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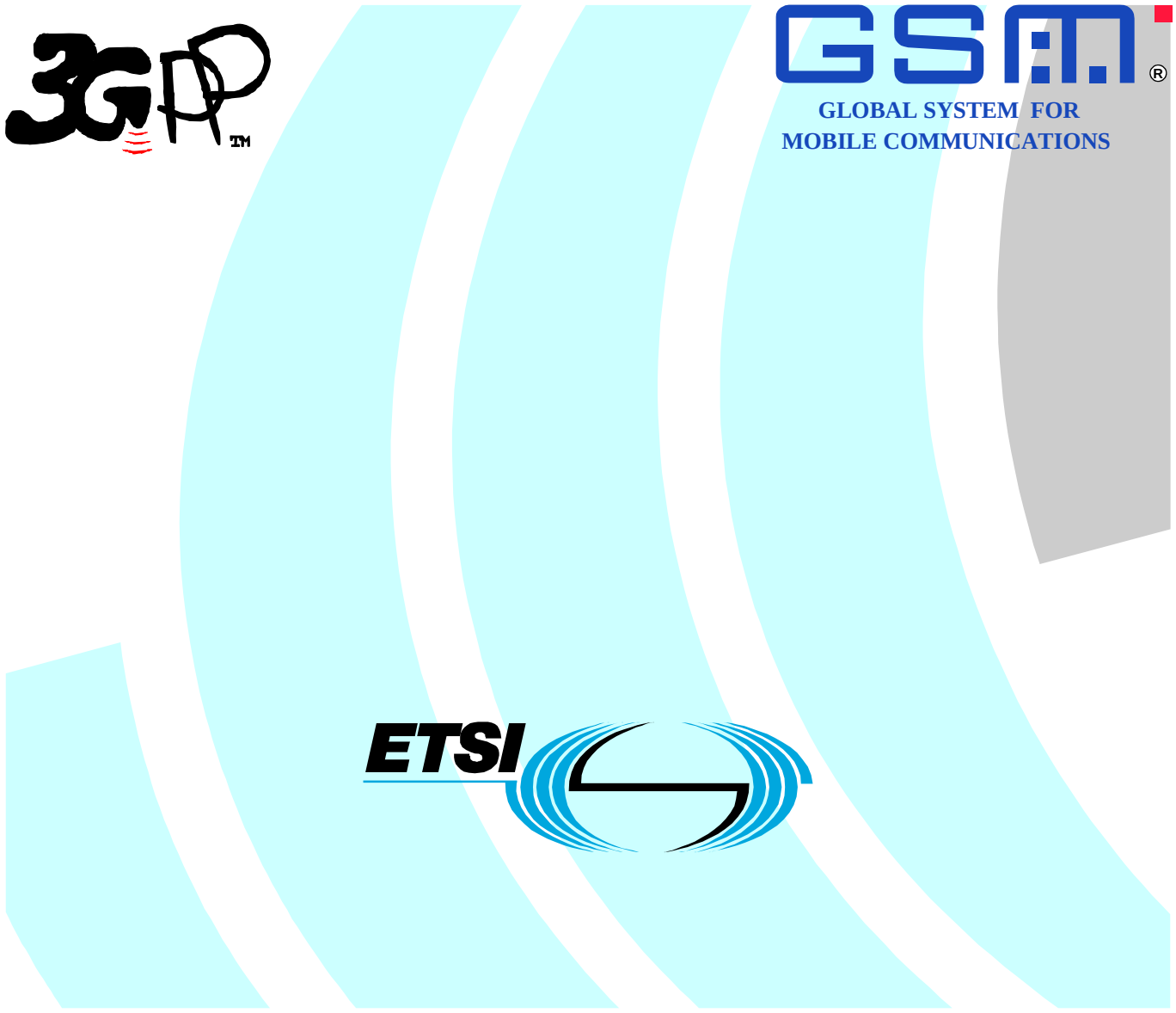

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ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

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

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

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

The present document may refer to technical specifications or reports using their 3GPP identities, UMTS identities or GSM identities. These should be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between GSM, UMTS, 3GPP and ETSI identities can be found under http://webapp.etsi.org/key/queryform.asp .

Contents

Foreword

This Technical Specification has been produced by the 3GPP.

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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1 Scope

The present document provides the Stage One description of Location Services (LCS) networks. A Stage One description provides an overall service description, primarily from the service subscriber's and user's points of view, but not dealing with the details of the Man Machine Interface (MMI). This TS includes information applicable to network operators, service providers and terminal, base station system, switch and data base manufacturers.

NOTE: Location Services may be considered as a network provided enabling technology consisting of standardized service capabilities which enables the provision of location applications. This application may be service provider specific. The description of the numerous and varied possible location applications which are enabled by this technology are outside the scope of this specification. However, clarifying examples of how the functionality being specified may be used to provide specific location services is included in various sections of the specification.

The present document contains the core requirements for the LCS to an extent sufficient to derive a complete definition of the LCS at the service level. However, the present document also documents some additional requirements which may suggest in a non-normative manner certain ways the system may be implemented to support the LCS feature.

LCS can be offered without subscription to basic telecommunication services. LCS is available to the following categories of LCS clients:

Value Added Services LCS Clients – use LCS to support various value added services. These clients can include MS subscribers as well as non-subscribers to other services.

PLMN Operator LCS Clients – use LCS to enhance or support certain O&M related tasks, supplementary services, IN related services and bearer services and teleservices.

Emergency Services LCS Clients – use LCS to enhance support for emergency calls from subscribers.

Lawful Intercept LCS Clients – use LCS to support various legally required or sanctioned services.

LCS is applicable to any target MS whether or not the MS supports LCS, but with restrictions on choice of positioning method or notification of a location request to the MS user when LCS or individual positioning methods, respectively, are not supported by the MS.

LCS will be developed in phases. Phase 1 includes provision of the following:

LCS Phase 1. This is the initial default phase of LCS. It provides a generic flexible architecture capable of supporting all positioning methods. Specific support is provided for Time Of Arrival (TOA), Enhanced Observed Time Difference (E-OTD) and Global Positioning System (GPS) based positioning methods. Support is provided for emergency services, value added services and PLMN operator services.

Chapter 9 specifies requirements for further LCS phases.

2. References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

2.1 Normative references

[1] GSM 01.04: "Digital cellular telecommunication system (Phase 2+); Abbreviations and acronyms".

[2] 3GPP TR 21.905: “Vocabulary for 3GPP Specifications”.

[3] 3GPP TS 23.032: "Universal Geographical Area Description"

[4] 3GPP TS 22.101: "Service principles"

[5] 3GPP TS 22.105: "Services and Service Capabilities"

[6] 3GPP TS 22.115: "Charging and Billing"

[7] 3GPP TS 22.121: "Virtual Home Environment"

[8] 3GPP TS 23.110: " UMTS Access Stratum; Services and Functions"

2.2 Informative references

[9] 3GPP TR 25.923: "Report on Location Services (LCS)"

[10] PD 30.lcs: "Project Plan for location services in UMTS"

[11] Third generation (3G) mobile communication system; Technical study report on the location services and technologies, ARIB ST9 December 1998.

[12] The North American Interest Group of the GSM MoU ASSOCIATION: Location Based Services, Service Requirements Document of the Services Working Group

3 Definitions and abbreviations

3.1 Abbreviations

For the purposes of the present document, in addition to GSM 01.04 [1] and TR 21.905, the following abbreviations apply:

LCS	Location Service
NA-ESRD	North American Emergency Services Routing Digits
NA-ESRK	North American Emergency Services Routing Key
NANP	North American Numbering Plan

NOTE: In the present document, acronyms are used in the text as if they are read either in their fully expanded form or in their alphabet names with no consistent principle.

3.2 Definitions

For the purposes of the present document the following definitions apply:

Current Location: after a location attempt has successfully delivered a location estimate and its associated time stamp, the location estimate and time stamp is referred to as the 'current location' at that point in time.

Deferred location request: a location request where the location response (responses) is (are) not required immediately.

Immediate location request: a location request where a single location response only is required immediately.

Initial Location: in the context of an originating emergency call the location estimate and the associated time stamp at the commencement of the call set-up is referred to as 'initial location'.

Last Known Location: The current location estimate and its associated time stamp for Target MS stored in the LCS Server is referred to as the 'last known location' and until replaced by a later location estimate and a new time stamp is referred to as the 'last known location'.

LCS Client: a software and/or hardware entity that interacts with a LCS Server for the purpose of obtaining location information for one or more Mobile Stations. LCS Clients subscribe to LCS in order to obtain location information. LCS Clients may or may not interact with human users. The LCS Client is responsible for formatting and presenting data and managing the user interface (dialogue).

NOTE: The LCS Client may reside inside or outside the PLMN.

LCS Client Access barring list: an optional list of MSISDNs per LCS Client where the LCS Client is not allowed to locate any MSISDN therein.

LCS Client Subscription Profile: a collection of subscription attributes of LCS related parameters that have been agreed for a contractual period of time between the LCS client and the service provider.

LCS Feature: the capability of a PLMN to support LCS Client/server interactions for locating Target MSs.

LCS Server: a software and/or hardware entity offering LCS capabilities. The LCS Server accepts requests, services requests, and sends back responses to the received requests. The LCS server consists of LCS components which are distributed to one or more PLMN and/or service provider.

Location Estimate: the geographic location of an MS and/or a valid Mobile Equipment (ME), expressed in latitude and longitude data. The Location Estimate shall be represented in a well-defined universal format. Translation from this universal format to another geographic location system may be supported, although the details are considered outside the scope of the primitive services.

North American Emergency Services Routing Digits (NA-ESRD): a telephone number in the North American Numbering Plan (NANP) that can be used to identify a North American emergency services provider and its associated LCS client. The ESRD also identifies the base station, cell site or sector from which a North American emergency call originates.

North American Emergency Services Routing Key (NA-ESRK): a telephone number in the North American Numbering Plan (NANP) assigned to an emergency services call by a North American VPLMN for the duration of the call. The NA-ESRK is used to identify (e.g. route to) both the emergency services provider and the switch in the VPLMN currently serving the emergency caller. During the lifetime of an emergency services call, the NA-ESRK also identifies the calling mobile subscriber.

PLMN Access barring list: an optional list of MSISDN per PLMN where any LCS Client is not allowed to locate any MSISDN therein except for certain exceptional cases.

Privacy Class: list of LCS Clients defined within a privacy exception class to which permission may be granted to locate the target MS. The permission shall be granted either on activation by the target MS or permanently for a contractual period of time agreed between the target MS and the service provider.

Privacy Exception List: a list consisting of various types of privacy classes (i.e. operator related, personal etc.). Certain types of classes may require agreement between the service provider and the target MS.**Target MS:** The MS being positioned.

Target MS Subscription Profile: the profile detailing the subscription to various types of privacy classes.

4 Functional Requirements

3GPP standards shall support location service features, to allow new and innovative location based services to be developed. It shall be possible to identify and report in a standard format (e.g. geographical co-ordinates) the current location of the user's terminal and to make the information available to the user, ME, network operator, service provider, value added service providers and for PLMN internal operations.

The location identification is provided to identify the likely location of specific MEs. This is meant to be used for charging, location-based services, lawful interception, emergency calls, etc., as well as the positioning services.

The standard shall support both GSM BSS and UTRAN to facilitate determination of the location of a mobile station.

NOTE: UTRAN will include support for LCS at Rel 1999, however full system support for LCS with UTRAN will be a part of release 2000.

4.1 Location Information

4.1.1 Geographic Location

Provision of the geographic location of a target MS is applicable to all LCS services.

Support may optionally be provided to enable the routing of emergency calls based on the geographic coordinates (latitude and longitude) of the calling party.

4.2 Quality of Service

4.2.1 Horizontal Accuracy

For Value Added Services and PLMN Operator Services, the following is applicable:

Accuracy is application driven and is one of the negotiable Quality of Service (QoS) parameters.

The precision of the location shall be network design dependent, i.e., should be an operator's choice. This precision requirement may vary from one part of a network to another.

The LCS shall allow an LCS Client to specify or negotiate the required horizontal accuracy. The LCS shall normally attempt to satisfy or approach as closely as possible the requested or negotiated accuracy when other quality of service parameters are not in conflict.

The required location accuracy varies from 10m up to 1km, depending on applications. The location determining process may be able to combine several techniques to accommodate local conditions and evolving technology. The accuracy provided as a result of a given positioning attempt may vary depending on dynamically changing radio conditions and other factors.

For Emergency Services (where required by local regulatory requirements) the following requirements shall be met:

- The LCS Server shall attempt to obtain the horizontal location of the calling MS, in terms of universal latitude and longitude coordinates, and shall provide this to an Emergency Service Provider. The accuracy shall be defined by local regulatory requirements. Annex A shows such requirements as exist in the United States.

NOTE: The LCS Server provides the location service capabilities but the mechanism by which location is reported to an emergency service provider is outside the scope of this service.

4.2.2 Vertical Accuracy

For Value Added Services, and PLMN Operator Services, the following is applicable:

The LCS Server may provide the vertical location of an MS in terms of either absolute height/depth or relative height/depth to local ground level. The LCS Server shall allow a LCS Client to specify or negotiate the required vertical accuracy. The LCS Server shall normally attempt to satisfy or approach as closely as possible the requested or negotiated accuracy when other quality of service parameters are not in conflict.

The vertical accuracy may range from a about ten metres (e.g. to resolve within 1 floor of a building) to hundreds of metres.

For Emergency Services (where required by local regulatory requirements) there is no requirement for the support of vertical positioning.

4.2.3 Response Time

For Value Added Services, and PLMN Operator Services, the following is applicable:

Response Time is one of the negotiable QoS parameters. Support of response time by a Public Land Mobile Network (PLMN) is optional. The LCS Server may allow a LCS Client to specify or negotiate the required response time (in the context of immediate location request, see table 1) either at provisioning or when the request is made. The LCS Server may optionally ignore any response time specified by the LCS Client that was not negotiated. If response time is not ignored, the LCS Server shall attempt to satisfy or approach it as closely as possible when other quality of service parameters are not in conflict.

For immediate location request response time options are as follows::

a) “no delay”: the LCS Server shall return either Initial or Last Known Location of the Target MS. If no estimate is available, the LCS Server shall return the failure indication and may initiate procedures to obtain a location estimate (e.g. to be available for a later request).

b) “low delay”: the LCS Server shall return the Current Location with minimum delay. The LCS shall attempt to fulfill any accuracy requirement, but in doing so shall not add any additional delay.

c) “delay tolerant”: the LCS Server shall obtain a Current Location with regard to fulfilling the accuracy requirement.

For Emergency Services (where required by local regulatory requirements) there may be no requirement to support negotiation of response time. The network shall then provide a response as quickly as possible with minimum delay. Response time supervision is implementation dependent.

4.3 Priority

For Value Added Services, and PLMN Operator Services, the following is applicable:

The LCS Server may allow different location requests to be assigned different levels of priority. A location request with a higher priority may be accorded faster access to resources than one with a lower priority and may receive a faster, more reliable and/or more accurate location estimate.

For Emergency Services (where required by local regulatory requirements) the location request shall be processed with the highest priority level.

4.4 Timestamp

For Value Added Services, and PLMN Operator Services, and Emergency Services (where required by local regulatory requirements), the LCS Server shall timestamp all location estimates provided to a LCS Client indicating the time at which the estimate was obtained.

4.5 Security

The LCS Client may be authorized by the LCS Server. Existing security mechanisms as well as security mechanisms of the LCS Server shall be used for authorizing the LCS Client and its request for location information.

For Value Added Services, the following is applicable:

Only authorized LCS Clients shall be able to access the LCS Server. Before providing the location of a Target MS to any authorized LCS Client, the LCS Server shall verify both the identity and authorization privileges of the LCS Client .

Once the LCS Server has verified that a particular LCS Client is authorized to locate a particular Target MS, any location estimate requested shall be provided to the LCS Client in a secure and reliable manner, such that the location information is neither lost, corrupted nor made available to any unauthorized third party.

For PLMN operator services, location information shall be provided in a secure and reliable manner. The ability to obtain location information shall depend on local regulatory laws and requirements in conjunction with requirements for MS privacy.

For Emergency Services (where required by local regulatory requirements) the following requirements shall be met:

Position information shall be provided to the Emergency Services Network as an authorized LCS client. Target MS authorization checks normally performed for value added services are not applicable (privacy is over-ridden). The position information shall be provided to the Emergency Services Network in a secure and reliable manner, such that the location information is neither lost, corrupted, nor made available to any unauthorized third party.

4.6 Privacy

Unless required by local regulatory requirements, or overridden by the target MS User, the target MS may be positioned only if allowed in the MS subscription profile.

For Value Added Services, the following is applicable:

The Target MS Subscriber shall be able to restrict access to the location information (permanently or on a per attempt basis). The LCS Client access shall be restricted unless otherwise stated in the Target MS Subscription Profile. The home network shall have the capability of defining the default circumstances in which the Target MS's location is allowed to be provided - as required by various administrations and/or network requirements.

If indicated in the subscription profile, where a target MS supports the LCS, the target MS user shall be notified of each location request for which there is no restriction in the MS subscription profile and be enabled to accept or reject it. The default treatment, in the absence of an indication from the MS user, is to accept.

The target MS subscriber may also subscribe to notification for each location request that is restricted in the MS subscription profile and be enabled to accept or reject it – the default treatment in the absence of an indication from the MS user being to reject. Where a target MS does not support LCS, a location request for which there is no restriction in the MS subscription profile shall be denied where required by local regulatory requirements and allowed otherwise. In the latter case, the LCS server may maintain a record of each location request including the result and the identity of the LCS client.

For PLMN operator services, the target MS subscriber may be able to restrict access to location information used to enhance or support particular types of service. The LCS client access shall be restricted unless stated otherwise in the Target MS subscription profile. The target MS user shall not be notified of any authorized location attempt.

For Emergency Services (where required by local regulatory requirements) Target MSs making an emergency call may be positioned regardless of the privacy attribute value of the subscriber associated with the Target MS (or ME) making the call.

For Lawful Interception Services (where required by local regulatory requirements), target MSs may be positioned under all circumstances required by local regulatory requirements. The target MS user shall not be notified of any location attempt.

4.7 Roaming Target MS

For Value Added Services, the following is applicable:

Provided that a roaming agreement exists, the LCS feature shall allow any properly authorized LCS client to request and receive the location of a particular Target MS when the Target MS is either located in its Home PLMN (HPLMN) or Visited PLMN (VPLMN). The LCS client shall be authorised by the HPLMN of the subscriber whose MS is the target of the location attempt. Any PLMN not supporting the LCS feature shall return a suitable error response to any

other PLMN from which an LCS request is received: the requesting PLMN shall then infer that the LCS feature is not supported and provide a suitable error response in turn to the requesting LCS Client.

For PLMN Operator Services, location of any roaming target MS shall be supported in the VPLMN as allowed by both local regulatory requirements and considerations, where applicable, of MS privacy.

For Emergency Services (where required by local regulatory requirements) the Serving PLMN shall support the positioning of all Target MSs including roaming Target MSs currently serviced by that serving PLMN. There is no requirement for a HPLMN to position the Target MSs that have roamed outside the HPLMN.

4.8 Support for all MSs

For value added services, and PLMN operator services, the LCS feature may be supported for all MSs.

For Emergency Services (where required by local regulatory requirements), positioning shall be supported for all MSs (i.e. including legacy MSs) where coverage is provided, and also MSs without a SIM.

4.9 Support for Unauthorized MSs

For value added services, support of unauthorized MSs may be provided by the PLMN.

For PLMN operator services, positioning of unauthorized MSs may be provided by the PLMN as required by local regulatory requirements.

For Emergency Services (where required by local regulatory requirements), the PLMN shall support positioning for unauthorized MSs (i.e. including stolen MSs and MSs without a SIM).

NOTE: A GSM subscriber is in general identified as an MS containing in it the SIM associated with the subscriber. In some exceptional cases (e.g., an E-911 call), an MS without a valid GSM subscription recognized in the PLMN can become a Target MS. In such a case, the subscriber may be identified by the identity associated with the Mobile Equipment (ME) involved in the call.

4.10 Periodic Location Reporting

Periodic location reporting is the act of LCS Server initiating multiple position locations spread over a period of time.

For value added services, and PLMN operator services, support of periodic location reporting may be provided by the PLMN.

For Emergency Services (where required by local regulatory requirements), there is no requirement for the PLMN to support periodic location reporting.

4.11 MS-Based Location Calculation

MS-Based Location Calculation may be supported on either a per-request basis or autonomously whereby a single request from an MS subscriber enables MS based location calculation over an extended period without further interaction with the PLMN.

For Commercial Services, the following may be applicable for autonomous location:

The network may broadcast location assistance information to mobiles, which enables mobiles to calculate their own location. The network may encrypt the location assistance information. If the location assistance information is encrypted, a single common standardized encryption algorithm shall be used.

The location assistance information may be available to the MS at all times, continuously in idle mode and during a call, without additional point to point signalling. The network may request location information from the MS for operator or for service provider applications. For this purpose a point to point signalling connection must be established.

4.12 MS_Assisted LCS Location Calculation

The MS-Assisted Location Calculation is accomplished by network resources based upon radio ranging measurements provided by the MS.

For Commercial Services, the following may be applicable for MS-Assisted location services:

The network may broadcast assistance information to mobiles, which enables mobiles to obtain the appropriate radio ranging measurements. The network may encrypt the assistance information. If the assistance information is encrypted, a single common standardized encryption algorithm shall be used.

The assistance information may be available to the MS at all times, continuously in idle mode and during a call, without additional point to point signalling. The network may request radio ranging measurement data from the MS for operator or for service provider applications. For this purpose a point to point signalling connection must be established. Optionally, this point to point connection can be used to deliver the resulting location to the MS.

4.13 Mobile Originating Location

Mobile Originating Location is the capability of the mobile station to obtain its own geographical location or have its own geographic location transferred to another LCS client.

For Value Added Services, the following may be applicable:

There are three classes of mobile originating location:

A) Basic Self Location - The mobile station needs to interact with the network for each separate location request

B) Autonomous Self Location - The mobile station does not need to interact with the network for each separate location request. One interaction with the network enables the mobile station to obtain multiple location positionings over a predetermined period of time.

C) Transfer to Third Party – The location of the mobile station is transferred by request of the mobile station to another specified LCS client.

5 Logical Description

5.1 Logical Reference Model

Figure 1 shows the logical reference model for LCS whereby an LCS Client is enabled to request location information for one or more certain target MSs from the LCS Server supported by a PLMN. The LCS Server employs a positioning function to obtain the location information and furnish the information to the LCS Client. The particular requirements and characteristics of an LCS Client are made known to the LCS Server by its LCS Client Subscription Profile. The particular LCS-related restrictions associated with each Target MS are detailed in the Target MS Subscription Profile. The LCS feature shall allow a Target MS to be positioned within a specified Quality of Service. The LCS feature shall allow the location of a Target MS to be determined at any time whilst the MS is attached.

The LCS feature shall support conveyance of both the location Quality of Service (QoS) requirements of the LCS Client and the location information returned to the LCS Client in a universal standard format.

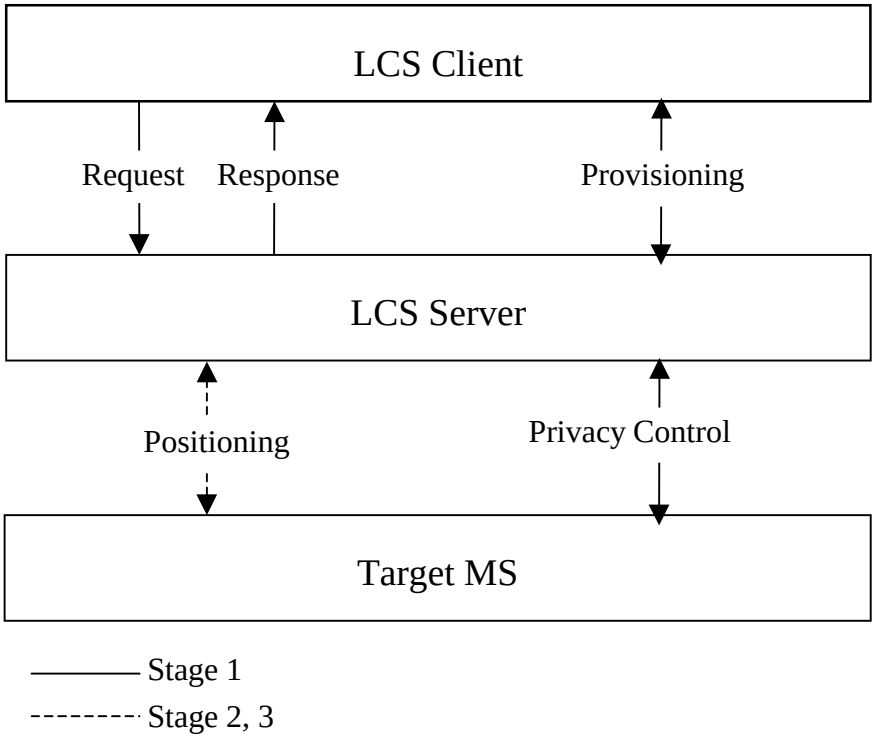

Figure 1. LCS Logical Reference Model

5.2 Functional Entities

5.2.1 LCS Client

An LCS Client is a logical functional entity that makes a request to the PLMN LCS server for the location information of one or more than one target MSs within a specified set of parameters such as QoS. The LCS Client may reside in an entity (including an MS) within the PLMN or in an entity external to the PLMN. The specification of the LCS Client's internal logic and its relationship to any external user is outside the scope of this document.

5.2.2 LCS Server

An LCS server consists of a number of location service components and bearers needed to serve the LCS clients. The LCS server shall provide a platform which will enable the support of location based services in parallel to other telecommunication services such as speech, data, messaging, other teleservices, user applications and supplementary services and therefore enable the market for services to be determined by users and service providers. The LCS server may respond to a location request from a properly authorized LCS client with location information for the target MSs specified by the LCS client if considerations of target MS privacy are satisfied. The LCS server may enable an LCS client to determine the services provided to it by the LCS server through a process of provisioning.

5.2.3 Positioning Function

Positioning is the basic function that performs the actual positioning of a specific target MS. The input to this function is a positioning request from a LCS Client with a set of parameters such as QoS requirements. The end results of this function are the location information for the positioned target MS.

5.2.4 Target MS

The Target MS is the object to be positioned by the LCS Server. For network based positioning methods, no support for LCS is required by the target MS. For mobile assisted and mobile based positioning methods, the target MS actively supports LCS. For all positioning methods, the ability to control privacy may be required to be given to the MS user for

each location request and/or to the MS subscriber through subscription to satisfy local regulatory requirements (see the previous section on Privacy).

5.3 Functional Interfaces

5.3.1 LCS Client / LCS Server Interface

The LCS client/server use LCS messages to exchange information. Each LCS message contains a set of parameters.

In the case of MS Based positioning methods, if the LCS Client is located in the MS, then an internal LCS Client /LCS Server interface may be supported.

NOTE: Further regional/national specific interfaces between LCS clients and servers may need to be supported in addition to the interfaces described here.

5.3.2.1 Location Service Request

Using the Location Service Request, an LCS client communicates with the LCS server to request the location information for one or more target MSs within a specified set of quality of service parameters.

As shown in Table 1, a location service may be specified as immediate or deferred.

Table 1: Location Service Requests

Request Type	Response Time	Number of Responses
Immediate	Immediate	Single
Deferred	Delayed (event driven)	One or More

For Emergency Services, LCS shall support requests for the initial, the current (updated), or the last known position of an ME while a voice connection is established.

5.3.2.2 Location Service Response

The Location Service Response provides the result of an immediate Location Service Request from the LCS Server to the LCS Client.

A LCS response is either '*immediate'* or '*deferred'*. The LCS Request indicates the type of response the LCS Client wishes to receive. The two types of location response are described in table 2.

Table 2: Types of LCS Response

Response	Description
Immediate	A Location Response is referred to as 'immediate ', when a response to a request for location information is answered immediately (within a set time). The response shall be single and not dependent to any event.
Deferred	A Location Response is referred to as 'deferred', when a response to a request for location information is returned after the occurrence of an event specified by the LCS client. The response can be single or periodic.

5.3.2.3 Location Service Request Report

The Location Service Request Report provides the result of a deferred Location Service Request from the LCS Server to the LCS Client. The report is provided using a dialog between the LCS Client and the LCS Server that is initiated by the LCS Server.

5.4 Location information

5.4.1 Sources of location information

It shall be possible for the location determining process to make use of several sources of information in determining the location. Propagation and deployment conditions may limit the number or quality of measurements or additional measurements may be possible. Some ME may also have additional (independent) sources of position information. The LCS shall be capable of making use of the restricted or the extra information as appropriate for the service being requested.

6 Service Provision

6.1 Identification of a Target MS

For value added services, the following is applicable:

The LCS client shall identify a target MS using the MSISDN.

For PLMN operator services, the LCS client may identify a target MS using any of the following:

MISISDN

IMSI

An identifier internal to the PLMN

For emergency services (where required by local regulatory requirements), the LCS client may identify a target MS using any one of the following:

MSISDN

IMSI

NA-ESRK + (optionally) IMEI

6.2 Location Information Provided to the LCS Client

For value added services, the following is applicable:

The LCS Server shall provide, on request, the current or most recent geographic location (if available) of the Target MS or, if location fails, an error indication plus optional reason for the failure.

For PLMN operator services (where allowed by local regulatory requirements and restrictions on MS privacy), location related information for a particular target MS may be provided to a PLMN operator LCS client either on request or on the occurrence of an event in the LCS server that has been defined to equate to such a request.

For emergency services (where required by local regulatory requirements), location related information may be provided to an emergency services LCS Client either without any request from the client at certain points in an emergency services call (e.g. following receipt of the emergency call request, when the call is answered, when the call is released) or following an explicit request from the client. The former type of provision is referred to as a “push” while the latter is known as a “pull”. In the case of a “pull”, the emergency service LCS Client shall identify the Target MS as defined in section 6.1. Table 3 shows the information that may be provided to the client for either a “push” or a “pull”.

Table 3: Location related information provided to an emergency services LCS Client

Type of Access	Information Items
Push	Current Geographic Location (if available) MSISDN IMSI IMEI NA-ESRK NA-ESRD State of emergency call – unanswered, answered, released (note 1)
Pull	Geographic location (note 2), either: Current location initial location at start of emergency call

NOTE 1: indication of call release means that any NA-ESRK will no longer identify the calling MS subscriber

NOTE 2: which type of location is required will be indicated by the LCS Client

6.3 LCS Client Subscription

It shall be possible for an LCS Client to subscribe to the LCS feature for third-party location with or without subscription to other services. A LCS Client may subscribe to one or more service providers' LCS feature in one or more PLMNs. The LCS Client Subscription Profile of a client may contain the range of QoS and subscriptions that the LCS Client is allowed to request.

For certain authorized LCS Clients internal to the PLMN, a subscription profile may be unnecessary. For these LCS Clients subscription to LCS feature is given implicitly as a result of subscription to an authorized PLMN service (e.g. supplementary services). These LCS Clients are empowered to access the LCS Server and request location information for a Target MS.

For emergency services, the subscription requirements to the LCS feature may not be needed.

6.4 Target MS Subscription

6.4.1 Privacy Subscription Options

It shall be possible for a Target MS Subscriber to subscribe to various types of privacy classes. The default treatment in the absence of the information to the contrary in the Target MS Subscription Profile shall be to assume that access is restricted to all LCS Clients (unless using privacy overriding, or otherwise overridden by local regulatory requirements).

Privacy Attributes consist of:

Privacy Exception List: determines which LCS Clients and classes of LCS Clients may position a Target MS;

Privacy Override Indicator: determines applicability of the Privacy Exception List.

6.4.2 Privacy Exception List

To support privacy , the LCS Server shall enable each Target MS Subscriber to subscribe to a "privacy exception list" containing the LCS Client identifiers and classes of LCS Clients to which the MS's location may be provided. An empty privacy exception list shall signify an intent to withhold location from all LCS Clients. The classes that can be included are as follows.

- Universal Class: location services may be provided to all LCS Clients;
- Call-related Class: location services may be provided to any value added LCS client that currently has a temporary association with the Target MS in the form of an established voice or data call originated by the Target MS;

- Call-unrelated Class – location services may be provided to a particular value added LCS Client or particular group of value added LCS Clients – where each LCS Client or group of LCS Clients is identified by a unique international, e.g. E.164, number. For each identified LCS Client or group of LCS Clients, one of the following geographical restrictions shall apply:

    a) Location request allowed from an LCS Client served by identified PLMN only;

    b) Location request allowed from an LCS Client served in the home country only;

    c) Location request allowed from any LCS Client;

PLMN Operator Class – location services may be provided by particular types of LCS clients supported within the HPLMN or VPLMN. The following types of clients are distinguished (see note):

- Clients broadcasting location related information to the MSs in a particular geographic area – e.g. on weather, traffic, hotels, restaurants;

a) O&M client (e.g. an Operations System) in the HPLMN

b) O&M client (e.g. an Operations System) in the VPLMN

c) Clients recording anonymous location information (i.e. without any MS identifiers) – e.g. for traffic engineering and statistical purposes

d) Clients enhancing or supporting any supplementary service, IN service, bearer service or teleservice subscribed to by the target MS subscriber.

NOTE: The definitions of the various PLMN operator categories may be supplemented by more precise language in contractual agreements both between MS subscribers and their home service providers and between individual network operators with inter-PLMN roaming agreements. Such classification of the PLMN operator categories is outside the scope of this specification.

6.4.3 Privacy Override Indicator

The privacy override indicator is applicable to lawful intercept and emergency services as allowed by local regulatory requirements. It is not applicable to value added and PLMN operator services. The Privacy Override Indicator shall be used to determine whether Subscriber Privacy of the Target MS subscriber should be overridden or not. This indicator will be set for certain special LCS Clients when it is justified. Each LCS Client shall be associated with a particular value of a position privacy override indicator during the LCS Client provisioning. The privacy override indicator is only valid when the LCS Server for the LCS client is located in the same country of the Target MS.

6.4.4 Subscription to Mobile Originating Location

The MS subscriber may subscribe to the following types of Mobile Originating Location (as defined in section 4):

A) Basic Self Location

B) Autonomous Self Location

C) Transfer to Third Party

6.5 Security

The LCS Server may authorize the LCS Client. There may be security mechanisms to authorize the LCS Client's request for locating a Target MS based on:

LCS Client access barring list(s)

PLMN/SP access barring list.

Point of origin of a location request.

6.6 Charging

The LCS Server shall enable a PLMN to charge LCS Clients for the LCS features that the PLMN provides. . The information that the operator uses to generate a bill to an LCS Client is operator or service provider specific. The charging information may be collected both for the LCS Client and to for inter-network revenue sharing.

7 Provisioning and Administration

7.1 Procedures for an LCS Client

These procedures are concerned with the LCS client's provisioning and administration to the LCS feature.

7.1.1 Provisioning

The provisioning is an action to make the LCS feature available to a subscriber.

The provision may be:

- General: where the service may be made available to all subscribers without prior arrangements being made with the service provider (i.e. emergency calls).
- Pre-arranged: where the service is made available to an individual LCS Client only after the necessary arrangements have been made with the service provider.

7.1.2 Withdrawal

The withdrawal is an action taken by the service provider to remove the available LCS feature from a LCS Client's subscription profile access.

The withdrawal may be:

- General: where the LCS feature is removed from all LCS Clients.
- Specific: where the LCS feature is removed on an individual basis per LCS Client.

7.1.3 Invocation

The invocation is an action to invoke the LCS feature, taken by the LCS Client (e.g. issuing a location request) or automatically by the LCS server as a result of a particular condition (e.g. mobile originating emergency call, etc.).

7.2 Procedures for a Target MS

These procedures are concerned with a Target MS's privacy exception list.. For emergency services, provisioning and withdrawal for Target MSs may not apply.

7.2.1 Provisioning

Provisioning is an an action to make the privacy exception list with its privacy classes available to a Target MS. The provision may be:

- General: where the list is made available to all Target MS's without prior arrangements being made with the service provider. The list shall contain the default privacy class.
- Pre-arranged: where any extra privacy permission class (--granting permission to locate an MS Client) shall be capable of being independently provisioned for a target MS as agreed with the service provider for a certain contractual period.

7.2.2 Withdrawal

Withdrawal is an action taken by the service provider to remove an available privacy class from a target MS's PEL. The withdrawal may be:

- General: where a privacy class is removed from all target MSs provided with this privacy class.
- Specific: where each of the privacy classes in the privacy exception list shall be independently withdrawn at the subscriber's request or for administrative reasons.

8 Interactions with Bearer and Teleservices and Other Services

LCS shall support location of any Target MS that is idle or has established a voice call.

Location of a Target MS that has a call using any other circuit switched teleservice or any other circuit switched bearer service is for further study.

Location of a GPRS terminal or an MS using SMS may be supported.

Provision of location services to assist supplementary services and CAMEL is outside the scope of this specification. The operation of location services shall be independent of other services - including Number Portability, private numbering, CAMEL, supplementary services, teleservices, and bearer services.

9 Cross Phase Compatibility for R99

This section details the cross phase compatibility requirements relating to the service requirements in this document.

Note: when a change is introduced which affects the 3GPP specifications, it is said to be 'backward compatible' if existing equipment can continue to operate and perform correctly with equipment that conforms to the new implementation.

9.1 Compatibility With Existing Standards

Where the service and operational requirements in this document relate to a core network functionality, compatibility is required.

UTRAN LCS mechanisms shall be developed to maximise synergies with LCS earlier phases and shall hence support LCS Phase 2 enhancements.

9.2 Compatibility With Future Releases

It is envisaged that 3GPP standards will evolve beyond R99, for example with the addition of new service requirements. The standards which define the technical implementation of R99 should be developed in such a way that it is practical to add the requirements in this section in a backward compatible manner.

Following chapters include requirements that are foreseen for future release.

9.2.1 UTRAN support

UTRAN shall support, or at least be prepared for, important location services features in 3GPP Release 99. The measurement method(s) concluded to be feasible for UTRAN shall be selected and standardized in 3GPP Release 99. It shall be possible to enable the introduction of more positioning methods later, with minimum impact on systems in operation.

It shall be possible for the location service to be used by the majority of ME within the UTRAN area without compromising the radio transmission or the signalling capabilities of the radio system. The location service is not an occasional "emergency only" service.

It shall be possible for the location service to be used by both "active" ME and by "idle" ME.

9.2.2 Location identification in UTRAN and/or ME

When location identification is supported by UTRAN, the following apply,

1) UTRAN obtains 'Area ID' and/or geographic co-ordinates with uncertainty parameters for identification of the likely location of ME, to be sent to the NAS entity side of the CN (i.e., edge node) 'Area ID' represents either a radio access cell/sector or a geographic area. 'Area ID' is coded in the same format as Cell Global Identification (CGI).

2) It shall be possible to report the [estimated achieved] accuracy level of the location report as a resolution that will be limited by the accuracy capability of the local serving UTRAN and the capability of the ME. Note that certain effects, such as multipath propagation, may lead to one-sided errors and thus a non-circular location error zone is likely.

3) Location information is always at least obtained from UTRAN by the appropriate edge node(s) at the activation of a Call/PDP Context. A mechanism to make it possible to obtain the location information at the release of a Call/PDP Context should be specified. Location information sent to the edge node at other occasions is on the basis of asynchronous requests from the edge node to UTRAN. An edge node can request UTRAN to send the location information with the two types of requests, Type 1 (Direct request) where UTRAN sends location information only once at the request and Type 2 (Event request) where UTRAN sends location information at each specified event (e.g. Cell Update) requested by the edge node.

9.2.3 Quality level negotiation

It shall be possible for the LCS Client to specify or negotiate a (minimum) level of quality, such as accuracy, in a ME location information request. Different applications demand different levels of positioning accuracy and other positioning performance parameters, so the levels of performance should be classified according to the type of applications. The quality of location information can involve parameters like accuracy, update frequency, time stamp, time-to-first-fix, reliability, continuity, etc in a feasible way. The quality of the generated location information can exceed the required level. In case location information is not available to the required quality level , the request can either be denied and the service execution terminated, or the user accepts the lower quality information. The quality level requirement of each service (application) could be set both by the subscriber and the service provider.

It shall be possible to select the repetition rate of the location information update. The reports may be distributed to different clients at different rates.

9.2.4 Defined geographical areas

It shall be possible to specify a geographical area as ellipse to a resolution that will be limited by the accuracy capability of the part of the serving network where the user is registered.

It may be possible to identify and report when the user's terminal enters or leaves a specified geographic area.

In order to enable ME to determine itself if it enters or leaves a defined geographical area information about the defined geographical area shall be made available to client. The method is FFS, one alternative is that cells covering parts of the geographical area broadcasts information about the geographical area.

9.2.5 Continuous check of location

The client may continuously check its current location with or without requesting signalling support from the network using the Self Location feature. In this way the client may become aware of entering or leaving a predefined geographical area, as defined above, and/ or it can supply the user or an application with real-time tracking information.

9.2.6 Identification of a Target MS

In future releases support usage of IP addresses for MS identification shall be supported by the standard.

9.2.7 PS Services

LCS shall support location services for packet switched services in future releases.

9.2.8 VHE

LCS shall support VHE 22.121 [7]. Specifically negotiation of parameters shall be done using VHE service capability features.

Annex A (Informative): USA FCC Wireless E911 Rules

Action was taken by the FCC on September 15, 1999, with respect to E911 location technology by the Third Report and Order (FCC 99-245).The FCC has adopted the following revisions to its wireless E911 rules:

- Wireless carriers who employ a Phase II location technology that requires new, modified or upgraded handsets (such as GPS-based technologies) may phase-in deployment of Phase II subject to the following requirements:

  - Without respect to any PSAP request for Phase II deployment, the carrier shall:

    1. Begin selling and activating ALI-capable handsets no later than March 1, 2001;
    2. Ensure that at least 50 percent of all new handsets activated are ALI-capable no later than October 1, 2001; and
    3. Ensure that at least 95 percent of all new digital handsets activated are ALI- capable no later than October 1, 2002.

  - Once a PSAP request is received, the carrier shall, in the area served by the PSAP:

  Within six months or by October 1, 2001, whichever is later:

    1. Ensure that 100 percent of all new handsets activated are ALI-capable;
    2. Implement any network upgrades or other steps necessary to locate handsets; and
    3. Begin delivering to the PSAP location information that satisfies Phase II requirements.

  Within two years or by December 31, 2004, whichever is later, undertake reasonable efforts to achieve 100 percent penetration of ALI-capable handsets in its total subscriber base.

- For roamers and other callers without ALI-capable handsets, carriers shall support Phase I ALI and other available best practice methods of providing the location of the handset to the PSAP.

- To be allowable under the FCC rules, an ALI technology that requires new, modified, or upgraded handsets shall conform to general standards and be interoperable, allowing roaming among different carriers employing handset-based location technologies.

- For carriers employing network-based location technologies, the FCC replaces its current plan, which requires that implementation be fully accomplished within 6 months of a PSAP request, with a revised rule requiring the carrier to deploy Phase II to 50 percent of callers within 6 months of a PSAP request and to 100 percent of callers within 18 months of such a request.

- The FCC adopts the following revised standards for Phase II location accuracy and reliability:

- For network-based solutions: 100 meters for 67 percent of calls, 300 meters for 95 percent of calls;

- For handset-based solutions: 50 meters for 67 percent of calls, 150 meters for 95 percent of calls.

- The FCC directs wireless carriers to report their plans for implementing E911 Phase II, including the technology they plan to use to provide caller location, by October 1, 2000. This report shall provide information to permit planning for Phase II implementation by public safety organizations, equipment manufacturers, local exchange carriers, and the FCC, in order to support Phase II deployment by October 1, 2001.

Annex B (informative): Change history

Change history										
TSG SA#	**SA Doc.**	**SA1 Doc**	**Spec**	**CR**	**Rev**	**Rel**	**Cat**	**Subject/Comment**	**Old**	**New**
Jun 1999			GSM 02.71					Transferred to 3GPP SA1	7.0.0	
SP-04			22.071						3.0.0	
SP-05	SP-99486	S1-99831	22.071	001	1	R99	C	UMTS LCS service requirements support for mobile originated positioning requests, and velocity as a service parameter	3.0.0	3.1.0
SP-05	SP-99438	S1-99832	22.071	002		R99	B	UMTS LCS service requirements	3.0.0	3.1.0
SP-05	SP-99438	S1-99833	22.071	003		R99	C	LCS accuracy requirements	3.0.0	3.1.0
SP-05	SP-99479	S1-99625	22.071	004		R99	D	Editorial changes for alignment	3.0.0	3.1.0
SP-06	SP-99522	S1-99955	22.071	005		R99	D	U.S. specific Emergency Services requirements included as an informative annex.	3.1.0	3.2.0
SP-09	SP-000378	S1-000485	22.071	007		R99	F	Correction to LCS Service Description Stage 1 Document (R'99)	3.2.0	3.3.0
SP-15	SP-020043	S1-020453	22.071	034		R99	F	CR 22.071 Rel.99 F Closure of a loophole in the privacy settings	3.3.0	3.4.0
SP-23	SP-040085	S1-040126	22.071	066	-	R99	F	Routing of Emergency Calls based on Geographic Coordinates	3.4.0	3.5.0

History

Document history		
V3.2.0	January 2000	Publication
V3.3.0	October 2000	Publication
V3.4.0	March 2002	Publication
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