
Source: **TSG SA WG2**
Title: **CRs on 03.71 R98 (v.7.2.1) and 23.171 R99 (v.3.0.0) on LCS stage 2**
Agenda Item: **6.2.3**

The following Change Requests (CRs) have been approved by TSG SA WG2 and are requested to be approved by TSG SA plenary #8.
Note: the source of all these CRs is now S2, even if the name of the originating company(ies) is still reflected on the cover page of all the attached CRs.

CR on 03.71 v.7.2.1

spec	release	CR #	cat	Title	S2 TDoc #
03.71	R98	A008	F	Ensure reliable privacy verification for value added LCS MT-LR	S2-000896

CRs on 23.171 v.3.0.0

spec	release	CR #	cat	Title	S2 TDoc #
23.171	R99	001r1	F	Ensure reliable privacy verification for value added LCS MT-LR	S2-001019
23.171	R99	002r1	F	Adding "hooks" indications in UMTS LCS stage 2, Removing PS LCS signaling procedures from R99 23.171	S2-001020

3GPP TSG SA WG2
Berlin, Germany, 22-26 May 2000

Document S2-00896
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

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03.71	CR	A008	Current Version:	7.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

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list expected approval meeting # here ↑		for information		non-strategic	X	

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Proposed change affects: (U)SIM [ ] ME [ ] UTRAN / Radio [ ] Core Network [X]
(at least one should be marked with an X)

Source: Siemens **Date:** 22 May 2000

Subject: Ensure reliable privacy verification for value added LCS MT-LR

Work item: Location Services

Category: *(only one category shall be marked with an X)*

F	Correction	X	**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	X
D	Editorial modification			Release 99	
				Release 00	

Reason for change: It needs to be ensured that a value added LCS client's identity (E.164 address) and name (when available) are provided by a GMLC to the VMSC and, where location notification or privacy verification are subscribed, to the target MS.

Clauses affected: 7.6.1.1

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs:
Other GSM core specifications	[ ]	→ List of CRs:
MS test specifications	[ ]	→ List of CRs:
BSS test specifications	[ ]	→ List of CRs:
O&M specifications	[ ]	→ List of CRs:

Other comments:

7.6 General Network Positioning Procedures

The generic network positioning procedure of providing the location information of an MS subscriber can be partitioned into the following procedures:

Location Preparation Procedure

This generic procedure is concerned with verifying the privacy restrictions of the MS subscriber, reserving network resources, communicating with the MS to be located and determining the positioning method to be used for locating the MS subscriber based on the requested QoS and the MS and network capabilities.

Positioning Measurement Establishment Procedure

This procedure is concerned with performing measurements by involving the necessary network and/or MS resources. Depending on the positioning method to be used for locating the MS the internals of this procedure can be positioning method dependent. The procedure is completed with the end of the positioning measurements.

Location Calculation and Release Procedure

This generic procedure is initiated after the measurements are completed and is concerned with calculating the location of the MS and releasing all network and/or MS resources involved in the positioning.

7.6.1 Mobile Terminating Location Request (MT-LR)

Figure 29 illustrates general network positioning for LCS clients external to the PLMN. In this scenario, it is assumed that the target MS is identified using either an MSISDN or IMSI.

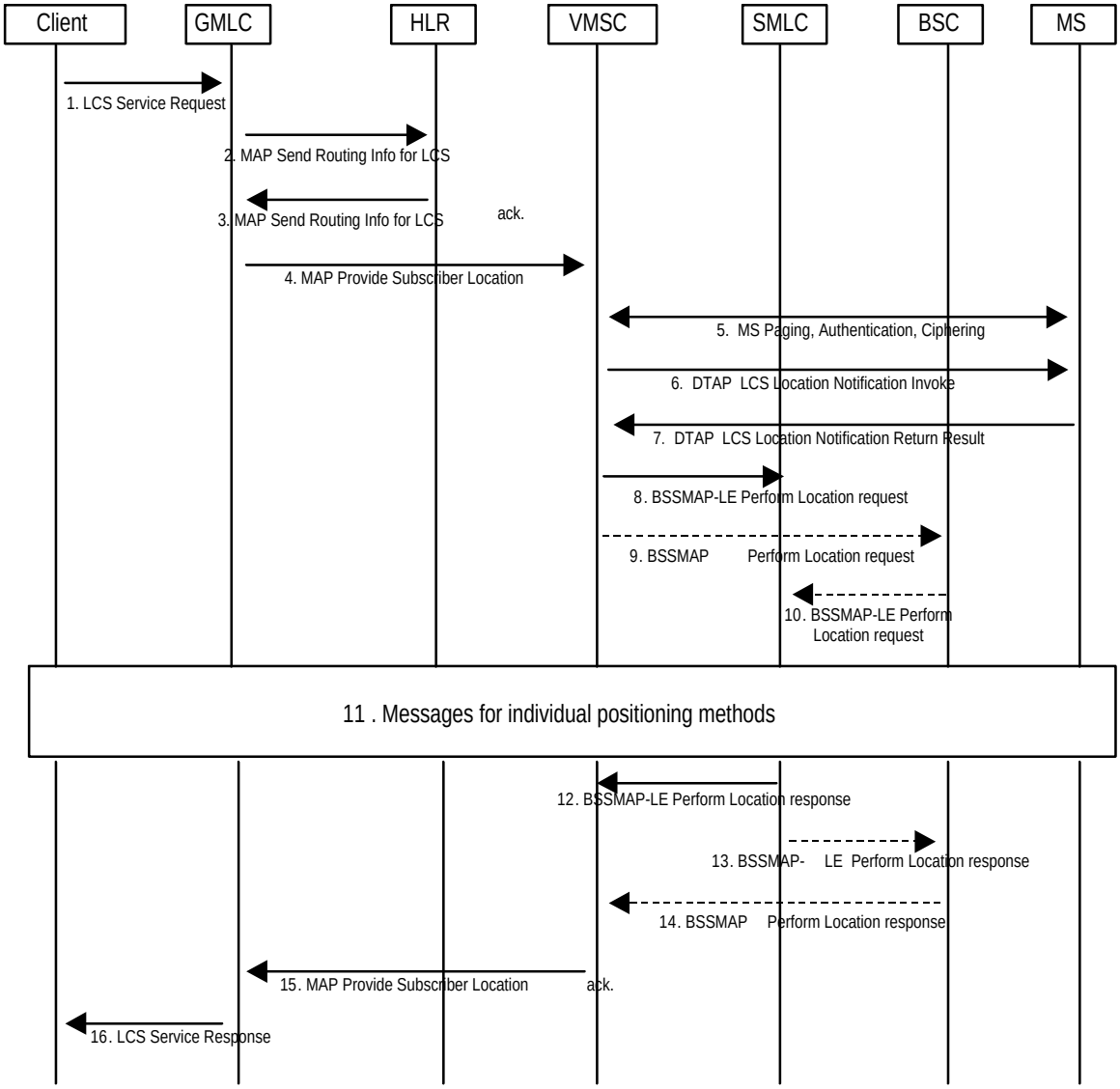

Figure 29: General Network Positioning for a MT-LR

7.6.1.1 Location Preparation Procedure

1) An external LCS client requests the current location of a target MS from a GMLC. The GMLC verifies the identity of the LCS client and its subscription to the LCS service requested and derives the MSISDN or IMSI of the target MS to be located and the LCS QoS from either subscription data or data supplied by the LCS client. For a call related location request, the GMLC obtains and authenticates the called party number of the LCS client (refer to Annex A for further details). If location is required for more than one MS, or if periodic location is requested, steps 2 to 12 below may be repeated.

2) If the GMLC already knows both the VMSC location and IMSI for the particular MSISDN (e.g. from a previous location request), this step and step 3 may be skipped. Otherwise, the GMLC sends a MAP_SEND_ROUTING_INFO_FOR_LCS message to the home HLR of the target MS to be located with either the IMSI or MSISDN of this MS.

3) The HLR verifies that the SCCP calling party address of the GMLC, corresponds to a known GSM network element that is authorized to request MS location information. The HLR then returns the current VMSC address and whichever of the IMSI and MSISDN was not provided in step 2 for the particular MS.

4) The GMLC sends a MAP_PROVIDE_SUBSCRIBER_LOCATION message to the VMSC indicated by the HLR. This message carries the type of location information requested (e.g. current location), the MS subscriber's IMSI, LCS QoS information (e.g. accuracy, response time) and an indication of whether the LCS client has the

override capability. For a call related location request, the message also carries the LCS client's called party number. ~~The message may optionally carry the identity of the LCS client.~~ For a value added LCS client, the message shall carry the client name if available and, for a call unrelated location request, the identity of the LCS client. In other cases, inclusion of the client name and/or identity is optional.

5) If the GMLC is located in another PLMN or another country, the VMSC first authenticates that a location request is allowed from this PLMN or from this country. If not, an error response is returned. If the target MS has an established circuit call other than speech, the location request may be denied and an error response is then returned to the GMLC. If the location request is allowed for a non-speech circuit call, it shall be up to the SMLC to decide, on the basis of the applicable position methods and requested QoS, whether positioning is possible. The VMSC then verifies LCS barring restrictions in the MS user's subscription profile in the VLR. In verifying the barring restrictions, barring of the whole location request is assumed if any part of it is barred or any requisite condition is not satisfied. If LCS is to be barred without notifying the target MS and a LCS client accessing a GMLC in the same country does not have the override capability, an error response is returned to the GMLC. Otherwise, if the MS is in idle mode, the VLR performs paging, authentication and ciphering. This procedure will provide the MS user's current cell ID and certain location information that includes the TA value in the BSSMAP Complete layer 3 Information used to convey the Paging Response. If the target MS supports any MS based or MS assisted positioning method(s), the MS will also provide the BSC and MSC with the positioning method(s) it supports via controlled early classmark sending (see GSM 04.08 and 08.08). If the MS is instead in dedicated mode, the VMSC will already have any early classmark information and will have been supplied with the current cell ID from either the serving BSC or serving MSC in the case of an established call with MSC-MSC handover.

6) If the location request comes from a value added LCS client and the MS subscription profile indicates that the MS must either be notified or notified with privacy verification and the MS supports notification of LCS (according to the MS Classmark 2), a DTAP LCS Location Notification Invoke message is sent to the target MS indicating the type of location request (e.g. current location), the identity of the LCS client and whether privacy verification is required. For a call related location request, the LCS client identity shall be set to the LCS client's called party number if no separate LCS client identity was received from the GMLC. Optionally, the VMSC may after sending the DTAP LCS Location Notification Invoke message continue in parallel the location process, i.e. continue to step 8 without waiting for a DTAP LCS Location Notification Return Result message in step 7.

7) The target MS notifies the MS user of the location request and, if privacy verification was requested, the target MS indicates to the MS 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 withhold permission. The MS then returns a DTAP LCS Location Notification Return Result to the VMSC indicating, if privacy verification was requested, whether permission is granted or denied. Optionally, the DTAP LCS Location Notification Return Result message can be returned some time after step 6, but before step 15. If the MS user does not respond after a predetermined time period, the VMSC shall infer a "no response" condition. The VMSC shall return an error response to the GMLC if privacy verification was requested and either the MS user denies permission or there is no response with the MS subscription profile indicating barring of the location request in the absence of a response.

8) The VMSC sends a MAP_PERFORM_LOCATION message to the SMLC associated with the MS's current cell location. The BSSMAP-LE message includes the type of location information requested, the MS's location capabilities and currently assigned radio channel type (SDCCH, TCH-FR or TCH-HR), the requested QoS and the current Cell ID and, if available, any location information including the TA value received in step 5.

9) If the SMLC is BSS based, the VMSC instead sends the BSSMAP PERFORM LOCATION message to the serving BSC for the target MS.

10) In the case of a BSS based SMLC, the BSC forwards the BSSMAP-LE PERFORM LOCATION request received in step 9 to the SMLC. The BSC may add additional measurement data to the message to assist with positioning. The message is transported inside an SCCP connection request.

7.6.1.2 Positioning Measurement Establishment Procedure

11) If the requested location information and the location accuracy within the QoS can be satisfied by the reported cell ID and, if available, TA value, the SMLC may send a MAP_PERFORM_LOCATION ack. immediately. Otherwise, the SMLC determines the positioning method and instigates the particular message sequence for this method defined in subsequent sections. If the position method returns position measurements, the SMLC uses them to compute a location estimate. If there has been a failure to obtain position measurements, the SMLC may use the current cell ID and, if available, TA value to derive an approximate location estimate. If an already computed location estimate is returned for an MS based position method, the SMLC may verify consistency with the current cell ID and, if available, TA value. If the location estimate so obtained does not satisfy the requested accuracy or the location attempt failed, e.g. due to missing data,and sufficient response time still remains, the SMLC may instigate a further location attempt using the same (e.g. providing more assistance data to MS) or a different position method. If a vertical location coordinate is requested but the SMLC can only obtain horizontal coordinates, these may be returned.

7.6.1.3 Location Calculation and Release Procedure

12) When location information best satisfying the requested location type and QoS has been obtained, the SMLC returns it to the VMSC in a Perform Location response if the SMLC is NSS based. If a location estimate could not be obtained, the SMLC returns a Perform Location response containing a failure cause and no location estimate.

13) For a BSS based SMLC, the location information is instead returned to the serving BSC.

14) In the case of a BSS based SMLC, the BSC forwards the BSSMAP PERFORM LOCATION response received in step 13 to the VMSC.

15) The VMSC returns the location information and its age to the GMLC, if the VMSC has not initiated the Privacy Verification process in step 6. If step 6 has been performed for privacy verification, the VMSC returns the location information only, if it has received a DTAP LCS Location Notification Return Result indicating that permission is granted. If a DTAP LCS Location Notification Return Result message indicating that permission is not granted is received, or there is no response with the MS subscription profile indicating barring of location in the absence of a response, the VMSC shall return an error response to the GMLC. If the SMLC did not return a successful location estimate, but the privacy checks in steps 5-7 were successfully executed, the VMSC may return the last known location of the target MS if this is known and the LCS client is requesting the current or last known location. The VLR may then release the Mobility Management connection to the MS, if the MS was previously idle, and the VMSC may record billing information.

16) The GMLC returns the MS location information to the requesting LCS client. If the LCS client requires it, the GMLC may first transform the universal location coordinates provided by the VMSC into some local geographic system. The GMLC may record billing for both the LCS client and inter-network revenue charges from the VMSC's network.

S2-001019

3GPP TSG SA WG2
Berlin, Germany, 22-26 May 2000

Document (rev. S2-00897)
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23.171	CR	001rev1	Current Version:	3.0.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	SA#8	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic	X	

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)*	(U)SIM		ME		UTRAN / Radio		Core Network	X

Source: Siemens/LCS drafting session **Date:** 25 May 2000

Subject: Ensure reliable privacy verification for value added LCS MT-LR

Work item: Location Services

Category: *(only one category shall be marked with an X)*

F	Correction	X	**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: Mirror CR to CR on same subject to GSM 03.71.

Clauses affected: 8.7.1.1

Other specs affected:

Other 3G core specifications		→ List of CRs:
Other GSM core specifications		→ List of CRs:
MS test specifications		→ List of CRs:
BSS test specifications		→ List of CRs:
O&M specifications		→ List of CRs:

Other comments: The corresponding change for PS LCS was removed, since it will be covered in R00.

8.7 Mobile Terminating Location Request

[Editorial note: The GPRS specification TS 23.060 requires periodical UE position reporting (GSM Phase 1 allows only a single response to one query). The MT signaling flows below should be enhanced to show "multiple responses to one query". It should be noted that the connection may be closed down between responses.]

8.7.1 Circuit Switched Mobile Terminating Location Request (CS-MT-LR)

Figure 8.4 illustrates general network positioning for LCS clients external to the PLMN. In this scenario, it is assumed that the target UE is identified using either an MSISDN or IMSI.

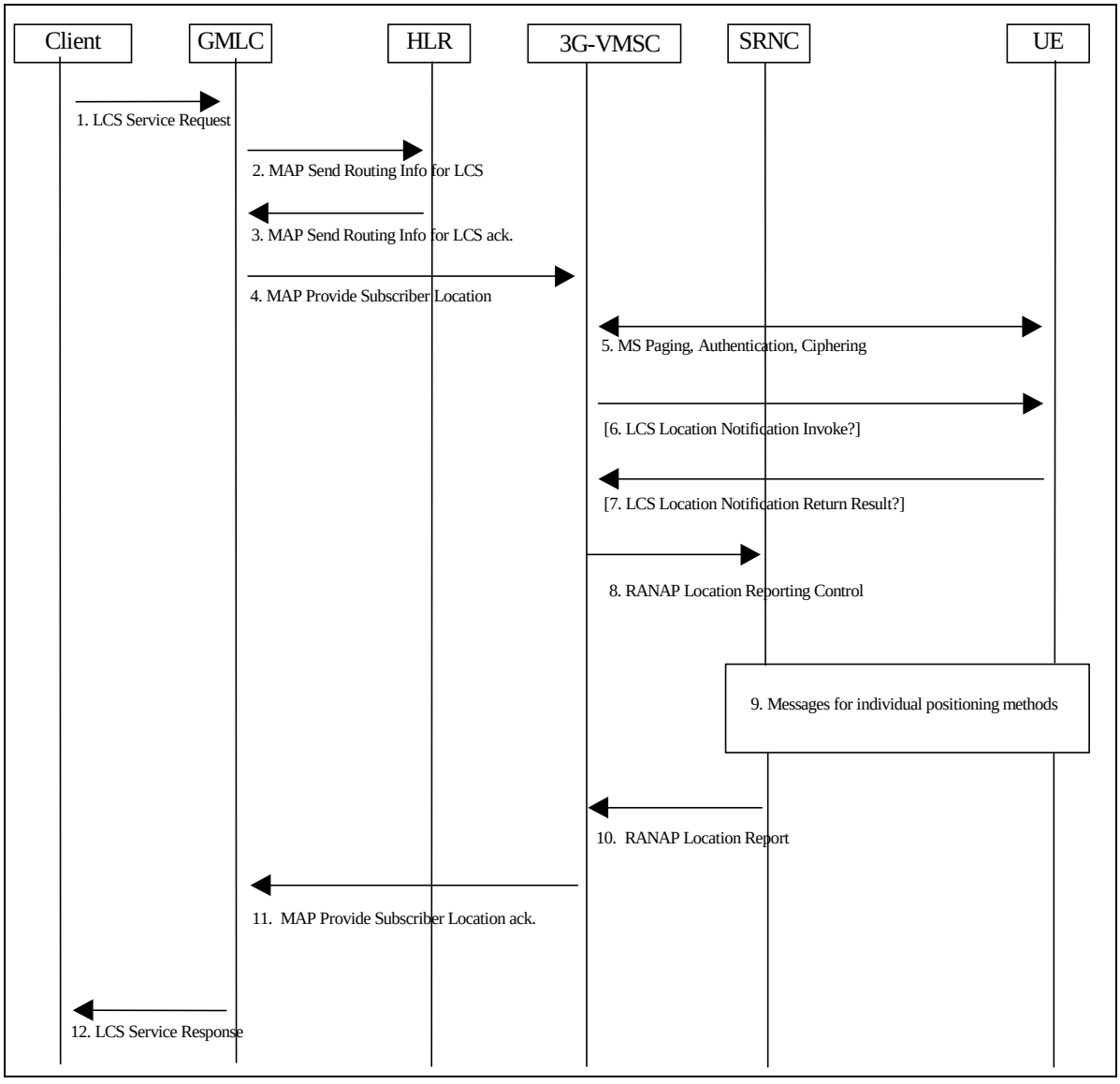

Figure 8.4: General Network Positioning for a MT-LR

8.7.1.1 Location Preparation Procedure

(1) An external LCS client requests the current location of a target UE from a GMLC. The GMLC verifies the identity of the LCS client and its subscription to the LCS service requested and derives the MSISDN or IMSI of the target UE to be located and the LCS QoS from either subscription data or data supplied by the LCS client. For a call related location request, the GMLC obtains and authenticates the called party number of the LCS

client [(refer to Annex A for further details)]. If location is required for more than one UE, or if periodic location is requested, steps 2 to 12 below may be repeated.

(2) If the GMLC already knows both the 3G-VMSC location and IMSI for the particular MSISDN (e.g. from a previous location request), this step and step 3 may be skipped. Otherwise, the GMLC sends a MAP_SEND_ROUTING_INFO_FOR_LCS message to the home HLR of the target UE to be located with either the IMSI or MSISDN of this UE.

(3) The HLR verifies that the calling party SCCP address of the GMLC corresponds to a known UMTS network element that is authorized to request UE location information. The HLR then returns the current 3G-VMSC address and whichever of the IMSI and MSISDN was not provided in step (2) for the particular UE.

(4) The GMLC sends a MAP_PROVIDE_ SUBSCRIBER _LOCATION message to the 3G-MSC indicated by the HLR. This message carries the type of location information requested (e.g. current location), 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 a call related location request, the message also carries the LCS client's called party number. ~~The message may optionally carry the identity of the LCS client.~~ For a value added LCS client, the message shall carry the client name if available and, for a call unrelated location request, the identity of the LCS client. In other cases, inclusion of the client name and/or identity is optional.

(5) If the GMLC is located in another PLMN or another country, the 3G-VMSC first authenticates that a location request is allowed from this PLMN or from this country. If not, an error response is returned. The 3G-VMSC then verifies LCS barring restrictions in the UE user's subscription profile in the VLR. In verifying the barring restrictions, barring of the whole location request is assumed if any part of it is barred or any requisite condition is not satisfied. If LCS is to be barred without notifying the target UE and a LCS client accessing a GMLC in the same country does not have the override capability, an error response is returned to the GMLC. Otherwise, if the UE is in idle mode, the Core Network performs paging, authentication and ciphering. If the target UE supports any UE based or UE assisted positioning method(s), the UE will also provide the SRNC and MSC with the positioning method(s) it supports via controlled early classmark sending. If the UE is instead in dedicated mode, the VMSC will already have any early classmark information.

[GSM LCS: If the target UE has an established circuit call other than speech, the location request may be denied and an error response is then returned to the GMLC. If the location request is allowed for a non-speech circuit call, it shall be up to the SRNC to decide, on the basis of the applicable position methods and requested QoS, whether positioning is possible. [this is FFS]]

(6) If the location request comes from a value added LCS client and the UE subscription profile indicates that the UE must either be notified or notified with privacy verification and the UE supports notification of LCS (according to the UE Classmark 2), an LCS Location Notification Invoke message is sent to the target UE indicating the type of location request (e.g. current location) and the identity of the LCS client and whether privacy verification is required. For a call related location request, the LCS client identity shall be set to the LCS client's called party number if no separate LCS client identity was received from the GMLC. Optionally, the VMSC may after sending the LCS Location Notification Invoke message continue in parallel the location process, i.e. continue to step 8 without waiting for a LCS Location Notification Return Result message in step 7.

(7) The target UE notifies the UE user of the location request. If privacy verification was requested, the target UE indicates to the UE 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 withhold permission. The UE then returns an LCS Location Notification Return Result to the 3G-VMSC indicating, if privacy verification was requested, whether permission is granted or denied. Optionally, the LCS Location Notification Return Result message can be returned some time after step 6, but before step 11. If the UE user does not respond after a predetermined time period, the VMSC shall infer a "no response" condition. The 3G-VMSC shall return an error response to the GMLC if privacy verification was requested and either the UE user denies permission or there is no response with the UE subscription profile indicating barring of the location request in the absence of a response.

(8) The 3G-MSC sends a RANAP Reporting Control message to the SRNC. This message includes the type of location information requested, the UE's location capabilities and requested QoS.

8.7.1.2 Positioning Measurement Establishment Procedure

(9) If the requested location information and the location accuracy within the QoS can be satisfied based on cell coverage, cell ID and, if available, RTT value, the SRNC may send a RANAP Location Report immediately.

Otherwise, the SRNC determines the positioning method and instigates the particular message sequence for this method, as specified in UTRAN Stage 2 [1]. If the position method returns position measurements, the SRNC uses them to compute a location estimate. If there has been a failure to obtain position measurements, the SRNC may use the current cell information and, if available, RTT value to derive an approximate location estimate. If the UE returns an already computed location estimate to SRNC using an UE based position method, the SRNC may verify consistency with the current cell and, if available, RTT value. If the location estimate so obtained does not satisfy the requested accuracy or the location attempt failed, e.g. due to missing data, and sufficient response time still remains, the SRNC may instigate a further location attempt using the same (e.g. providing more assistance data to UE) or a different position method. If a vertical location co-ordinate is requested but the SRNC can only obtain horizontal co-ordinates, these may be returned.

In case IPDL is used the SRNC may send a massage to the BS/Node B to configure the power cease period of the Node Bs involved in the positioning process. However, if the IPDL alignment is specified in lower layers e.g. layer 1 then the functional split of IPDL processing may partly included in network elements functionality.

8.7.1.3 Location Calculation and Release Procedure

(10) When a location estimate best satisfying the requested QoS has been obtained, the SRNC returns it to the 3G-MSC in a Location Report message. If a location estimate could not be obtained, the SRNC returns a Location Report message containing a failure cause and no location estimate.

(11) The 3G-MSC returns the location information and its age to the GMLC, if the VMSC has not initiated the Privacy Verification process in step 6. If step 6 has been performed for privacy verification, the VMSC returns the location information only, if it has received a LCS Location Notification Return Result indicating that permission is granted. If a LCS Location Notification Return Result message indicating that permission is not granted is received, or there is no response, with the UE subscription profile indicating barring of location in the absence of a response, the VMSC shall return an error response to the GMLC. If the SRNC did not return a successful location estimate, but the privacy checks in steps 6-7 were successfully executed, the 3G-VMSC may return the last known location of the target UE if this is known and the LCS client is requesting the current or last known location. The VLR may then release the Mobility Management connection to the UE, if the UE was previously idle, and the 3G-MSC may record billing information.

(12) The GMLC returns the UE location estimate to the requesting LCS client. If the LCS client requires it, the GMLC may first transform the universal location co-ordinates provided by the 3G-MSC into some local geographic system. The GMLC may record billing for both the LCS client and inter-network revenue charges from the 3G-MSC's network.

S2 Meeting #13
Berlin, Germany, 22. - 26. May 2000

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23.171	CR	02rev1	Current Version:	3.0.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: SA #8 *list expected approval meeting # here ↑*

for approval [X]
For information [ ]

strategic [ ]
non-strategic [ ]
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Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [ ] UTRAN / Radio [ ] Core Network [ ]

Source: LCS drafting session **Date:** 25 May 2000

Subject: Adding "hooks" indications in UMTS LCS stage 2, 23.171, R99, removing PS LCS signaling procedures from R99 23.171

Work item: Location Services (LCS) in UMTS

PT SMG CR cover form is available from: http://docbox.etsi.org/tech-org/smg/Document/smg/tools/CR_form/crf28_1.zip

Category: *(one category and one release only shall be marked with an X)*

F	Correction	[ ]
A	Corresponds to a correction in an earlier release	[ ]
B	Addition of feature	[ ]
C	Functional modification of feature	[ ]
D	Editorial modification	[ ]

Release:

Phase 2	[ ]
Release 96	[ ]
Release 97	[ ]
Release 98	[ ]
Release 99	[X]
UMTS	[X]

Reason for change: Support for location services in the Packet Switched domain was agreed at the S2 #12 meeting to be added as "hooks" in the UMTS LCS stage 2 specification 23.171. This contribution aims at making the R99 LCS System Stage 2 specification consistent with this decision. Text parts that are applicable to later releases only have been identified and are indicated by brackets { }. The changes are editorial in nature, such as adding the words 3G-SGSN and Packet Switched (PS) in appropriate place
The PS LCS signaling procedures are removed from R99 to avoid confusion with R00. Figure 6.1 on the LCS architecture in UMTS is proposed to be replaced with the corresponding figure from TS 23.002.

Clauses affected: several

Other specs affected:

Other releases of same specification	[ ]	→ List of CRs:
Other core specifications	[ ]	→ List of CRs:
MS test specifications / TBRs	[ ]	→ List of CRs:
BSS test specifications	[ ]	→ List of CRs:
O&M specifications	[ ]	→ List of CRs:

Other comments: Text marked within { brackets } is intended for releases later than Release 99.

3G TS 23.171 V3.0.0 (2000-03)

Technical Specification

3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Functional stage 2 description of location services in UMTS, (Release 1999)

Keywords

3GPP

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<< First modified section >>

4.1 Location services in UMTS Release 1999

It should be noted that UMTS Release 99 supports only cell coverage based LCS in the circuit switched domain. In addition UMTS Release 99 also contains LCS "hooks" for compatibility with future releases.

These "hooks" in UTRAN are descriptions of the positioning methods OTDOA-IPDL (observed time difference of arrival with network adjustable idle periods) and assisted GPS methods that are specified in the UTRAN Stage 2 specification 25.305 and in the present document 23.171 from system point of view.

LCS support in the packet switched domain is regarded as LCS Core Network "hooks", which in R99 are defined only in the present document 23.171.

Text marked within { brackets } is intended for releases later than Release 99.

<< Next modified section >>

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 3G-VMSC{ or 3G-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 also generates charging and billing related data for LCS via the Location System Billing Function (LSBF).

5.4.1.2 Location Client Authorization Function (LCAF)

The Location Client Authorization Function (LCAF) is responsible for providing access and subscription authorization to a client. Specifically, it provides authorization to a LCS client requesting access to the network and authorizes the subscription of a client. LCAF provides authorization to a LCS client requesting Location Information of a specific UE.

5.43.1.2.1 Access Subfunction

An *Access Subfunction* enables LCS clients to access LCS services. This subfunction provides verification and authorization of the requesting client.

When a LCS is requested, the Access Subfunction uses the information stored in the LCS client *subscription profile* to verify that:

- the LCS client is registered; and
- the LCS client is authorized to use the specified LCS request type;
- the LCS client is allowed to request location information for the subscriber(s) specified in the LCS request.

5.43.1.2.2 Subscription Subfunction

The LCS client Subscription profile shall contain a minimum set of parameters assigned on per LCS client basis for an agreed contractual period. The LCS client profile shall contain the following set of access parameters:

- LCS client identity;

- Allowed LCS request types (i.e. LIR, LDR or both); (see note)
- Maximum number of subscribers allowed in a single LCS request;
- Priority;
- Position override indicator;
- State(s);
- Event(s) (applicable to LDR requests only);
- Local coordinate system;
- LCS client access barring list (optional);
- PLMN access barring list applicability;

NOTE: LIR = Location Immediate Request; and LDR = Location Deferred Request.

For certain authorized LCS client internal to the PLMN, a subscription profile is unnecessary. These clients are empowered to access any defined service that is not barred for an UE subscriber. This permits positioning of emergency calls without the need for pre-subscription.

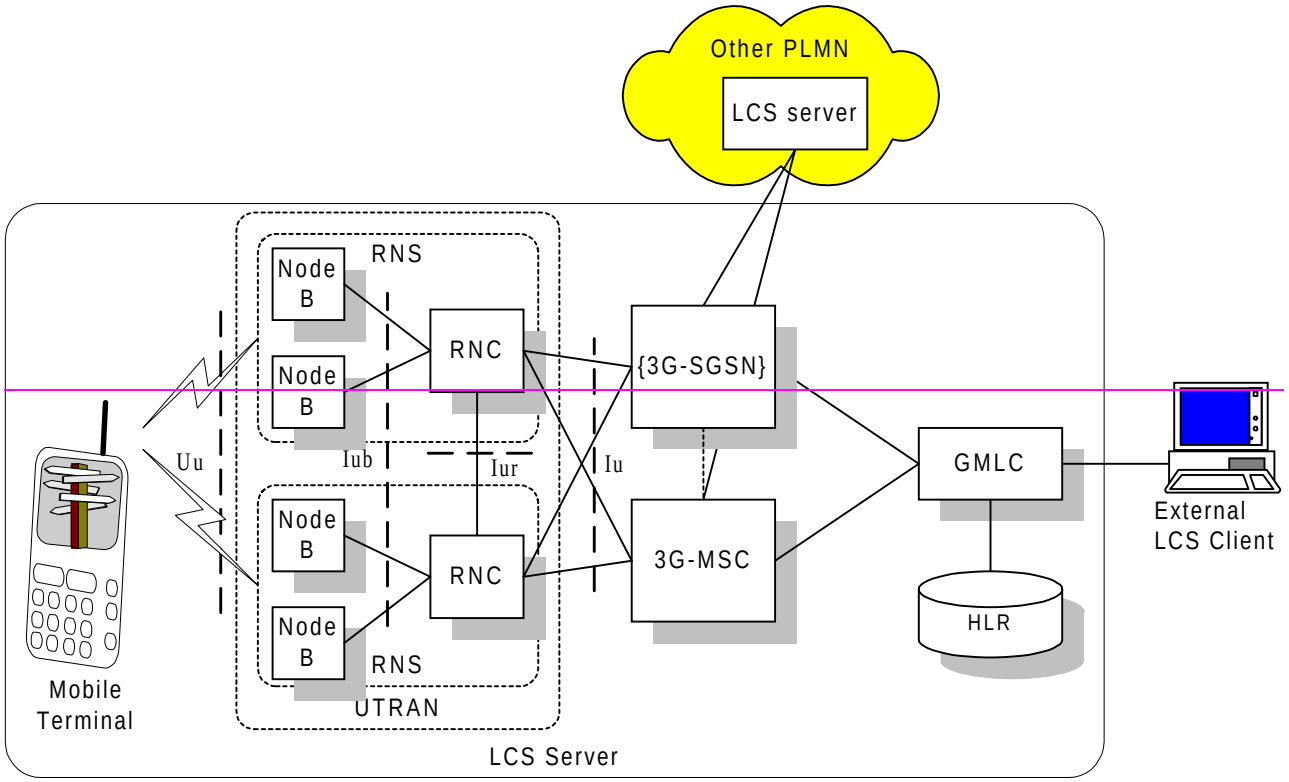
<< Next modified section >>

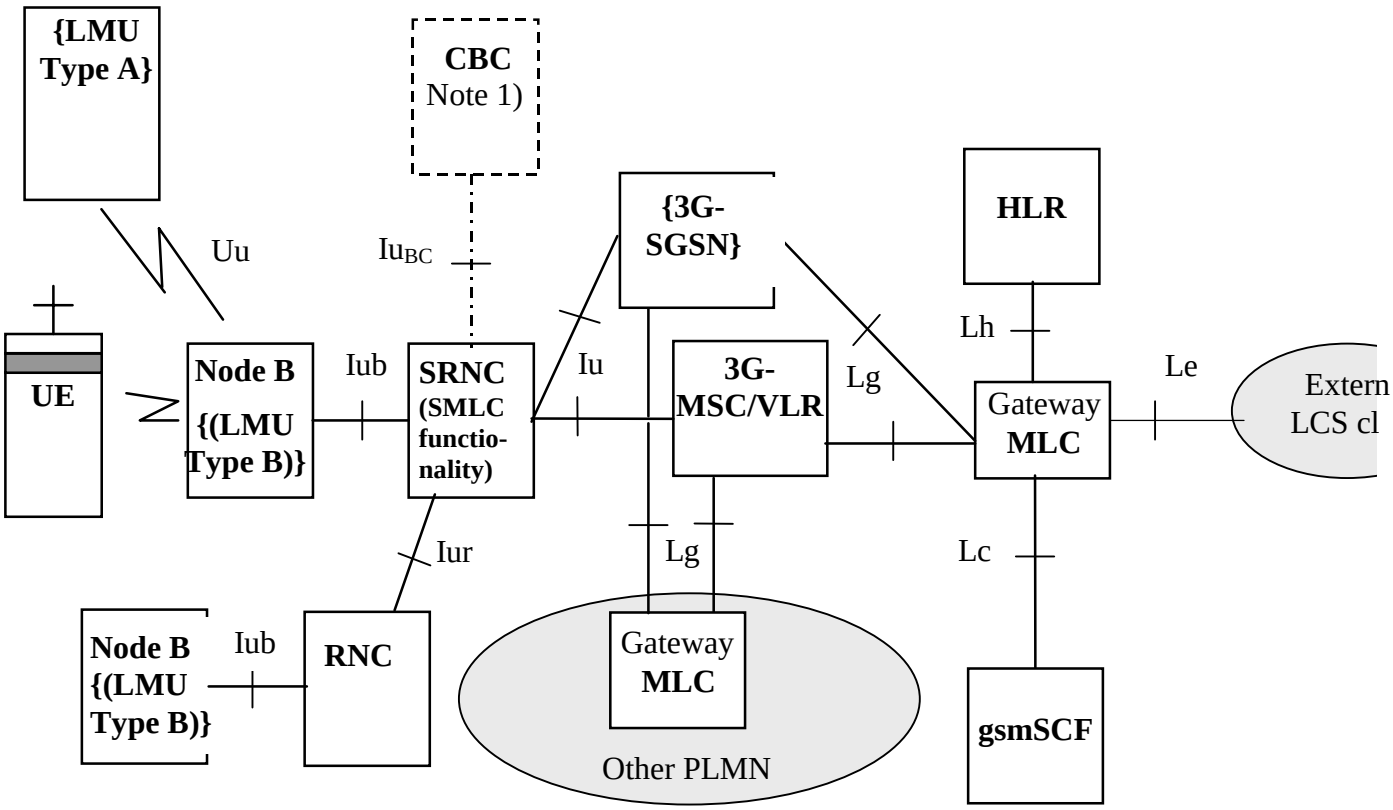
6 UMTS LCS Architecture

Figure 6.1 shows the general arrangement of the Location Service feature in UMTS. This illustrates, generally, the relation of LCS Clients and servers in the core network with the UMTS Access Network. The LCS entities within the Access Network communicate with the Core Network (CN) across the Iu interface. Communication among the Access Network LCS entities makes use of the messaging and signalling capabilities of the Access Network.

As part of their service or operation, the LCS Clients may request the location information of user equipment UE (UE without a valid SIM/USIM) or mobile stations. There may be more than one LCS client. These may be associated with the UMTS network or the Access Network operated as part of a UE application or accessed by the UE through its access to an application (e.g. through the Internet).

The clients make their requests to a LCS Server. There may be more than one LCS Server. The client must be authenticated and the resources of the network must be co-ordinated including the UE and the calculation functions, to estimate the location of the UE and result returned to the client. As part of this process, information from other systems (other Access Networks) can be used. As part of the location information returned to the client, an estimate of the accuracy of the estimate and the time-of-day the measurement was made shall be provided.





Note 1): The usage of CBC for LCS assistance data in UMTS is for further study. The assistance data is generated in SRNC.

Figure 6.1: General arrangement of LCS in UMTS, UTRAN example

<< Next modified section >>

6.2 Allocation of LCS functions to UMTS network elements

Table 6.1 shows a summary of the Functional Groups and Functional Blocks for Location services in UMTS. Table 6.2 and Figure 6.2 show the generic configuration for LCS in UMTS and the distribution of LCS functional blocks to UMTS 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 mobile station.

LCS is logically implemented on the UMTS 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 in UMTS

Funct.Group	Functional component	Full name of Functional Block	Abbrev.
Loc. Client	Location Client component	(External) Location Client Function	LCF
		Internal Location Client Function	U-LCF -internal
LCS Server in PLMN	Client handling component	Location Client Control Function	LCCF
		Location Client Authorization Function	LCAF
	System handling component	Stand-alone LMU Mobility Management Function	LMMF
		Location System Control Function	LSCF
		Location System Control Function in RNC	U-LSCF
		Location System Billing Function	LSBF
		Location System Operations Function	LSOF
	Subscr. handling component	Location Subscriber Authorization Function	LSAF
		Location Subscriber Privacy function	LSPF
	Positioning component	UMTS- Positioning Radio Control Function	U-PRCF
		UMTS- Positioning Calculation Function	U-PCF
		UMTS- Positioning Signal Measurement Function	U-PSMF
		UMTS- Positioning Radio Resource Management	U-PRRM

Table 6.2 and Figure 6.2 illustrate the allocation of functional entities in the reference configuration of LCS in UMTS. 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 in UMTS shall take benefit of the standardized Iur interface between RNSs, 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 mobile station may use e.g. the GPS positioning mechanism, but still demand e.g. auxiliary measurements from the serving network.}

Table 6.2: Allocation of LCS functional entities to network elements

	UE	RAN	GMLC	{3G-SGSN}	3G-MSC	Client
Location client functions						
LCF	X			X	X	X
U-LCF Internal	ffs	X				
Client handling functions						
LCCTF			X			
LCCF			X			
LCAF			X			
System handling functions						
LMMF				?	?	
LSCF				X	X	
U-LSCF		X				
LSBF			X	X	X	
LSOF	X	X	X	X	X	
Subscriber handling functions						
LSAF				X	X	
LSPF				X	X	
Positioning functions						
PRCF		X				
PCF	X	X				
PSMF	X	X				
PRRM		X				
	UE	**RAN**	**GMLC**	**{3G-SGSN}**	**3G-MSC**	**Client**

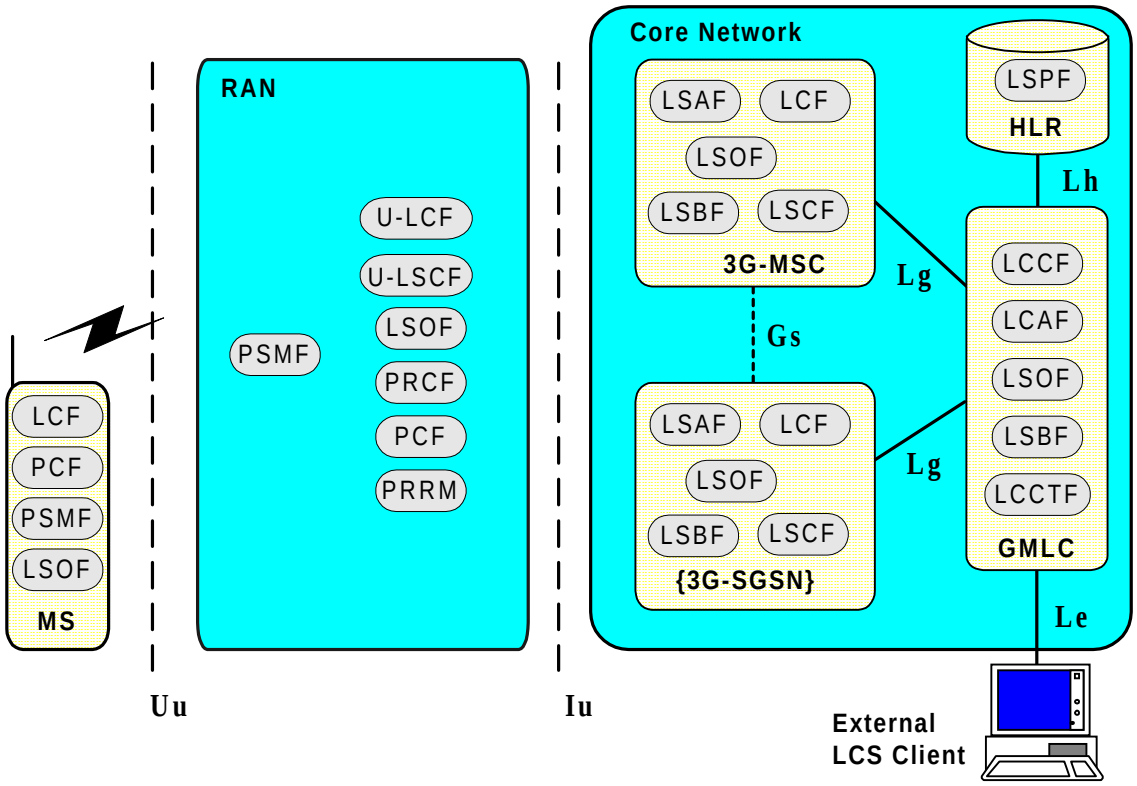


Figure 6.2: Generic LCS Logical Architecture

<< Next modified section >>

6.3.3 Gateway Mobile Location Center, GMLC

The Gateway Mobile Location Center (GMLC) contains functionality required to support LCS. In one PLMN, there may be more than one GMLC.

The GMLC is the first node an external LCS client accesses in a GSM PLMN (i.e. the Le reference point is supported by the GMLC). The GMLC may request routing information from the HLR via the Lh interface ~~or from 3G-SGSN via the Lg' interface~~. After performing registration authorization, it sends positioning requests to and receives final location estimates from the 3G-VMSC {or 3G-SGSN} via the Lg interface ~~or from the 3G-SGSN via the Lg' interface~~.

6.3.4 Serving RNC, UTRAN case

The Serving RNC (SRNC) is a network element of UTRAN and contains functionality required to support LCS in PLMN. The LCS functionality of SRNC is given in [1].

{6.3.5 LCS support in the Mobile Station }

{The UE may be involved in the various positioning procedures. Specific UE involvement is specified in each of the positioning procedures specified in TR 25.305.

The UE interacts with the measurement co-ordination functions to ~~transmit the needed signals for uplink based LCS measurements and to~~ make measurements of downlink signals. The measurements to be made will be determined by the ~~chosen~~ location method.

The UE may also contain LCS applications, or access a LCS application through communication with a network accessed by the UE or an application residing in the UE. This application may include the needed measurement and calculation functions to determine the UE's location with or without assistance of the UMTS LCS entities.

The UE may also, for example, contain an independent location function (e.g. Global Satellite Positioning Service GPS) and thus be able to report its location, independent of the UTRAN transmissions. The UE with an independent location function may also make use of information broadcast by the UTRAN that assists the function.}

6.3.6 LMU

The Location Measurement Unit LMU entity makes measurements (e.g. of radio signals) and communicates these measurements within the Access Network. The LMU is described in **Error! Reference source not found.**.

6.3.7 3G-MSC/VLR

The 3G-MSC/VLR contains functionality responsible for UE subscription authorization and managing call-related and non-call related positioning requests of LCS. The 3G-MSC is accessible to the GMLC via the Lg interface. The LCS functions of 3G-MSC are related to charging and billing, LCS co-ordination, location request, authorization and operation of the LCS services.

{6.3.8 3G-SGSN}

{The ~~3G-service GPRS support node~~ 3G-SGSN contains functionality responsible for UE subscription authorization and managing ~~call-related and non-call related~~ positioning requests of LCS. The 3G-SGSN is accessible to the GMLC via the Lg' interface. The LCS functions of 3G-SGSN are related to charging and billing, LCS co-ordination, location request, authorization and operation of the LCS services.}

<< Next modified section >>

7.4 MAP Interfaces

The MAP interfaces defined for GSM LCS should be re-used as much as possible in UMTS. {It is seen feasible to use the same MAP interface between GMLC and 3G-SGSN, as between GMLC and 3G-MSC.}

There are two MAP interfaces in the UMTS Location Services:

- Interface between GMLC and HLR (Lh interface).

This interface is used by the GMLC to request the address of the visited MSC or 3G-SGSN for a particular target UE whose location has been requested.

- Interface between GMLC - MSC {and GMLC – 3G-SGSN} (Lg interface).

This interface is used by the GMLC to convey a location request to the MSC {or 3G-SGSN} currently serving a particular target UE whose location was requested. The interface is used by the MSC {or 3G-SGSN} to return location results to the GMLC.

The following MAP services are defined for GSM LCS and should be re-used for UMTS LCS:

- MAP-SEND-ROUTING-INFO-FOR-LCS Service.

This service is used between the GMLC and the HLR to retrieve the routing information needed for routing a location service request to the servicing 3G-VMSC {or 3G-SGSN}.

- MAP-PROVIDE-SUBSCRIBER-LOCATION Service.

This service is used by a GMLC to request the location of a target UE from the visited MSC {or 3G-SGSN} at any time.

- MAP-SUBSCRIBER-LOCATION-REPORT Service.

This service is used by a 3G-VMSC {or 3G-SGSN} to provide the location of a target UE to a GMLC when a request for location is either implicitly administered or made at some earlier time.

{ The MAP Subscriber Location Report could also be used to send information about location of the Target UE (for MO-LR) to an external client. }

{8.3 LCS State description for 3G-SGSN}

{8.3.1 3G-SGSN States}

{8.3.1.1 LCS IDLE State}

{In this state, the 3G-SGSN location service is inactive for a particular UE. }

{8.3.1.2 LOCATION State}

{In this state, the 3G-SGSN is awaiting a response from the SRNC after requesting the location for a particular UE.}

{8.3.2 State Functionality}

{8.3.2.1 State Transitions}

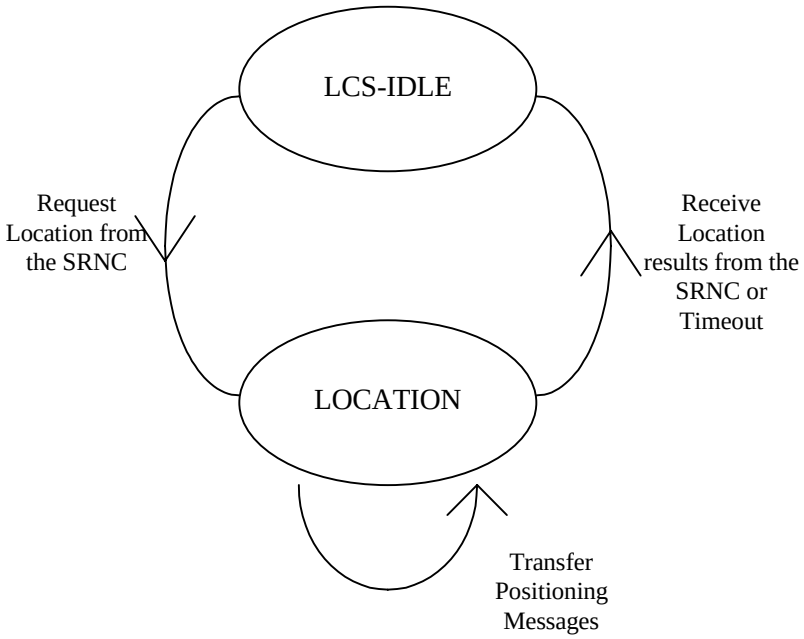


Figure 8.3: State Transitions in the 3G-SGSN

{Moving from LCS-IDLE to LOCATION state:

After a request has been received to locate a particular UE and the UE subscription options have been verified to allow this, the 3G-SGSN sends a location request to the SRNC associated with the UE to be located. The 3G-SGSN then enters the LOCATION state.

Moving from LOCATION to LCS IDLE state:

After the return of a location estimate result from SRNC, or if the Location Timer described below expires, the 3G-SGSN shall re-enter IDLE state.}

{8.3.2.2 LOCATION Timer Function}

{The 3G-SGSN runs a timer while in the LOCATION state to limit the amount of time waiting for a location response from the SRNC. If the timer expires before such information is received, the 3G-SGSN indicates a location failure to the original requesting entity and re-enters IDLE state.}

<< Next modified section >>

8.5 Iu Signaling Connection

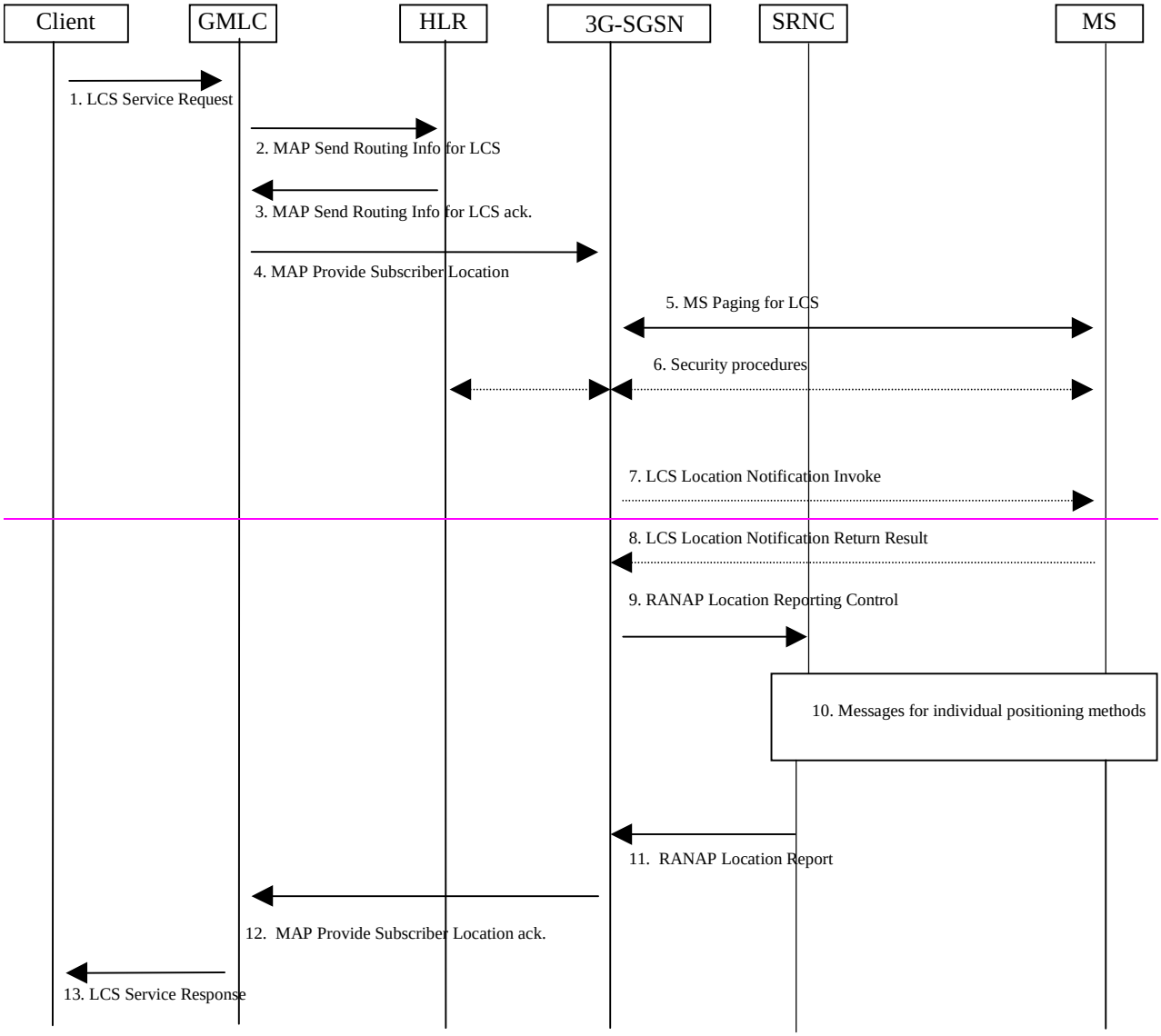
Before 3G-MSC {/3G-SGSN} can request location information of a Target UE from SRNC, an Iu Signaling Connection must have been established between 3G-MSC {/3G-SGSN} and SRNC. The 3G-MSC {/3G-SGSN} sends a RANAP Location Reporting control message to the SRNC, SRNC determines the location of the target UE related to this Iu Signalling Connection and sends a Location Report to 3G-MSC {/3G-SGSN} over the same Iu Signalling Connection.

<< Next modified section >>

{8.7.5 Packet Switched Mobile Terminating Location Request (PS-MT-LR)}

This signaling procedure is described in the R00 version of the LCS system stage 2 specification.

~~Figure 8.7 illustrates the general network positioning for LCS clients external to the PLMN for packet switched services. In this scenario, it is assumed that the target UE is identified using an MSISDN, PDP address or IMSI.~~



~~Figure 8.7: General Network Positioning for Packet Switched MT-LR~~

~~8.7.5.1 Location Preparation Procedure~~

~~(3)An external LCS client requests the current location of a target UE from a GMLC. The GMLC verifies the identity of the LCS client and its subscription to the LCS service requested and derives the PDP address, MSISDN or IMSI of the target UE to be located and the LCS QoS from either subscription data or data supplied by the LCS client. For a call related location request (VoIP), the GMLC obtains and authenticates the called party identity of the LCS. If location is required for more than one UE, or if periodic location is requested, steps 2 to 13 above may be repeated.~~

(4)If the GMLC already knows both the 3G-SGSN location and IMSI for the particular PDP address or MSISDN (e.g. from a previous location request), this step and step 3 may be skipped. Otherwise, the GMLC sends a MAP_SEND_ROUTING_INFO_FOR_LCS message to the home HLR of the target UE to be located with the IMSI, PDP address or MSISDN of this UE.

(5)The HLR verifies that the SCCP calling party address of the GMLC, corresponds to a known GSM/UMTS network element that is authorized to request UE location information. The HLR then returns the current SGSN and/or VMSC addresses, conceivably prioritizing one of the addresses to be used for positioning the UE and whichever of the IMSI or MSISDN was not provided in step (2) for the particular UE.

(6)In case the GMLC receives both SGSN and VMSC addresses it has to decide where to send the location request. In case 3G-SGSN is chosen then the GMLC sends a MAP_PROVIDE_SUBSCRIBER_LOCATION message to the 3G-SGSN indicated by the HLR. This message carries the type of location information requested (e.g. current location), 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 a call related (VoIP) location request, the message also carries the LCS client's called party identity. The message shall carry the identity of the LCS client.

(7)If the GMLC is located in another PLMN or another country, the 3G-SGSN first authenticates that a location request is allowed from this PLMN or from this country. If not, an error response is returned. The 3G-SGSN then verifies LCS barring restrictions in the UE user's subscription profile in the 3G-SGSN. In verifying the barring restrictions, barring of the whole location request is assumed if any part of it is barred or any requisite condition is not satisfied. If LCS is to be barred without notifying the target UE and a LCS client accessing a GMLC in the same country does not have the override capability, an error response is returned to the GMLC. Otherwise, the 3G-SGSN performs paging for location services. Paging is performed at the 3G-SGSN by sending a RANAP paging message indicating "Paging for LCS" to the RNC. The RNC converts the Paging message to a RRC Paging Request indicating paging for LCS.

(8)The UE may be paged for location services even in Ready Mode. This makes it possible for the UE to start preparing an anticipated location service coming later by e.g. starting to measure GPS signals.

(9) Upon receipt of a Packet Paging Request message indicating paging for LCS, the UE shall respond with a layer 3 LCS Paging Response. This message may include information about the location of the UE (e.g. recently calculated position with its age, if such is available).

(10)Security functions may be executed. These procedures are defined in [23.060].

(11)If the location request comes from a value added LCS client and the UE subscription profile indicates that the UE must either be notified or notified with privacy verification and the UE supports notification of LCS (according to the UE's capability information), an LCS Location Notification Invoke message is sent to the target UE indicating the type of location request (e.g. current location) and the identity of the LCS client and whether privacy verification is required. Optionally, the 3G-SGSN may after sending the LCS Location Notification Invoke message continue in parallel the location process, i.e. continue to step 9 without waiting for a LCS Location Notification Return Result message in step 8.] [This functionality needs to be further studied.]

(12)[The target UE notifies the UE user of the location request and, if privacy verification was requested, waits for the user to grant or withhold permission. The UE then returns an LCS Location Notification Return Result to the 3G-SGSN indicating, if privacy verification was requested, whether permission is granted or denied. Optionally, the LCS Location Notification Return Result message can be returned some time after step 7, but before step 12. If the UE user does not respond after a predetermined time period, the 3G-SGSN shall infer a "no response" condition. The 3G-SGSN shall return an error response to the GMLC if privacy verification was requested and either the UE user denies permission or there is no response with the UE subscription profile indicating barring of the location request.] *[This functionality needs to be further studied*].

(13)The 3G-SGSN sends a RANAP Location Reporting Control message to the SRNC. This message includes the type of location information requested, the UE's location capabilities, the requested QoS and any other location information received in paging response.

8.7.5.2 Positioning Measurement Establishment Procedure

(14) If the requested location information and the location accuracy within the QoS can be satisfied based on parameters received from the 3G-SGSN and the parameters obtained by the SRNC e.g. cell coverage and timing information (i.e. RTT or TA), the SRNC may send a RANAP Location Report immediately. Otherwise, the SRNC determines the positioning method and instigates the particular message sequence for this method in UTRAN Stage 2 [1]. If the position method returns position measurements, the SRNC uses them to compute a location estimate. If there has been a failure to obtain position measurements, the SRNC may use the current cell information and, if available, TA or RTT value to derive an approximate location estimate. If an already computed location estimate is returned for an UE based position method, the SRNC may verify consistency with the current cell and, if available, RTT oar TA value. If the location estimate so obtained does not satisfy the requested accuracy and sufficient response time still remains, the SRNC may instigate a further location attempt using the same or a different position method. If a vertical location co-ordinate is requested but the SRNC can only obtain horizontal co-ordinates, these may be returned.

In case IPDL is used the SRNC may send a message to Node B to configure the power cease period of the Node Bs involved in the positioning process. However, if the IPDL alignment is specified in lower layers e.g. layer 1 then the functional split of IPDL processing may be partly included in the network element functionality.

8.7.5.3 Location Calculation and Release Procedure

(15) When location information best satisfying the requested location type and QoS has been obtained, the SRNC returns it to the 3G-SGSN in a RANAP Location Report message. If a location estimate could not be obtained, the SRNC returns a Location Report message containing a failure cause and no location estimate.

(16) The 3G-SGSN returns the location information and its age to the GMLC, if the 3G-SGSN has not initiated the Privacy Verification process in step 7. If step 7 has been performed for privacy verification, the 3G-SGSN returns the location information only, if it has received a LCS Location Notification Return Result indicating that permission is granted. If a LCS Location Notification Return Result message indicating that permission is not granted is received, or there is no response, with the UE subscription profile indicating barring of location, the 3G-SGSN shall return an error response to the GMLC. If the 3G-SGSN did not return a successful location estimate, but the privacy checks were successfully executed, the 3G-SGSN may return the last known location of the target UE if this is known and the LCS client is requesting the current or last known location. The 3G-SGSN may record billing information.

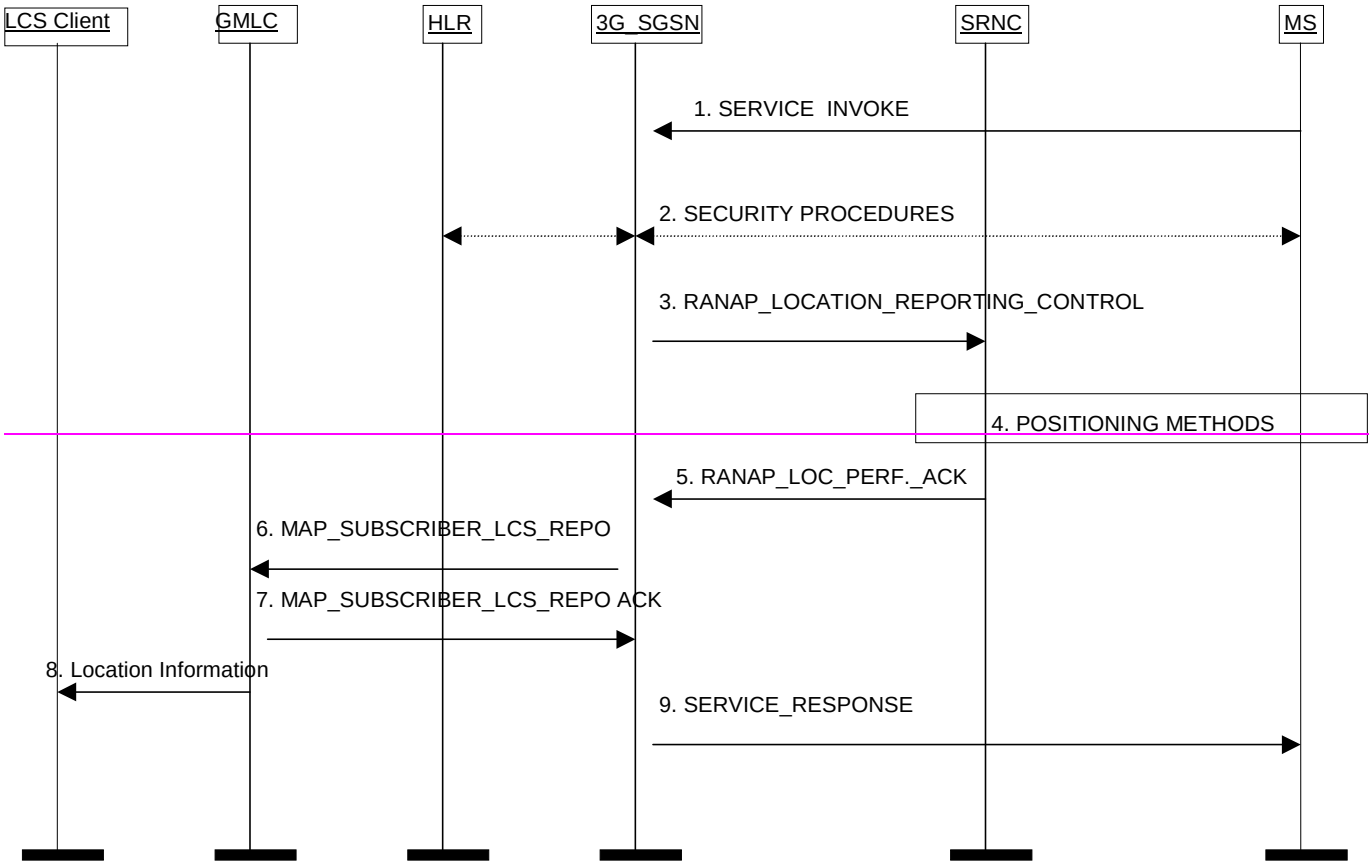
(17) The GMLC returns the UE location information to the requesting LCS client. If the LCS client requires it, the GMLC may first transform the universal location co-ordinates provided by the 3G-SGSN into some local geographic system. The GMLC may record billing for both the LCS client and inter-network revenue charges from the 3G-SGSN's network.

<< Next modified section >>

{8.8.2 Mobile Originating Location Request, Packet Switched (PS-MO-LR)}

This signaling procedure is described in the R00 version of the LCS system stage 2 specification.

~~The following procedure shown in Figure 8.9 allows an UE to request either its own location; location assistance data or broadcast assistance data message ciphering keys from the network. Location assistance data may be used subsequently by the UE to compute its own location throughout an extended interval using a mobile based position method. A ciphering key enables the UE to decipher other location assistance data broadcast periodically by the network. The MO-LR may be used to request ciphering keys or GPS assistance data. The procedure may also be used to enable an UE to request that its own location be sent to another LCS client.~~



~~Figure 8.9: General Network Positioning for packet switched MO-LR~~

~~8.8.2.1 Location Preparation Procedure~~

~~(1)The mobile station originated location request in packet mode starts at the mobile station by sending a SERVICE INVOKE message to the 3G-SGSN. Different types of location services can be requested: location of the UE, location of the UE to be sent to another LCS client, location assistance data or ciphering keys. If the UE is requesting its own location or that its own location be sent to another LCS client, this message carries LCS requested QoS information (e.g. accuracy, response time). If the UE is requesting that its location be sent to another LCS client, the message shall include the identity of the LCS client and may include the address of the GMLC through which the LCS client should be accessed. If a GMLC address is not included, the 3G-SGSN may assign its own GMLC address and may verify that the identified LCS client is supported by this GMLC. If a GMLC address is not available for this case, the 3G-SGSN shall reject the location request. If the UE is instead requesting location assistance data or ciphering keys, the message specifies the type of assistance data or deciphering keys and the positioning method for which the assistance data or ciphering applies. The 3G-SGSN verifies the subscription profile of the UE and decides if the requested service is allowed or not.~~

~~(2)Security functions may be executed. These procedures are described in [23.060].~~

(3)The 3G-SGSN sends a RANAP-Perform-Location message to the SRNC associated with the Target UE's location. The RANAP message indicates whether a location estimate or location assistance data is requested and includes the UE's location capabilities. If the UE's location is requested, the message also includes the requested QoS. If location assistance data is requested, the message carries the requested types of location assistance data. The message carries also location parameters received in the Service Invoke message.

8.8.2.2 Positioning Measurement Establishment Procedure

(4)If the UE is requesting its own location, the actions described under [to be defined] performed. If the UE is instead requesting location assistance data, the SRNC transfers this data to the UE as described in subsequent sections. The SRNC determines the exact location assistance data to transfer according to the type of data specified by the UE, the UE location capabilities and the current cell.

8.8.2.3 Location Calculation and Release Procedure

(5)When a location estimate best satisfying the requested QoS has been obtained or when the requested location assistance data has been transferred to the UE, the SRNC returns a RANAP Location Report to the 3G-SGSN. This message carries the location estimate or ciphering keys if this was obtained. If a location estimate or deciphering keys were not successfully obtained or if the requested location assistance data could not be transferred successfully to the UE, a failure cause is included in the Location Report.

(6)If the UE requested transfer of its location to another LCS client and a location estimate was successfully obtained, the 3G-SGSN shall send a MAP Subscriber Location Report to the GMLC obtained in step 1 carrying the MSISDN or PDP address of the UE, the identity of the LCS client, the event causing the location estimate (MO-LR-PS) and the location estimate and its age.

(7)The GMLC shall acknowledge receipt of the location estimate provided that it serves the identified LCS client and the client is accessible.

(8)The GMLC transfers the location information to the LCS client either immediately or upon request from the client.

(9)The 3G-SGSN returns a Service Response message to the UE carrying any location estimate requested by the UE, ciphering keys or a confirmation that a location estimate was successfully transferred to the GMLC serving an LCS client.

<< one added section >>

{9.4 3G-SGSN}

{The 3G-SGSN contains the same LCS permanent data for each registered UE subscriber, as does the HLR. This data is downloaded to the 3G-SGSN as part of the location update procedure between the 3G-SGSN and HLR for an UE subscriber.}