13) If the MSC/SGSN does not supports the deferred location request for the change of area event (for temporary or permanent reasons), the MSC/SGSN sends the subscriber location report to its associated V-GMLC with a suitable error cause. Otherwise, the MSC/SGSN sends the subscriber location report to its associated V-GMLC with an indication of the event occurrence, the LDR reference number, the R-GMLC address and the H-GMLC address. V-GMLC sends an acknowledgement to MSC/SGSN in step 13b and the MSC/SGSN may record billing information.

14) If the V-GMLC does not supports the deferred location request for the change of area event (for temporary or permanent reasons), the V-GMLC sends an LCS Service Response to the H-GMLC with a suitable error cause. Otherwise, the V-GMLC sends the LCS Service Response to the H-GMLC with an indication of the event occurrence, the LDR reference number, the R-GMLC address and the H-GMLC address. The LDR reference number, the R-GMLC address and the H-GMLC address will be used to identify the source of the original deferred location request in the case that the UE has relocated before the area event occurred.

15) The H-GMLC performs the privacy check as described in clause 9.1.1.

16) The H-GMLC sends the LCS Service Response to R-GMLC. Unless multiple reports were requested, the deferred location request shall be completed in the H-GMLC after sending the LCS Service Response to the R-GMLC.

17) The R-GMLC sends the LCS Service Response to the LCS client. Unless multiple reports were requested, the deferred location request shall be completed in the R-GMLC after sending the LCS Service Response to the LCS client.

< New added clause >>

9.1.9.1 Cancellation of a Deferred Location Request – Change of Area event

Figure 9-7b illustrates the procedure for cancelling the Deferred Location Request for the change of area event.
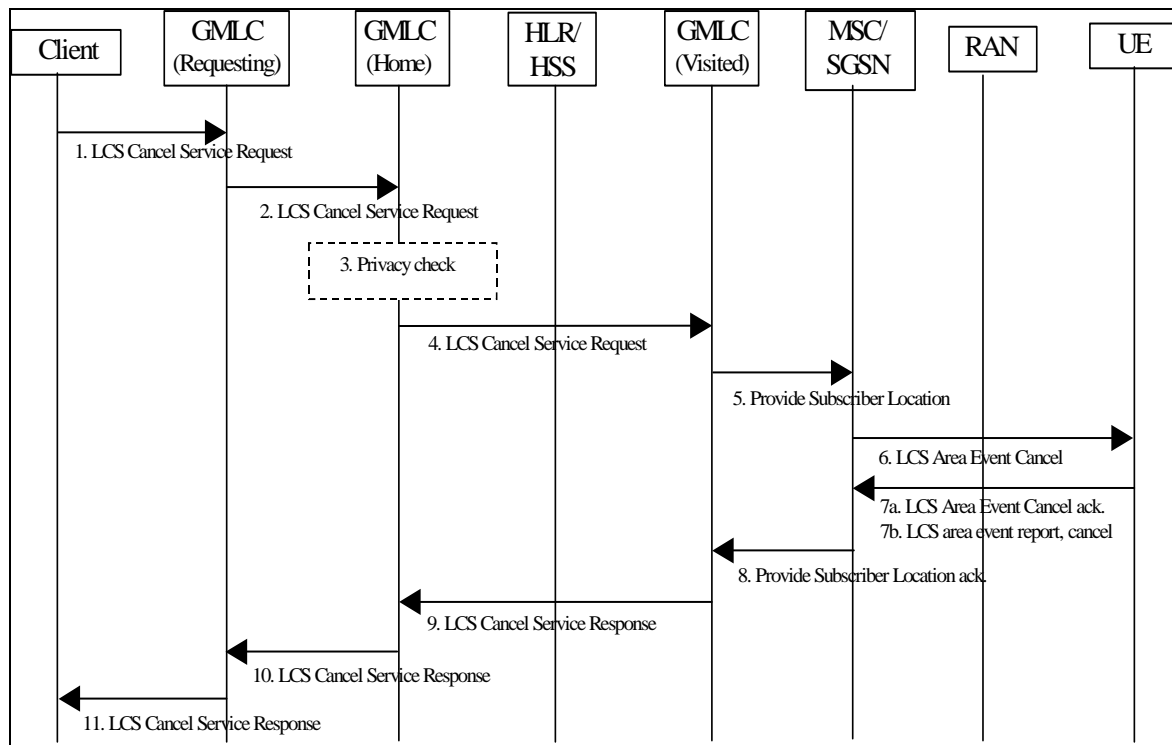
Figure 9.7b: Cancellation of a Deferred MT-LR with change of area event procedure

1. The LCS Client requests the cancellation of a previously requested Deferred Location Request.

2) The R-GMLC sends the cancellation request to H-GMLC, including the LDR reference number. R-GMLC may itself initiates the cancellation for some other reason, e.g. because a timer in the R-GMLC has expired.

3) If the UE's privacy profile stored in the H-GMLC or in the PPR was changed in such a way that it may impact on a specific deferred location request, H-GMLC shall cancel this deferred location request as described in step 4 and onwards. H-GMLC is made aware that the UE subscribers privacy profile has been changed in the PPR, as described in 9.1.1.2.

4) The H-GMLC forwards the LCS Cancel Service Request to V-GMLC with the LDR reference number which is received from the R-GMLC, and the H-GMLC address.

5) The V-GMLC sends the Provide Subscriber Location request to SGSN/MSC, indicating a cancellation of a deferred location request and including the LDR reference number and the H-GMLC address received from the H-GMLC.

6) The SGSN/MSC sends the LCS Area Event Cancellation, including the LDR reference number and the H-GMLC address, request to UE.

7a) The UE cancels the Area event deferred location request and sends the LCS Area Event cancellation ack., with no area event information included to VMSC/SGSN.

7b) While the UE is monitoring for the area event to occur, the UE may cancel or terminate the deferred location request for the change of area on its own behalf by sending the LCS Area Event report with the LDR reference number, an indication of the cancellation and an appropriate error cause.

8) The SGSN/MSC sends the cancellation acknowledgement to the V-GMLC in the Provide Subscriber Location Ack, with the LDR reference number and the H-GMLC address.

9) The V-GMLC sends the LCS Cancel Service Response to H-GMLC with the LDR reference number and the H-GMLC address.

10) H-GMLC sends the LCS Cancel Service Response to R-GMLC with the LDR reference number. H-GMLC may send the LCS Cancel Service Response to R-GMLC, even if the R-GMLC/LCS client has not requested the cancellation, see step 3.

11) R-GMLC sends the LCS Cancel Service Response to the LCS Client.

<< Next modified clause >>

11   Operational Aspects

11.1   Charging

Charging Information collected by the PLMN serving the LCS Client.

The following charging information shall be collected by the PLMN serving the LCS Client:

-    type and identity of the LCS Client;

-    identity of the target UE;

-    results (e.g. success/failure, method used if known, response time, accuracy) - to be repeated for each instance of positioning for a deferred location request;

-    identity of the visited PLMN;

-    LCS request type (i.e. LDR or LIR);

-    state;

-    type of event (applicable to LDR requests only);

-    time stamp;

-    type of co-ordinate system used.

11.2   Charging Information Collected by the Visited PLMN

The following charging information shall be collected by the visited PLMN:

-    date and time;

-    type and identity of the LCS Client (if known);

-    identity of the target UE;

-    location of the target UE (e.g., MSC, MSC Server, SGSN, location area ID, cell ID, location co-ordinates);

-    which location services were requested;

-    results (e.g. success/failure, positioning method used, response time, accuracy) - to be repeated for each instance of positioning for a batch location request;

-    identity of the GMLC or PLMN serving the LCS Client;

-    state;

-    type of event (applicable to LDR requests only).

<< New added Annex >>

Annex F (Informative): Mechanism for performing Change of Area Event Detection.

Note: the classification (i.e. normative or informative) of this Annex is FFS.

As described in section 9.1.9 that there may be alternative mechanisms to transfer the deferred MT-LR with Area Event request to the UE. This annex illustrates one mechanism. In this mechanism a Short Message Service (SMS) is used to transfer, to the UE/(U)SIM, the Area event detection request via an (U)SIM Application Toolkit application.

(U)SIM Application Toolkit (USAT) Based Solution

In this (U)SAT based solution, the area event detection mechanism relies on the proactive control of the UE by the (U)SIM using the (U)SAT commands controlled by a specific Change of Area Deferred Location application. Figure F.1 illustrates one possible method for downloading a change of area event application to the UE, but does not detail the operation of the application. The details of the application is outside the scope of this specification. Further information about the possible (U)SAT commands, can be found from TS 31.111.

The following procedure (shown in Figure F.1) replaces Figure 9.6d in clause 9.1.9.
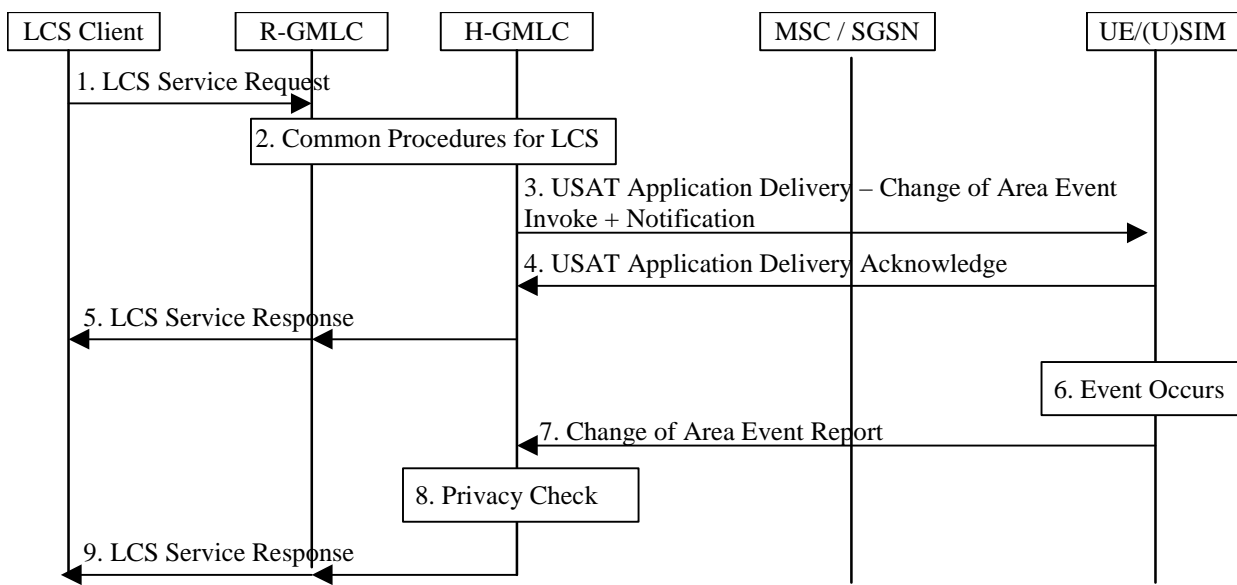
Figure F.1: (U)SAT Application Download and Change of Area Event Detection Procedure

1) This step is the same as step 1 in clause 9.1.9.

2) This step is similar to step 2 in clause 9.1.9, except the LCS Service Request does not reach the V-GMLC. Also the H-GMLC may request a translation of geographic shape to network identities from a GMLC in the network serving the target UE.

3) Information about the event, the (U)SAT application, that shall trigger the sending of the Location Report shall be sent to the UE/(U)SIM. If privacy action (notification and/or verification) was requested as a result of the privacy check, the H-GMLC shall also include the required action to the UE/(U)SIM. If notification/verification is required, the request shall indicate the identity of the LCS client, the Requestor Identity (if available), and the reference number. The mechanism by which the trigger detection is performed via (U)SAT application may be operator dependent. However, the (U)SAT Application shall contain the following information: reference number, H-GMLC address, validity period of request, and the area definition (of the target area).

4) If privacy verification was requested, the UE/(U)SIM indicates to its user whether the location request will be allowed or not allowed in the absence of a response and waits for the user to grant or deny permission. If privacy verification was requested and the user grants permission, the USAT Application shall be installed and the UE/(U)SIM then returns an acknowledgement to the H-GMLC indicating permission is granted and (U)SAT application is successfully installed. If the UE user does not respond after a predetermined time period (and the request is not allowed in the absence of a response) or denies permission, the UE/(U)SIM shall infer a "no response" condition, the USAT Application is not installed, an appropriate error response is returned to the GMLC/LCS Client and the remaining steps are skipped. Otherwise the UE/(U)SIM notifies the UE user of the location request (if required by the privacy action) and shall install the (U)SAT application and acknowledge successful installation to the H-GMLC, including an indication of "no response" but request is allowed if necessary. If at any point the (U)SAT application fails to install, due to lack of support or otherwise, the UE/(U)SIM shall inform the H-GMLC using an appropriate error cause.

5) The H-GMLC returns a LCS Service Response to the LCS Client to notify whether the request was successfully accepted/installed or not, without a location estimate.

6) The UE/(U)SIM detects the desired change of area event.

7) The UE/(U)SIM reports the change of area event.

8) The H-GMLC may perform another privacy check as described in clause 9.1.1.

9) The H-GMLC then returns a LCS Service Response to the LCS Client via the R-GMLC, if applicable, as in 9.1.1. If the GMLC for some other reason decides to not wait any longer for the requested event to occur (e.g. timer expires), an LCS Service Response shall be returned with an appropriate error cause indicating termination of the deferred location request.

H-GMLC may be the origination point of the SMS-DELIVER and the USAT Application messages.

<< Modified Annex >>

Annex G~~F~~ (informative):
Change history

...