TSG-SA WG1 #23 **S1-040191**
Innsbruck, Austria, 12 – 16 January 2004

Title: Response to LS on EC Requirements on Emergency Telecommunications
Work Item: Emergency call (EMC1)
Source: SA1
To: OCG EMTEL
Cc: SA

Contact Person:
Name: Maria Cristina Mascione
Tel. Number: +39 06 39009475
E-mail Address: mmascione@mail.tim.it

Attachments: TS 22.071 V6.6.0; TS 22.101 6.6.0

---

1. Overall Description:

TSG SA WG1 Services is the group that works on the services and features for 3G.
SA1 is responsible for setting high level requirements for the overall system and for providing this in a Stage 1 description in the form of specifications and reports.

SA 1 would like to thank OCG EMTEL for their Liaison Statement entitled “LS on EC Requirements on Emergency Telecommunications”.

SA1 would like to inform OCG EMTEL that SA1 has carried out extensive work on emergency calls over IMS and over LCS. The related specifications (TS 22.101 and TS 22.071) have been updated accordingly.

SA1 will keep EMTEL informed about existing and expected activities on Emergency Calls issue and about the status of related specifications.

The latest version of TS 22.071 and TS 22.101 are attached to this LS.

2. Actions:

ACTION: none

3. Date of Next TSG-SA1 Meetings:

SA1#24	10 – 14 May 2004	Shenzhen, CN

3GPP TS 22.071 V6.6.0 (2004-01)

Technical Specification

3rd Generation Partnership Project;
Technical Specification Group Services and System Aspects;
Location Services (LCS);
Service description; Stage 1
(Release 6)

Keywords
GSM, UMTS, location, stage 1

3GPP

Postal address

3GPP support office address
650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet
http://www.3gpp.org

Contents

Foreword

This Technical Specification (TS) has been produced by the 3GPP.

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

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the specification;

1 Scope

This document provides the Stage One description of Location Services (LCS). 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 enable the provision of location based applications. These applications 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.

This document provides core requirements to an extent sufficient to derive a complete definition of location services at the service level. However, the present document also provides additional requirements which may suggest in a non-normative manner certain ways the system may be implemented to support location services.

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

LCS is being developed in phases with enhancements added in 3GPP releases.

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

[2] 3GPP TS 23.032: "Universal Geographical Area Description".

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

[4] 3GPP TS 22.105: "Services and Service Capabilities".

[5] 3GPP TS 22.115: "Charging and Billing"

[6] 3GPP TS 22.127: "Stage 1 Service Requirement for the Open Service Access (OSA)".

[7] 3GPP TS 23.110: " UMTS Access Stratum; Services and Functions".

2.2 Informative references

[8] 3GPP TR 25.923: "Report on Location Services (LCS)".

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

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

[11] 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 3GPP 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:

Change of Area: is one event supported for deferred Location Requests. Change of Area means that the network is required to report the location or the occurrence of the event of the requested subscriber in triggered fashion immediately after the network (MSC/SGSN) processes the mobility event for the the new location of the subscriber. Usually new location is noticed after the Location Update, Handover, RAU, Registration or RANAP Location Report, e.g. when the SAI changes.

Codeword: access code, which is used by a Requestor or LCS Client in order to gain acceptance of a location request for a Target UE. The codeword is part of the privacy information that may be registered by a Target UE user.

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

Deferred location request: a location request where the location response (responses) is (are) required after specific event has occurred. Event may or may not occur immediately. In addition event may occur many times.

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 UE 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). The LCS Client is identified by a unique international identification, e.g. E.164.

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 UEs.

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.

Service Identifier: A service provided by an LCS Client is identified by a Service Identifier. One LCS client may have one or more services. The combination of the LCS client Identifier and the Service Identifier constitutes a unique identification of a service.

Location Estimate: the geographic location of a UE 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 UE. The permission shall be granted either on activation by the target UE or permanently for a contractual period of time agreed between the target UE 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 UE being positioned.

Requestor: an originating entity, which has requested the location of the target UE from the LCS client.

Target UE: The UE being positioned.

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

UE available: deferred Location Request event in which the MSC/SGSN has established a contact with the UE. Note, this event is considered to be applicable when the UE is temporarily unavailable due to inaction by the UE user,

temporarily loss of radio connectivity or IMSI detach and so on. Note that IMSI detach is only applicable in the case UE has previously been registered and information is still kept in the node.

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 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 GERAN and UTRAN to facilitate determination of the location of a mobile station.

The following subsections provide general descriptions of attributes that can be used to describe or characterize various location services.

The relative importance of these attributes varies from service to service. However, accuracy, coverage, privacy and transaction rate may be considered the primary distinguishing attributes that define a value-added service. Briefly:

- accuracy is the difference between actual location and estimated location,
- coverage is an expression of the geographic area in which the UE user will receive an adequate perceived quality of service,
- privacy describes the user's perception of confidentiality of the location information, and
- transaction rate indicates how frequently network messaging is required to support the service.

A general comparison of the specific attributes of various location-based services is provided in Annex C of this document.

4.1 High Level Requirements

The following high level requirements are applicable:

1 The supporting mechanisms should incorporate flexible modular components with open interfaces that facilitate equipment interoperability and the evolution of service providing capabilities.

2 The network should be sufficiently flexible to accommodate evolving enabling mechanisms and service requirements to provide new and improved services.

3 It shall be possible to provide multiple layers of permissions to comply with local, national, and regional privacy requirements.

4 Multiple positioning methods should be supported in the different Access Networks, including (but not limited to) UL-TOA, E-OTD, IPDL-OTDOA, Network Assisted GPS and methods using cell site or sector information and Timing Advance or RoundTrip Time measurements.

5 The location determining process should be able to combine diverse positioning techniques and local knowledge when considering quality of service parameters to provide an optimal positioning request response.

6 It should be possible to provide position information to location services applications existing within the PLMN, external to the PLMN, or in Mobile Equipment;

7 Support should be provided for networks based on an Intelligent Network architecture (i.e. with specific support for CAMEL based Location Services).

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

9 It shall be possible to provide the originating party's serving cell id to the LCS client.

4.2 Location Information

Location Information consists of Geographic Location, Velocity, and Quality of Service information, as described in the subsequent sections.

4.2.1 Geographic Location

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

Note: For services other than LCS the network may also determine within which Cell or Service Area the Target UE is located ("Service Area" is a UTRAN concept and it may consist of one (in R99) or more than one cell). The Service Area information or Cell ID may be used for routing of calls or for CAMEL applications.

It should be noted that the Service Area concept is different from the Localized Service Area concept used for SoLSA.

4.2.2 Velocity

Velocity is the combination of Speed and Heading (direction) of a Target UE. The LCS Server may provide the Velocity of an UE.

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

Provision of the velocity of a target UE is application driven. Location Services may allow an LCS Client to request or negotiate the provision of velocity.

For Emergency Services there is no requirement to provide velocity.

4.3 Quality of Service

4.3.1 Horizontal Accuracy

The accuracy that can be provided with various positioning technologies depends on a number of factors, many of which are dynamic in nature. As such the accuracy that will be realistically achievable in an operational system will vary due to such factors as the dynamically varying radio environments (considering signal attenuation and multipath propagation), network topography in terms of base station density and geography, and positioning equipment available.

The accuracy for location services can be expressed in terms of a range of values that reflect the general accuracy level needed for the application. Different services require different levels of positioning accuracy. The range may vary from tens of meters (navigation services) to perhaps kilometers (fleet management).

The majority of attractive value added location services are enabled when location accuracies of between 25m and 200m can be provided.

Based on decreasing accuracy requirement some examples of location services are provided in table 4.1. The LCS service shall provide techniques that allow operators to deploy networks that can provide at least the level of accuracy required by the regional regulatory bodies (e.g. Annex A).

Table 4.1; Example of location services with decreasing accuracy requirement

· Location-independent	Most existing cellular services, Stock prices, sports reports
· PLMN or country	Services that are restricted to one country or one PLMN
· Regional (up to 200km)	Weather reports, localized weather warnings, traffic information (pre-trip)
· District (up to 20km)	Local news, traffic reports
· Up to 1 km	Vehicle asset management, targeted congestion avoidance advice
· 500m to 1km	Rural and suburban emergency services, manpower planning, information services (where are?)
· 100m (67%) · 300m (95%)	U.S. FCC mandate (99-245) for wireless emergency calls using network based positioning methods
· 75m-125m	Urban SOS, localized advertising, home zone pricing, network maintenance, network demand monitoring, asset tracking, information services (where is the nearest?)
· 50m (67%) · 150m (95%)	U.S. FCC mandate (99-245) for wireless emergency calls using handset based positioning methods
· 10m-50m	Asset Location, route guidance, navigation

Accuracy may be independently considered with respect to horizontal and vertical positioning estimates. Some location services may not require both, others may require both, but with different degrees of accuracy.

Given that the location estimate is the best possible within the bounds of required response time, the location estimates of a fixed position UE (assuming several estimates are made) will reveal a ‘spread’ of estimates around the actual UE position. The distribution of locations can be described by normal statistical parameters and suggests that a small proportion of location estimates may lie outside of the acceptable Quality of Service (QoS) parameters for specific services (as determined by the network operator).

It may be possible to provide information on the confidence that can be associated with a location estimate. This may be used by location services to decide if a position update should be requested, for example, if the reported accuracy falls below a threshold determined by the LCS Client or Network Operator for a specific service.

It may also be possible to determine velocity (speed and heading) information from a location request.

When delivered with a location estimate, the confidence region parameters, speed and heading may allow an application to improve the service delivered to the UE user. Some examples are given below:

a) Confidence Region: Simple measure of uncertainty that specifies the size and orientation of the ellipse in which an UE is likely to lie with a predetermined confidence (e.g. 67%). The size of the confidence region may be used by the network operator or the LCS Client to request an updated location estimate.

b) Speed: enables e.g. congestion monitoring, and average travel time estimates between locations.

c) Heading: the location estimate of a vehicle may be improved to identify the appropriate side of the highway. This may enable the provision of traffic information that relates only to the user's direction of travel.

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 achieved accuracy level of location information shall be indicated using the shapes and uncertainty areas defined in 3GPP TS 23.032 [2].

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 UE, 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.

4.3.2 Vertical Accuracy

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

The LCS Server may provide the vertical location of an UE 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 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.

4.3.3 Response Time

Different location based services, or different LCS Clients, may have different requirements (depending on the urgency of the positioning request) for obtaining a response. The location server may need to make trade-offs between requirements for positioning accuracy and 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 server should immediately return any location estimate that it currently has. The LCS Server shall return either the Initial or Last Known Location of the Target UE. If no estimate is available, the LCS Server shall return the failure indication and may optionally initiate procedures to obtain a location estimate (e.g. to be available for a later request).

b) “low delay”: fulfillment of the response time requirement takes precedence over fulfillment of the accuracy requirement. 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 (i.e. a quick response with lower accuracy is more desirable than waiting for a more accurate response).

c) “delay tolerant”: fulfillment of the accuracy requirement takes precedence over fulfillment of the response time requirement. If necessary, the server should delay providing a response until the accuracy requirement of the requesting application is met. 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.

4.3.4 LCS QoS Class

The LCS QoS Class defines the degree of adherence by the Location Service to the quality of service parameters (Accuracy and Response Time).

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

LCS QoS Class is a non-negotiable QoS parameter. Support of QoS Class by a Public Land Mobile Network (PLMN) is optional. The LCS Service may allow a LCS Client to specify the required QoS Class (in the context of immediate location request) either at provisioning or when the request is made. The LCS Service shall attempt to satisfy as closely as possible the other quality of service parameters regardless of the use of QoS Class.

For immediate location request response, LCS QoS Class options are:

a) "Assured": The other QoS parameters shall be adhered to strictly. The LCS Service shall obtain a Current Location with regard to fulfilling the requirements set by the other QoS parameters. If the location request response does not satisfy the other QoS parameters, the response shall be discarded by the LCS Service.

b) "Best Effort": The other QoS parameters do not have to be adhered to strictly. The LCS Service shall obtain a Current Location, using only one attempt with a single technology, with regard to fulfilling the requirements set by the other QoS parameters. Even if the location request response does not satisfy the other QoS parameters, the response may be forwarded to the LCS Client.

4.4 Reliability

Reliability provides a measure of how often positioning requests that satisfy QoS requirements are successful. For some applications, such as cross-country vehicle tracking, this may not be especially critical. If a positioning attempt fails, due to lack of coverage or transient radio conditions, etc, another positioning attempt may be made. This attempt should be specified in Location Service Request. (see the section 5.3.1.1). However for other services, perhaps such as child tracking, reliability may be more important.

The network shall provide statistical reporting of reliability (QoS parameters) data.

4.5 Priority

Location requests for different services may be processed with different levels of 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.

4.6 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.

4.7 Security

Specific local, national, and regional security regulations must be complied with.

Position information should be safeguarded against unapproved disclosure or usage. Position information should also be provided in a secure and reliable manner that ensures the information is neither lost nor corrupted. Audit records should be maintained of positioning requests and responses to facilitate resolution of security violations.

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.

The target UE user shall be authenticated before being allowed to access (to modify/query) her personal data or query/cancel an LCS request.

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 UE 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 UE, 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 UE 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 UE 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.

4.8 Privacy

Specific local, national, and regional privacy regulations must be complied with, and multiple layers of permissions may be required.

Location information must always be available to the network service provider.

Means shall be provided for the UE subscriber to control privacy for value added services.

The user shall be able to change the setting of the Privacy exception list at any time.

Unless required by local regulatory requirements, or overridden by the target UE User, the target UE may be positioned only if allowed in the UE subscription profile. In general, for valued added location services, the target UE being positioned should be afforded the maximum possible privacy, and should not be positioned unless the positioning attempt is explicitly authorized. In the absence of specific permission to position the target UE, the target UE should not be positioned.

It may also be possible for a target UE to authorize positioning attempts after the target UE is notified of a positioning request and the target UE grants permission for positioning This notification condition (notification with privacy verification) shall be specified in the Target UE Subscription Profile. (See the subsequent "target subscriber notification" section of this document for charging and billing aspects.)

The privacy of an inanimate asset for an embedded target UE may be completely defined by the UE subscriber.

Additionally, specific privacy exceptions may exist for compliance with mandated location based services (such as for emergency services or lawful intercept) which are required by national or local regulatory requirements.

For Value Added Services, the following is applicable:

The Target UE 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 UE Subscription Profile. The home network shall have the capability of defining the default circumstances in which the Target UE's Location Information is allowed to be provided - as required by various administrations and/or network requirements.

The privacy check shall be performed in the Home Environment of the target UE subscriber. This makes it possible for operators to ensure the privacy of their own subscribers i.e. the privacy settings that are used for privacy checks are always up to date and as specified by the Home Environment of the target UE subscriber. It shall be possible for privacy check to take into account Home Environment specific information such as time of day, subscriber location. It shall be possible to ensure that privacy checks are performed according to the latest information as available in the Home Environment.

It shall be possible for location services to support conditional positioning. Under these conditions, an application that is granted conditional positioning authorization must notify and obtain positioning authorization from the user of the target UE prior to performing the positioning process. Thus the user of the target UE shall be able to accept or reject the positioning attempt.

The default treatment, which is applicable in the absence of a response from the Target UE, shall be specified in the Target UE Subscription Profile. Thus for some location services the default treatment may be to accept the positioning request, whereas for other location services the default treatment may be to reject the positioning attempt.

However, considering that in general, users shall be afforded the maximum possible privacy, and shall not be positioned unless the target subscriber authorizes the requesting location application to perform positioning, the default condition shall normally be to deny the positioning attempt.

For PLMN operator services, the target UE 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 UE subscription profile. The target UE user shall not be notified of any authorized location attempt.

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

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

All location requests (LRs) shall be done with a privacy check except for the following:

- LRs relating to lawful interception
- LRs related to emergency calls
- LRs from the serving network related to anonymous tracking for statistical and O&M purposes
- LRs from the home network as requested by the home network operator for its own internal purposes. The home network operator should not use the UE location information, which was obtained from the visited network without privacy checks, for value added services or to forward such location information to any third party (except for the cases of lawful interception or emergency calls).

4.8.1 Service Type Privacy

The user may wish to differentiate between privacy requirements even with one LCS Client, depending on which service the user requests from this LCS client or which service the LCS client offers to the user.

The users shall be able to allow or deny their location information to be given to LCS clients providing an indicated type of service. The user could e.g. allow all dating type services to get location information but decline other types of services to get the user's location. The location request message issued by the LCS client may include a service identity, and the LCS Server may interpret that the indicated service belong to a certain Service Type. The subscriber shall be able to define and set privacy rules based on service type, so that services belonging to that service type shall be handled according to the corresponding service type privacy setting.

It shall be possible to verify that the service type indicated by the LCS client is correct. The service type privacy check may be done by the LCS server or by the user of the target mobile.

The LCS Server shall be aware of what service types a certain LCS Client supports. The LCS Server shall map the service identity given by the LCS client to a service type, as described below. The PLMN operator defines to what service type the given service identity belongs to.

4.8.1.1 Standardized Service Types

Annex C lists the attributes of specific location based services as determined by the GSM Alliance Services Working Group. The standardized Service Types to be used in privacy checking are listed in table 4.2 and are based on the services listed in Annex C. It is noted that not all services listed in Annex C need belong to a standardized service type.

It should be noted that only the names and identities (number) of the Service Types are standardized.

It shall be possible for the network operator/service provider to define additional, non-standardised service types that need not be globally unique.

Table 4.2, Standardized Service Types

Location based services categories	Standardized Service Types
Public Safety Services	Emergency Services
	Emergency Alert Services
Location Sensitive Charging	
Tracking Services	Person Tracking
	Fleet Management.
	Asset Management
Traffic Monitoring	Traffic Congestion Reporting
Enhanced Call Routing	Roadside Assistance
	Routing to Nearest Commercial Enterprise
Location Based Information Services	Traffic and public transportation information
	City Sightseeing
	Localized Advertising
	Mobile Yellow Pages
	Weather
	Asset and Service Finding
Entertainment and Community Services	Gaming
	Find Your Friend
	Dating
	Chatting
	Route Finding
	Where-am-I
Service Provider Specific Services	

Note: It should not be possible for the target UE subscriber to block the emergency services Service Type, so maybe this Service Type is not needed, this is FFS.

4.9 Service Authorization

Requests for positioning information should be processed only if the requesting application is authorized. The identity and authorization privileges of the requesting application should be verified prior to processing positioning requests.

4.10 Service Activation and De-Activation

To maximize the adoption of location services, the service activation process must be simple. Three types of service package, may be distinguished, each of which may require a different service activation process:

1 On Demand: the user accesses services only when required.

2 Period Subscription: the subscriber requires periodic availability of the service

3 Mixed: some services provided on subscription and the remainder on-demand.

The process of activation + service delivery + deactivation may be provided in a single transaction. It may be possible for a subscriber to activate a location service on one occasion before deactivating an existing invocation.

Furthermore, a location service may be 'enabled' at the point of sale as part of the service package purchased by the UE subscriber. The use of Over-The-Air (OTA) provisioning may allow the location feature to be enabled for UE-based positioning methods.

4.11 Coverage

In general an UE user should be able to access a location service anywhere within the operator's coverage area, or within the roaming area. Three levels of coverage may be considered:

1 Home Network - Complete

2 Home Network - Partial

3 Roaming Networks

Considering network topography and dynamically varying environmental factors, a network operator may not be able to guarantee homogeneous service quality across the entire home network geographic area, or roaming partners' networks. Even within those areas where service is offered, the provided quality of service may vary due to dynamic environmental (i.e. radio) conditions. Additionally, the location method may have an accuracy that depends on the UE location, for example due to varying radio conditions, cell configuration and cell density in different areas, and geometric dilution of precision.

Furthermore the roaming partner's network may not accept a similar location method to that experienced by the user in the home network.

Finally, the service may not be available in a roaming partner's network despite technical interoperability between the location method supported by the UE and the network.

Therefore coverage may be considered not only to be a technical attribute, but may also be related to roaming contracts between network operators. In general, provided that a roaming agreement exists, any properly authorized location-based service may position a Target UE in either the Home PLMN (HPLMN) or a Visited PLMN (VPLMN). It may also be noteworthy that some location based services (such as location based information services) may be especially attractive to subscribers roaming outside their home networks.

4.12 Roaming Target UE

With respect to roaming, specific local, national, and regional privacy regulations must be complied with, and multiple layers of permissions may be required.

Many location-based services may be especially attractive to subscribers roaming outside their home PLMN. As such, support should be provided for the transparent and consistent provision of location based services to the fullest extent possible. Consideration for roaming support should be provided with the following priorities:

1. Roaming between 3GPP networks.

2. Roaming between 3GPP systems and IMT 2000 family networks.

3. Roaming between 3GPP and ANSI-41 or other systems.

If the location capability in the VPLMN is compatible with that provided in the HPLMN, the same parameters must be provided to the location server in the VPLMN that would be provided to the server in the HPLMN to enable provision of the same services.

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 UE when the Target UE 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 UE 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 UE shall be supported in the VPLMN as allowed by both local regulatory requirements and considerations, where applicable, of UE privacy.

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

4.13 Support for all UEs

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

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

Both “active” and “idle” UEs shall be capable of being positioned.

4.14 Support for Unauthorized UEs

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

For PLMN operator services, positioning of unauthorized UEs 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 UEs (i.e. including stolen UEs and UEs without a SIM/USIM).

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

4.15 Periodic Location Reporting

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

The periodic reporting function is generally applicable for asset management services and exists as several variants, each applicable to different value added services:

· Location reporting only within predetermined period	e.g. commercial asset tracking and, subject to provision of privacy, manpower planning.
· Periodic location reporting within specified period and reporting triggered by a specific event	e.g. high value asset security, stolen vehicle monitoring, home zone charging.
· Periodic location reporting triggered by a specific event	e.g. 24hr depot management, transit passenger information systems

Periodic location determination and reporting increases network traffic. However, scheduling the periods of location monitoring and reporting will reduce this. Finally, event-based logic provided by the network operator that monitors the asset (location and status) and only reports events that meet conditions agreed with the application may reduce network traffic further without reducing the QoS.

If this event-based or time-based decision process is the responsibility of the application and not the network operator then all of the above services can be regarded as periodic location reporting.

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

When an LCS client activates Periodic Location Reporting, the LCS server shall be able to inform the target Ms of this activation according to the Privacy Exception List.

Optionally, it may be possible for the target UE at any time to query the LCS server about any valid requests activated for that target UE, and/or cancel the request.

When a request is cancelled by the target UE, the LCS server shall inform the LCS client of this cancellation.

It should be possible for more than one LCS client to activate requests for the same target UE.

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

4.16 UE-Based Location Calculation

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

For Commercial Services, the following may be applicable for semi-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 UE 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 UE for operator or for service provider applications. For this purpose a point to point signalling connection must be established.

4.17 UE_Assisted LCS Location Calculation

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

For Commercial Services, the following may be applicable for UE-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 UE 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 UE 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 UE.

4.18 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:

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

Semi-autonomous Self Location - One interaction with the network assists the mobile station to obtain multiple location positionings over a predetermined period of time.

NOTE: Autonomous Self Location – The mobile needs no interaction with the network and is therefore considered to be outside the scope of this technical specification.

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

4.19 Network support for LCS

The provision of location services shall be possible without significantly adversely impacting the radio transmission or the signalling capabilities of the network.

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 UEs 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 UE are detailed in the Target UE Subscription Profile. The LCS feature shall allow a Target UE to be positioned within a specified Quality of Service. The LCS feature shall allow the location of a Target UE to be determined at any time whilst the UE 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.

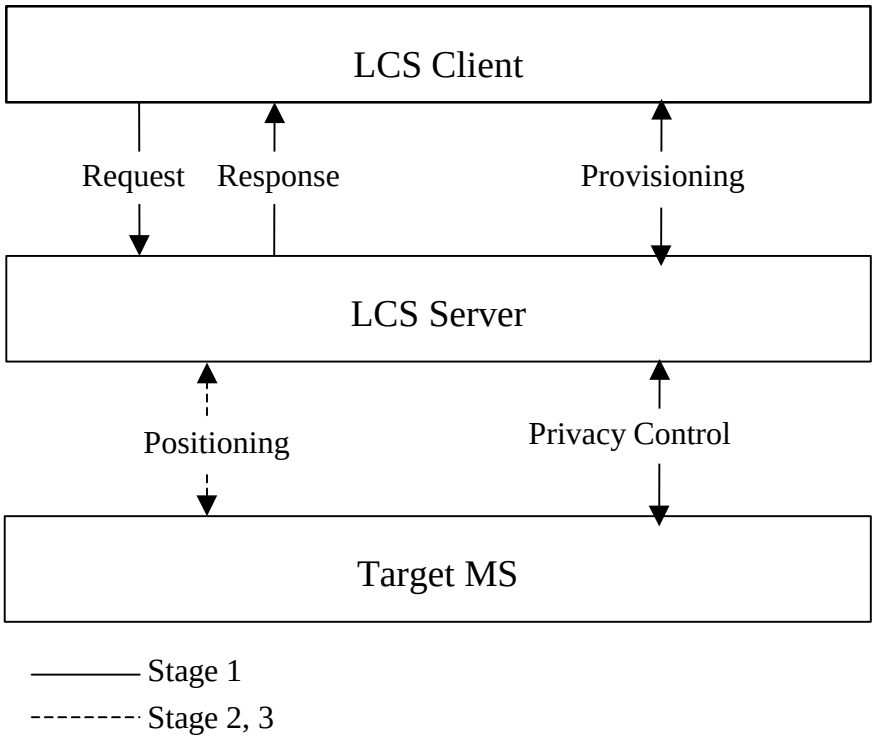

Figure 1. LCS Logical Reference Model

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 UEs within a specified set of parameters such as QoS. The LCS Client may reside in an entity (including an UE) within the PLMN or in an entity external to the PLMN. When the LCS client resides in an entity external to the PLMN, the LCS client may be connected to several Requestors who originate the location requests. The specification of the LCS Client's internal logic and its relationship to any external user (e.g. Requestor) 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 UEs specified by the LCS client if considerations of target UE 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 UE. 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 UE.

5.2.4 Target UE

The Target UE is the object to be positioned by the LCS Server. For network based positioning methods, no support for LCS is required by the target UE. For mobile assisted and mobile based positioning methods, the target UE actively supports LCS. For all positioning methods, the ability to control privacy may be required to be given to the UE user for each location request and/or to the UE subscriber through the Target UE subscription profile 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 UE Based positioning methods, if the LCS Client is located in the UE, 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.

5.3.1.1 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 UEs 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

If a positioning attempt fails, the LCS server may make another positioning attempt. This attempt should be made when the target UE can be detected by the network. It may be possible for the LCS client to set this action as an option. This optional action should be applied for both request types.

Note: This functionality may be provided using one or more of the existing toolkits, including but not limited to CAMEL and OSA.

When using the Deferred type (event driven), the LCS client shall be able to set the following items:

- Time interval of positioning
- Number of responses (if needed)
- Valid period of the request (if needed)
- Type of event

  Currently following events are introduced:

  - UE available
  - Change of Area

It shall be possible for the LCS client to cancel the pre-arranged request.

It shall be possible for the LCS server to set the minimum time interval of positioning allowed.

It shall be possible to limit the area where the Change of Area event will be reported e.g use the OSA messages defined in 3GPP TS 29.198.

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.

5.3.1.2 Location Service Response

The Location Service Response provides the result of a 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.

When the location positioning for the target UE has failed, the LCS server may be able to report the reason for failure and Last Known Location with the relevant timestamp.

5.3.1.3 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 UE

For value added services, the following is applicable:

The LCS client shall identify a target UE using the MSISDN or SIP URL.

The LCS Client shall be able to identify the target UE using IP addressing.

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

MSISDN

SIP URL

IMSI

An identifier internal to the PLMN

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

MSISDN

SIP URL

IMSI

NA-ESRK + (optionally) IMEI

It shall be possible for the target mobile's user to hide her true identity from the requestor and the LCS client and replace it with an alias. The alias shall be a unique identification that has a one-to-one relationship to the true identity of the subscriber and may be permanent or temporary. The target mobile user shall be able to know her own alias so that she can pass the alias to the LCS client, e.g. when invoking a location-based service.

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 Location Information (if available) of the Target UE or, if positioning fails, an error indication plus optional reason for the failure.

For PLMN operator services (where allowed by local regulatory requirements and restrictions on UE privacy), Location Information for a particular target UE 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), the geographic location 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 UE 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 SIP URL 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 UE 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 UE.

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

6.4 Target UE Subscription

6.4.1 Privacy Subscription Options

It shall be possible for a Target UE Subscriber to subscribe to various types of privacy classes. The default treatment in the absence of the information to the contrary in the Target UE 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:

Codeword: an additional level of security that may be set by a Target UE user to determine which Requestors are allowed to request location information;

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

Service Type Privacy: determines whether the service type allows the LCS Clients to get the position of a Target UE;

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

6.4.2 Codeword

It shall be possible for a Requestor and an LCS client to request location information by indicating a Codeword associated with the Target UE user. The codeword shall be either checked by the Target UE/user or by the LCS server in the home network. In the former case, the codeword supplied by the requestor and forwarded by the LCS client with the request shall be forwarded to the TargetUE/user for verification and acceptance. In the latter case, the codeword shall be registered with the LCS server by the Target UE user (or subscriber) in advance. Optionally, the UE and/or network may have the capability to generate and/or distribute codewords. The generation of codewords and the distribution of those codewords are out of scope of this specification. A comparision of the codeword sent by the Requestor and the registered codeword shall be performed. A location request shall only be accepted if this comparision is successful. In the case where the Target UE/user does not check the codeword, the codeword need not be sent to the Target UE/user. In the case where the codeword is checked by the Target UE/user, the Target UE subscriber need not register the codeword in advance.

The other privacy settings should also be checked even when the codeword has been checked.

The Target UE Subscriber may register multiple codewords for multiple requestors. Once the codeword has been set and properly distributed, the Target UE user would be protected against location requests from third parties, which do not know the appropriate codeword.

It should be possible for a Target UE subscriber to enable and disable codeword checking for each of the LCS Clients.

The codeword is applicable to the value added services only.

6.4.2.1 Enhanced codeword

It shall be possible for the target UE/ user to secure the codeword from being misused. Only the intended requestor or LCS client shall be able to use the secured codeword.

It shall be possible for the target UE/user to ensure that the secured codeword can be used only within a specific time period, as determined by the target UE/user. It shall be possible for the target UE/user to ensure that a secured codeword can be used only a specific number of times, as determined by the target UE/user.

The user of the target UE shall not need to be involved in checking the validity of the secured codeword during the location service request. The secured codeword shall be checked by the LCS server.

6.4.3 Privacy Exception List

To support privacy, the LCS Server shall enable each Target UE Subscriber to subscribe to a "privacy exception list" containing the LCS Client identifiers, the service identifiers, classes of LCS Clients, the target subscriber notification setting (with/without notification) and the default treatment, which is applicable in the absence of a response from the Target UE for each LCS Client and service identifiers.

The privacy exception list shall support a minimum of 20 clients. For each client the privacy exception list shall support a minimum of 10 services. The maximum number of clients and services shall be determined by implementation constraints.

If the target subscriber notification is set as "notification with verification", each positioning request from the LCS Client or the service shall be notified to the target UE before positioning. The treatment for location request from the LCS Client or service, which is not registered in the privacy exception list, shall also be specified in the privacy exception list. 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/session-related Class: location services may be provided to any value added LCS clients or a particular value added LCS client or a particular service or particular group of value added LCS Clients – where each LCS Client, service or group of LCS Clients is identified by a unique international identification, e.g. E.164 - that currently has a temporary association with the Target UE in the form of an established voice, data call or PS session originated by the Target UE. For each identified LCS Client, service or group of LCS Clients, one of the following geographical restrictions shall apply:

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

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

  c) Location request allowed from any LCS Client or service;

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

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

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

  c) Location request allowed from any LCS Client or service;

- 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):

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

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

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

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

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

NOTE: The definitions of the various PLMN operator categories may be supplemented by more precise language in contractual agreements both between UE 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.

6.4.4 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 UE 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 normally only valid when the LCS Server for the LCS client is located in the same country of the Target UE. If agreed by bi-lateral agreements between operators, the privacy override indicator shall also be valid when the LCS client is not located in the same country as the Target UE.

6.4.5 Subscription to Mobile Originating Location

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

A) Basic Self Location

B) Semi-autonomous Self Location

C) Transfer to Third Party

6.4.6 Void

6.4A Requestor

The Location Request issued by the LCS client to GMLC shall optionally include also the identity of the originator of the location request, i.e. the Requestor, not only the identity of the LCS client.

The requestor shall be authenticated by the LCS client and/or the network.

The identity of the Requestor shall be included in the privacy interrogation request. It may be either checked by an entity in the network, the Target UE or the user.

It shall be possible for the requestor to use an alias, so that the true identity of the requestor is unknown to the LCS client. The alias shall be a unique identification that has a one-to-one relationship to the true identity of the requestor and may be permanent or temporary. The LCS client shall indicate the requestor alias instead of the real requestor identity in the location request. The target mobile user in this case authorizes the requestor based on the requestor's true identity, after it has been decrypted in the requestor's operator's network.

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 UE 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 for inter-network revenue sharing.

To support charging and billing for location services, additional information will need to be provided in call detail records.

Charging for value added location services may be provided on a transaction basis, periodically, or a mixture of both.

To support transaction based charging where applicable, service associated call detail records may need to include (as a minimum) the following additional information (depending on the specific service):

- Type and Identity of the LCS Client;
- Identity of the target UE;
- Results (e.g. success/failure, method used, position, response time, accuracy)
- Time Stamp;
- Type of coordinate system used.

6.7 LCS Open Service Architecture and Application Programming Interface

Note: LCS information may be accessible through the Open Service Architecture (OSA) standardized Application Programming Interface (API). OSA service aspects of LCS are described in 22.127. [6]

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

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

Provisioning 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

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

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

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. periodic location request, mobile originating emergency call, etc.).

7.2 Procedures for a Target UE

These procedures are concerned with a Target UE's privacy exception list.. For emergency services, provisioning and withdrawal for Target UEs 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 UE. The provision may be:

- General: where the list is made available to all Target UE'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 UE Client) shall be capable of being independently provisioned for a target UE 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 UE's PEL. Withdrawal may be:

- General: where a privacy class is removed from all target UEs 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.

7.2.3 User Control

The user shall be able to change the following settings in the privacy exception list:

- the LCS Client and/or group of LCS Clients list
- the codeword
- the requestor
- the service types
- the target subscriber notification setting (with/without notification)
- the default treatment, which is applicable in the absence of a response from the Target UE for each LCS Client identifiers.

7.3 Barring Capability of the Location Service

It shall be possible for operators to bar the Location Service of a specific user at any time. i.e. any location requests towards the user's Target UE and her own location requests towards her own Target UE are barred.

If the LCS request fails due to barring then an error cause is returned to the LCS Requestor.

For Emergency Services and other services where required by local regulatory requirements, and for PLMN operator Services, the location request shall be processed with the highest priority level regardless of the barring status of LCS.

8 Interactions with Bearer and Teleservices and Other Services

LCS shall support location of any Target UE that is idle or has established any CS teleservice, bearer service or PS session.

Location of a GPRS terminal or an UE 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 between releases

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 earlier LCS phases.

9.2 Compatibility With Future Releases

It is envisaged that 3GPP standards will evolve in future releases, for example with the addition of new service requirements. The standards which define the technical implementation of LCS 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 Void

9.2.2 Location determination in call or PDP context activation and release

A possible future enhancement in LCS is that location information of a specific target UE may be obtained at the activation of a Call or PDP Context. A corresponding mechanism to obtain the location information of a specific target UE at the release of a Call or PDP Context may also be feasible.

9.2.3 Void

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 UE

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

9.2.7 Void

9.2.8 VHE

LCS shall support VHE 22.121 [6].

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): Descriptions of possible location based services

B1 Public Safety Services

Service providers offer these location-based services for the good of the public. They are made available without requiring pre-subscription.

B1.1 Emergency Services

Specific consideration of mandated Emergency Services is outside the scope of this specification. Such requirements may be regionally or nationally specific.

B1.1.1 Attributes

Specific consideration of the attributes for mandated Emergency Services is outside the scope of this specification. However, the current requirements specified by the U.S. FCC Phase II Mandate may be useful as an example.

> The FCC's Third Report and Order (FCC 99-245) in the matter of revision of the commission's rules to ensure compatibility with Enhanced 911 Emergency Calling Systems (CC Docket No. 94-102 RM-8143), adopted September 15, 1999, states:
>
> *We adopt the following revised standards for Phase II location accuracy and reliability:*
>
> - *For network-based solutions: 100 meters for 67% of calls, 300 meters for 95 percent of calls;*
> - *For handset-based solutions: 50 meters for 67% of calls, 150 meters for 95 percent of calls.*

The network should be sufficiently flexible to accommodate evolving enabling mechanisms and service requirements to provide new and improved services.

B1.1.2 Emergency Alert Services

Emergency Alert Services may be enabled to notify wireless subscribers within a specific geographic location of emergency alerts. This may include such alerts as tornado warnings, pending volcano eruptions, etc.

No requirements currently exist for Emergency Alert Services, and they may be considered for further study.

B2 Location Based Charging

Location Based Charging allows a subscriber to be charged different rates depending on the subscriber's location or geographic zone, or changes in location or zone. The rates charged may be applicable to the entire duration of the call, or to only a part of call's duration. This service may be provided on an individual subscriber basis, or on a group basis.

For example, when provided on an individual basis this service could apply reduced rates to those areas most often frequented by the subscriber by taking into consideration the subscriber's daily route and life style. Different rates may be applied at country clubs, golf courses, or shopping malls. For example, a "home" zone may be defined which is centered around a user’s home, an agreed larger area, work or travel corridor or some unrelated zone. The zone may vary in size and shape from a cell (or sector) coverage area to a precisely defined polygon completely independent of cell coverage.

Additionally, different rates may be applied in different zones based on the time of day or week.

In addition to being applicable on an individual basis, this service may be applicable on a group basis, which may be desirable for example, for business groups. Locations may be defined for business groups to include corporate campuses, work zones or business zones with different tiers of charging rates.

Individual and group subscribers should be notified of the zone or billing rate currently applicable, and be notified when the rate changes. Location Based Charging may be invoked upon initial registration. A charging zone would then be associated with the subscriber's location. When the subscriber moves to a different zone, the subscriber would be notified.

This service should be transparently provided to the subscriber (i.e. independent of existing voice calls, data, or other services being provided).

B2.1 Attributes

Normal service operation includes invocation upon initial registration, autonomous registration, call origination, and call termination. Location-Based Charging should analyze location information to compare against service zones established for the subscriber. The service would notify the subscriber of their relative location to the established service zone, indicating either "in" or "out" of zone. As the subscriber changes location or predefined location service area they should be notified of their location-based charging service opportunity, being "in" or "out" of a subscribed zone. Except for subscriber notification, the user should experience transparency in interaction with other services (Voice, Data, SMS, etc).

This service may, as an option, be activated/de-activated using special feature codes on a subscriber or business customer basis.

B2.1.1 Target Subscriber Notification

The user needs to be informed on an ongoing basis which zone and billing rate is currently applicable.

Users should be enabled to make an informed decision on expected call charges and therefore need to be provided charging zone information accurately, and in a timely manner, being notified which zone they are in when a call is set up. Notification to the subscriber/user could be provided in several forms including tone, announcement, or short message.

The billing system will need to consider the following possible scenarios:

1. For the duration of the call, the subscriber remains in a single charging zone

2. During the call, the charging zones may change

2.1. The user may initiate a call in one zone, then move to a different zone where the call is terminated.

2.2. The user may cross back and forth between zones multiple times during the duration of a call, and the call may terminate in the zone it was originated from, or in a different zone.

Notification to the user may be via the UE MMI prior to initiation of the call and, during the call.

B2.1.2 Charging

To support appropriate charging, call detail records may need to include the following additional information:

1 Location Service (Location Based Charging) Identification

2 Location Information

3 Zone Information

4 Type of Event

5 Duration of Event

B2.1.3 Roaming

If a subscriber with active location based charging roams into a system that does not support the service, the subscriber may be notified of an "out of coverage zone" notification using the best possible method (UE display, SMS, etc.).

B3 Tracking Services

Although Fleet and Asset Management services may be offered as separate services, within this document they are described as a single service category. In a similar manner, Person Tracking may be viewed as a form of personal asset tracking.

B3.1 Fleet and Asset Management Services

Fleet and Asset Management services allow the tracking of location and status of specific service group users. Examples may include a supervisor of a delivery service who needs to know the location and status of employees, parents who need to know where their children are, animal tracking, and tracking of assets.

The service may be invoked by the managing entity, or the entity being managed, depending on the service being provided.

Fleet Management may enable an enterprise or a public organization to track the location of vehicles (cars, trucks, etc.) and use location information to optimize services.

Asset management services, for example, may range from asset visualization (general reporting of position) to stolen vehicle location and geofencing (reporting of location when an asset leaves or enters a defined zone). The range of attributes for these services is wide.

For Fleet and Asset Management services, a distinction may be made between the manager of the fleet/assets in charge of tracking, and the entities being tracked (service group users, etc). The tracking service may make use of mobile station handsets with possible specialized functions (Web browsers, etc) to allow for tracking and specific methods for communicating with the managing entity. A managing entity would be able to access one or several managed entities' location and status information through a specified communication interface (Internet, Interactive Voice Response, Data service, etc). The managing entity would be able to access both real-time and recent location and status results of managed entities.

The network shall provide the capability to provide the last known location and timestamp. In cases where the service group user's mobile station is not registered (i.e. Inactive, out of coverage) the last known location information and timestamp may optionally be provided. If this information is unavailable in real-time, a reason for why the information is unattainable may be provided. The managing entity may also be able to relay messages to service group users through the appropriate interface, as well as receive messages originated by the service group users.

Activation of Fleet and Asset Management services could be performed via subscriber provisioning by the service provider, as well as by offering subscriber-based service activation codes to the service group user/subscriber. The managing entity could also initiate service via requests to a provisioning system through Interactive Voice Response or Internet request. A feature code may optionally also be provided to allow for specific mobile user group subscriber activation by the managing entity (*FC + Mobile ID). A specific user group mobile could also be able to self-activate through the use of a feature code.

B3.2 Traffic Monitoring

Mobiles in automobiles on freeways anonymously sampled to determine average velocity of vehicles. Congestion detected and reported.

Congestion, average flow rates, vehicle occupancy and related traffic information can be gathered from a variety of sources including roadside telematic sensors, roadside assistance organizations and ad-hoc reports from individual drivers. In addition average link speeds can be computed through anonymous random sampling of UE locations.

B3.2.1 Attributes

B3.2.1.1 Privacy

Anonymous sampling of target UE requires all unique information relating to the UE location to be retained by the network operator. Depending on the capabilities of the location method (ref. section 3.4) traffic behavior described above can only be determined if an UE is sampled at least twice within a finite predetermined period.

The UE identification must be sufficiently unique to allow time separated measurements to be paired before discarding the source UE identification.

The level of uniqueness can be a highly truncated form of the UE-IMSI (or equivalent). For example maintaining 1000 unattached location estimates for subsequent pairing with future estimates will only require 3 least significant digits of the IMSI. Ambiguity in matching will occur but at a low (detectable) rate. Finally, all unattached estimates can be set to expire after a preset time.

B4 Enhanced Call Routing

Enhanced Call Routing (ECR) allows subscriber or user calls to be routed to the closest service client based on the location of the originating and terminating calls of the user. The user may optionally dial a feature or service code to invoke the service (*GAS for closest gas station, etc).

In addition to routing the call based on location, ECR should be capable of delivering the location information to the associated service client. For example, this capability may be needed for services such as Emergency Roadside Service. This could be used for the purpose of dispatching service agents for ECR service clients that can make use of this information.

ECR services may be offered, for example, through menu driven access allowing users to interactively select from a variety of services.

B5 Location Based Information Services

Location-Based Information services allow subscribers to access information for which the information is filtered and tailored based on the location of the requesting user. Service requests may be initiated on demand by subscribers, or automatically when triggering conditions are met, and may be a singular request or result in periodic responses.

The following subsections provide some examples of possible location based information services.

B5.1 Navigation

The purpose of the navigation application is to guide the handset user to his/her destination. The destination can be input to the terminal, which gives guidance how to reach the destination. The guidance information can be e.g. plain text, symbols with text information (e.g. turn + distance) or symbols on the map display. The instructions may also be given verbally to the users by using a voice call.

Note: this may involve a service provider giving verbal directions to a lost motorist, or providing periodic short text messages (possibly using SMS), in addition to, or as an alternative to the provision of a graphic map.

This can be accomplished through carrying a mobile phone that has location technology capabilities down to a few feet. Less granularity impedes the applicability of this functionality.

This service can either be menu driven from a handset using SIM Application Toolkit or a WAP based terminal with a map application running – similar to a GPS system. A central server may handle all mapping of locations, and may save specific locations (i.e., favorite fishing holes).

B5.2 City Sightseeing

City Sightseeing would enable the delivery of location specific information to a sightseer. Such information might consist of combinations of the services described throughout this document to describe historical sites, providing navigation directions between sites, facilitate finding the nearest restaurant, bank, airport, bus terminal, restroom facility, etc.

B5.3 Location Dependent Content Broadcast

The main characteristic of this service category is that the network automatically broadcasts information to terminals in a certain geographical area. The information may be broadcast to all terminals in a given area, or only to members of specific group (perhaps only to members of a specific organization). The user may disable the functionality totally from the terminal or select only the information categories that the user is interested in.

An example of such a service may be localized advertising. For example, merchants could broadcast advertisements to passersby based on location / demographic / psychographic information (for example "today only, 30% off on blue jeans").

B5.4 Mobile Yellow Pages

The internet has also changed how people find phone numbers. Instead of thumbing through the yellow pages or calling Directory assistance you simply go online and search the number. The need for paper copy phonebooks is gone.

Wireless takes this one step further by adding the location of the subscriber to the search. Now the phone number of the nearest location can be ascertained as opposed to all locations within a 50-mile area.

Mobile Yellow Pages services provide the user with the location of the nearest service point, e.g. Italian restaurant. The result of the query may be a list of service points fulfilling the criteria (e.g. Italian restaurants within three kilometers). The information can be provided to the users in text format (e.g. name of the restaurant, address and telephone number) or in graphical format (map showing the location of the user and the restaurants).

B5.5 Location Sensitive Internet

Location Sensitive Internet is for further study.

B6 Network Enhancing Services

The Network Enhancing Services described in this section are for further study and privacy issues will require further consideration.

B6.1 Applications for Network Planning

The network operator may be able to use location information to aid network planning. The operator may be able to locate calls in certain areas to estimate the distribution of calls and user mobility for network planning purposes. These applications may be used for hot spot detection and user behavior modeling

B6.2 Applications for Network QoS Improvements

The network operator may be able to use location services to improve the Quality of Service of the network. The location system may be used to track dropped calls to identify problematic areas. The system may also be used to identify poor quality areas.

B6.3 Improved Radio Resource Management

The location of the handset may be used for more intelligent handovers and more efficient channel allocation techniques.

Annex C (Informative): Attributes of Specific Services

The following table (provided by the GSM Alliance Services Working Group) depicts ranges of values that may be expected for various attributes of location based services.

Requirement -> Service Category	Service Authorization	Privacy	Target Subscriber Notification	Horizontal Accuracy	Vertical Accuracy	Response Time	Reliability	Security	Periodic Location Reporting	Service Registration	Service Activation	Service De-Activation	Service Invocation	Roaming	Service Specific Considerations	Interactions With Other Wireless Services
Public Safety Services																
Emergency Services	None req'd	Implied when dialing 911 info provided to safety organizations	Not required	Network based: 100m (67%) 300m (95%) Handset based: 50m (67%) 150m (95%)	n/a now (5-15m future ?	5 sec.	Same as GSM	Same as GSM	Required Period TBD suggest 1-10 minutes	None req'd	None required	Not Allowed	Keystroke or Dialed string (911)	Required if emergency call can be made		Lat and Long. To PSAP

Requirement -> Service Category	Service Authorization	Privacy	Target Subscriber Notification	Horizontal Accuracy	Vertical Accuracy	Response Time	Reliability	Security	Periodic Location Reporting	Service Registration	Service Activation	Service De-Activation	Service Invocation	Roaming	Service Specific Considerations	Interactions With Other Wireless Services
Emergency Alert Services	Req'd	Info only passed to subscribed to service provider	Not required	125 m (10 m future?)	n/a now (5-15m future?	5 sec.	Same as GSM	Same as GSM	Required Period TBD suggest 1-10 minutes	Req'd	By menu, keystroke, interactive or live operator	By menu, keystroke, interactive or live operator	Automatic	Preferred where roaming is allowed		Lat & Long to Service Provider Live, SMS or other data service (WAP,GPRS) return msg.
Location Sensitive Charging																
Home-Zone Billing	Req'd	Info only passed to subscribed to carrier	Not required	Depends on billing zone (5m-300m)	n/a	Depends on increments of billing.	Same as GSM	Same as GSM	Required depends on billing increment and coverage zone	Req'd	Interactive with Carrier	Interactive with Carrier	Automatic	n/a		Lat & Long to Carrier

Requirement -> Service Category	Service Authorization	Privacy	Target Subscriber Notification	Horizontal Accuracy	Vertical Accuracy	Response Time	Reliability	Security	Periodic Location Reporting	Service Registration	Service Activation	Service De-Activation	Service Invocation	Roaming	Service Specific Considerations	Interactions With Other Wireless Services
Tracking Services																
Fleet Mgment.	Req'd	Info only passed to subscribed to service provider	Not required	125m-Cell ID	n/a	5 sec.	Same as GSM	Same as GSM	Required (1-10 minutes)	Req'd	Interactive or live operator	Interactive or live operator	Interactive or live operator	Preferred where roaming is allowed		Lat & Long to Service Provider To requesting customer's interface (e-mail, Web or live operator

Requirement -> Service Category	Service Authorization	Privacy	Target Subscriber Notification	Horizontal Accuracy	Vertical Accuracy	Response Time	Reliability	Security	Periodic Location Reporting	Service Registration	Service Activation	Service De-Activation	Service Invocation	Roaming	Service Specific Considerations	Interactions With Other Wireless Services
Asset Mgment	Req'd	Info only passed to subscribed to service provider	Not required	10m-125m	n/a (5-15m future?)	5 sec.	Same as GSM	Same as GSM	Required (1-10 minutes)	Req'd	Interactive or live operator	Interactive or live operator	Interactive or live operator	Preferred where roaming is allowed	Special Terminal	Lat & Long to Service Provider To requesting customer's interface (e-mail, Web or live operator

Requirement -> Service Category	Service Authorization	Privacy	Target Subscriber Notification	Horizontal Accuracy	Vertical Accuracy	Response Time	Reliability	Security	Periodic Location Reporting	Service Registration	Service Activation	Service De-Activation	Service Invocation	Roaming	Service Specific Considerations	Interactions With Other Wireless Services
Person Tracking	Req'd	Info only passed to subscribed to service provider	May be required (Child versus Employee?)	10m-125m	n/a (5-15m future?	5 sec.	Same as GSM	Same as GSM	Required (1-10 minutes)	Req'd	Interactive or live operator	Interactive or live operator	Interactive or live operator	Preferred where roaming is allowed		Lat & Long to Service Provider To requesting customer's interface (e-mail, Web or live operator

Requirement -> Service Category	Service Authorization	Privacy	Target Subscriber Notification	Horizontal Accuracy	Vertical Accuracy	Response Time	Reliability	Security	Periodic Location Reporting	Service Registration	Service Activation	Service De-Activation	Service Invocation	Roaming	Service Specific Considerations	Interactions With Other Wireless Services
Pet Tracking	Req'd	Info only passed to subscribed to service provider	Not required	10m-125m	n/a (5-15m future ?	5 sec.	Same as GSM	Same as GSM	Required (1-10 minutes)	Req'd	Interactive or live operator	Interactive or live operator	Interactive or live operator	Preferred where roaming is allowed	Special Terminal	Lat & Long to Service Provider To requesting customer's interface (e-mail, Web or live operator
Traffic Monitoring																
Traffic Congestion Reporting	Req'd	No specific Target UE info allowed	Not required	10-40m Hi- res. req'd muti- near proximity lanes (opposing and adjacent)	May be req'd for over-passes	5 sec.	Same as GSM	Same as GSM	Required (1-2 minutes)	Req'd	By menu, keystroke, interactive or live operator	By menu, keystroke, interactive or live operator	By menu, keystroke, interactive or live operator	Preferred where roaming is allowed	High bandwidth req on network.	Lat & Long to Service Provider Live or SMS return msg.

Requirement -> Service Category	Service Authorization	Privacy	Target Subscriber Notification	Horizontal Accuracy	Vertical Accuracy	Response Time	Reliability	Security	Periodic Location Reporting	Service Registration	Service Activation	Service De-Activation	Service Invocation	Roaming	Service Specific Considerations	Interactions With Other Wireless Services
Enhanced Call Routing																
Routing to Nearest Commercial Enterprise	Req'd	Info only passed to subscribed to service provider	Not required	10m-125m	n/a	5 sec.	Same as GSM	Same as GSM	Not required	Req'd	By menu, keystroke, interactive or live operator	By menu, keystroke, interactive or live operator	By menu, keystroke, interactive or live operator	Preferred where roaming is allowed		Lat & Long to Service Provider
Roadside Assistance	Req'd	Info only passed to subscribed to service provider	Not required	10m-125m	n/a	5 sec.	Same as GSM	Same as GSM	Not required	Req'd	By menu, keystroke, interactive or live operator	By menu, keystroke, interactive or live operator	By menu, keystroke, interactive or live operator	Preferred where roaming is allowed		Lat & Long to Service Provider Live or SMS return msg.
Location Based Information Services																

Requirement -> Service Category	Service Authorization	Privacy	Target Subscriber Notification	Horizontal Accuracy	Vertical Accuracy	Response Time	Reliability	Security	Periodic Location Reporting	Service Registration	Service Activation	Service De-Activation	Service Invocation	Roaming	Service Specific Considerations	Interactions With Other Wireless Services
Navigation	Req'd	Info only passed to subscribed to service provider	Required	10m-125m	n/a	5 sec.	Same as GSM	Same as GSM	Required (1-10 minutes)	Req'd	By menu, keystroke, interactive or live operator	By menu, keystroke, interactive or live operator	By menu, keystroke, interactive or live operator	Preferred where roaming is allowed		Lat & Long to Service Provider Live, SMS or other data service (WAP,GPRS) return msg.

Requirement -> Service Category	Service Authorization	Privacy	Target Subscriber Notification	Horizontal Accuracy	Vertical Accuracy	Response Time	Reliability	Security	Periodic Location Reporting	Service Registration	Service Activation	Service De-Activation	Service Invocation	Roaming	Service Specific Considerations	Interactions With Other Wireless Services
City Sightseeing	Req'd	Info only passed to subscribed to service provider	Not required	10m-125m	n/a	5 sec.	Same as GSM	Same as GSM	Not required	Req'd	By menu, keystroke, interactive or live operator	By menu, keystroke, interactive or live operator	By menu, keystroke, interactive or live operator	Preferred where roaming is allowed		Lat & Long to Service Provider Live, SMS or other data service (WAP,GPRS) return msg.
Localized Advertising	Req'd	Info only passed to subscribed to service provider	Not required	125m-Cell ID	n/a	Not sensitive (default to 5 sec.)	Same as GSM	Same as GSM	Not required	Req'd	By menu, keystroke, interactive or live operator	By menu, keystroke, interactive or live operator	By menu, keystroke, interactive or live operator	Preferred where roaming is allowed		Lat & Long to Service Provider SMS return msg.

Requirement -> Service Category	Service Authorization	Privacy	Target Subscriber Notification	Horizontal Accuracy	Vertical Accuracy	Response Time	Reliability	Security	Periodic Location Reporting	Service Registration	Service Activation	Service De-Activation	Service Invocation	Roaming	Service Specific Considerations	Interactions With Other Wireless Services
Mobile Yellow Pages	Req'd	Info only passed to subscribed to service provider	Not required	125m-Cell ID	n/a	5 sec.	Same as GSM	Same as GSM	Not required	Req'd	By menu, keystroke, interactive or live operator	By menu, keystroke, interactive or live operator	By menu, keystroke, interactive or live operator	Preferred where roaming is allowed		Lat & Long to Service Provider Live, SMS or other data service (WAP,GPRS) return msg.
Service Provider Specific Services																
Network Planning	Not Req'd	Specific Target UE info allowed	Not Required	10m-Cell ID	n/a	5 sec.	Same as GSM	Same as GSM	Required (1 minute)	Not Req'd	N/a	n/a	n/a	n/a		n/a
Dynamic Network Control	Not Req'd	Specific Target UE info allowed	Not Required	10m-Cell ID	n/a	5 sec.	Same as GSM	Same as GSM	Required (1 minute)	Not Req'd	N/a	n/a	n/a	n/a		n/a

Annex D (informative): Change history

Change history											
TSG SA#	SA Doc.	SA1 Doc	Spec	CR	Rev	Rel	Cat	Subject/Comment	Old	New	WI
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-08	SP-000212	S1-000338	22.071	006		R00	C	Incorporation of TSG SA1#8 LCS Contributions and email contributions	3.2.0	4.0.0	
SP-09	SP-000378	S1-000484	22.071	008		R4	F	Correction to LCS Service Description Stage 1 Document (R'00)	4.0.0	4.1.0	
SP-09	SP-000392	S1-000667	22.071	009		R4	C	Provision of Velocity for Location Services	4.0.0	4.1.0	
SP-09	SP-000392	S1-000670	22.071	010		R4	B	External LCS client identity	4.0.0	4.1.0	
SP-09	SP-000392	S1-000671	22.071	011		R4	B	Privacy Control for LCS	4.0.0	4.1.0	
SP-09	SP-000392	S1-000672	22.071	012		R4	F	Privacy Control for LCS	4.0.0	4.1.0	
SP-09	SP-000392	S1-000673	22.071	013		R4	D	Clarifications to LCS on privacy and Service response	4.0.0	4.1.0	
SP-09	SP-000392	S1-000674	22.071	014		R4	F	LCS: Geographic Location	4.0.0	4.1.0	
SP-09	SP-000392	S1-000675	22.071	015		R4	D	Adding statement on "active" and "idle" UE in chapter 4.13	4.0.0	4.1.0	
SP-09	SP-000392	S1-000676	22.071	016		R4	D	Radio Access Network support for LCS	4.0.0	4.1.0	
SP-09	SP-000392	S1-000677	22.071	017		R4	D	LCS, Identification of a Target UE using IP addresses	4.0.0	4.1.0	
SP-09	SP-000392	S1-000678	22.071	018		R4	D	LCS: LCS Open Service Architecture (OSA) and Application Programming Interface.	4.0.0	4.1.0	
SP-10	SP-000544	S1-000787	22.071	019		Rel-4	B	Privacy Exception List	4.1.0	4.2.0	LCS
SP-10	SP-000544	S1-000788	22.071	020		Rel-4	B	Periodic Location Reporting	4.1.0	4.2.0	LCS
SP-10	SP-000544	S1-000791	22.071	021		Rel-4	B	Location Service Request	4.1.0	4.2.0	LCS
SP-10	SP-000544	S1-000851	22.071	022		Rel-4	C	Periodic Location Reporting amendment	4.1.0	4.2.0	LCS1
SP-10	SP-000544	S1-000803	22.071	023		Rel-4	C	Addition of achieved location information accuracy with reference to TS 23.032	4.1.0	4.2.0	LCS1
SP-11	SP-010044	S1-010235	22.071	024		Rel-4	C	Quality level negation	4.2.0	4.3.0	LCS1
SP-11	SP-010044	S1-010239	22.071	025		Rel-4	C	Location determination in call or PDP context activation and release	4.2.0	4.3.0	LCS1-PS
SP-11	SP-010044	S1-010237	22.071	026		Rel-4	C	OSA support for LCS	4.2.0	4.3.0	LCS1
SP-11	SP-010044	S1-010218	22.071	027		Rel-4	D	Editorial Cleanup	4.2.0	4.3.0	LCS1
SP-11	SP-010044	S1-010269	22.071	028		Rel-4	C	Number of LCS Clients	4.2.0	4.3.0	LCS1

SP-14	SP-010673	S1-011285	22.071	029		Rel-5	C	Privacy Override Indicator	4.3.0	5.0.0	LCS1
SP-15	SP-020047	S1-020467	22.071	030		Rel-5	B	CR 22.071 Rel.5 B Requestor	5.0.0	5.1.0	LCS1
SP-15	SP-020047	S1-020478	22.071	031		Rel-5	B	CR 22.071 Rel.5 B Introducing service type privacy for location services	5.0.0	5.1.0	LCS1
SP-15	SP-020047	S1-020479	22.071	032		Rel-5	C	Introduction of a Codeword Setting	5.0.0	5.1.0	LCS1
SP-15	SP-020047	S1-020632	22.071	033		Rel-5	B	CR to 22.071 on Clarifying checking of requester ID	5.0.0	5.1.0	LCS1
SP-15	SP-020043	S1-020455	22.071	036		Rel-5	A	CR 22.071 Rel-5 A Closure of a loophole in the privacy settings	5.0.0	5.1.0	TEI
SP-15	SP-020047	S1-020466	22.071	037		Rel-5	B	CR 22.071 Rel.5 B Deferred Location Request with Change of Area Event	5.0.0	5.1.0	LCS1
SP-15	SP-020045	S1-020457	22.071	039	-	Rel-5	A	Editorial CR to correct terms and references	5.0.0	5.1.0	CORRECT
			22.071	-	-	Rel-5		Editorial to change page layout for Annex C	5.1.0	5.1.1	
SP-16	SP-020254	S1-020864	22.071	040		Rel-6	C	CR to TS 22.071 Rel-6 Privacy control in HPLMN	5.1.1	6.0.0	LCS1
SP-16	SP-020254	S1-020922	22.071	041		Rel-6	C	Enhancement of Codeword Requirements for LCS	5.1.1	6.0.0	LCS1
SP-17	SP-020556	S1-021662	22.071	042		Rel-6	D	CR to 22.071: Too big file size	6.0.0	6.1.0	LCS1
SP-17	SP-020556	S1-021794	22.071	043		Rel-6	B	CR to 22.071 on LCS Anonymous requestor and anonymous target mobile (REL6)	6.0.0	6.1.0	LCS1
SP-17	SP-020556	S1-021490	22.071	044		Rel-6	B	CR to 22.071 on LCS Codeword improvements (REL6)	6.0.0	6.1.0	LCS1
SP-17	SP-020556	S1-021491	22.071	045		Rel-6	B	LCS extended user privacy	6.0.0	6.1.0	LCS1
SP-17	SP-020556	S1-021799	22.071	046		Rel-6	C	Update to 22.071 for regional specific location accuracy requirements	6.0.0	6.1.0	LCS
SP-18	SP-020657	S1-022013	22.071	047		Rel-6	C	CR to LCS stage 1 'Service Type'	6.1.0	6.2.0	LCS2
SP-18	SP-020657	S1-022299	22.071	048		Rel-6	C	Handling of privacy checks for Network Induced Location Requests	6.1.0	6.2.0	LCS2
SP-19	SP-030020	S1-030277	22.071	049	-	Rel-6	B	Applicability of barring capability to the Location Service	6.2.0	6.3.0	LCS2
SP-20	SP-030252	S1-030526	22.071	050	-	Rel-6	B	Introduction of codeword generation by network or UE	6.3.0	6.4.0	LCS
SP-20	SP-030252	S1-030392	22.071	051	-	Rel-6	B	LCS in IMS	6.3.0	6.4.0	LCS
SP-20	SP-030252	S1-030557	22.071	052		Rel-6	F	Clarification of requirement regarding 'Query, Cancel of activated location requests for the Target UE'	6.3.0	6.4.0	LCS
SP-20	SP-030322	S1-030650	22.071	053		Rel-6	B	Routing of Emergency Calls based on Geographic Coordinates	6.3.0	6.4.0	LCS2
SP-21	SP-030455	S1-030945	22.071	056	-	Rel-6	A	Correction of requirements on the identity format of LCS clients	6.4.0	6.5.0	TEI
SP-21	SP-030459	S1-030946	22.071	057	-	Rel-6	C	Clarification of Mobile Originating Location	6.4.0	6.5.0	TEI6
SP-21	SP-030459	S1-030947	22.071	058	-	Rel-6	B	A requirement of authentication to the Target UE user	6.4.0	6.5.0	LCS
SP-21	SP-030459	S1-030948	22.071	059	-	Rel-6	B	Introduction of LCS QoS Classes	6.4.0	6.5.0	LCS2
SP-22	SP-030690	S1-031328	22.071	062	-	Rel-6	A	Removal of misleading and obsolete text	6.5.0	6.6.0	LCS1
SP-22	SP-030697	S1-031272	22.071	063	-	Rel-6	F	Correction of "velocity" requirements	6.5.0	6.6.0	LCS1
SP-22	SP-030697	S1-031329	22.071	064	-	Rel-6	B	Cell ID	6.5.0	6.6.0	LCS

3GPP TS 22.101 6.6.0 (2004-01)

Technical Specification

3rd Generation Partnership Project;
Technical Specification Group Services and System Aspects
Service aspects;
Service principles
(Release 6)

Keywords
UMTS, service

3GPP

Postal address

3GPP support office address
650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet
http://www.3gpp.org

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:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

This Technical Specification (TS) describes the Service Principles for PLMNs specified by 3GPP.

3GPP specifications provide integrated personal communications services. The system will support different applications ranging from narrow-band to wide-band communications capability with integrated personal and terminal mobility to meet the user and service requirements of the 21st century.

3GPP specifications allow the realisation of a new generation of mobile communications technology for a world in which personal communications services should allow person-to-person calling, independent of location, the terminal used, the means of transmission (wired or wireless) and the choice of technology. Personal communication services should be based on a combination of fixed and wireless/mobile services to form a seamless end-to-end service for the user.

3GPP specifications should be in compliance with the following objectives:

a) to provide a single integrated system in which the user can access services in an easy to use and uniform way in all environments;

b) to allow differentiation between service offerings of various serving networks and home environments;

c) to provide a wide range of telecommunications services including those provided by fixed networks and requiring user bit rates of up to 2 Mbits/s as well as services special to mobile communications. These services should be supported in residential, public and office environments and in areas of diverse population densities. These services are provided with a quality comparable with that provided by fixed networks such as ISDN;

d) to provide services via hand held, portable, vehicular mounted, movable and fixed terminals (including those which normally operate connected to fixed networks), in all environments (in different service environments - residential, private domestic and different radio environments) provided that the terminal has the necessary capabilities;

e) to provide support of roaming users by enabling users to access services provided by their home environment in the same way even when roaming.

f) to provide audio, data, video and particularly multimedia services;

g) to provide for the flexible introduction of telecommunication services;

h) to provide within the residential environment the capability to enable a pedestrian user to access all services normally provided by fixed networks;

i) to provide within the office environment the capability to enable a pedestrian user to access all services normally provided by PBXs and LANs;

j) to provide a substitute for fixed networks in areas of diverse population densities, under conditions approved by the appropriate national or regional regulatory authority.

k) to provide support for interfaces which allow the use of terminals normally connected to fixed networks.

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] 3GPP TS 22.105 “Services and Service Capabilities”

[2] 3GPP TS 22.121: "Virtual Home Environment (VHE), Stage 1"

[3] 3GPP TS 22.038: "SIM application toolkit, stage 1"

[4] 3GPP TS 22.001: " Principles of Circuit telecommunication services supported by a Public Land Mobile Network (PLMN)".

[5] 3GPP TS 22.004: General on supplementary services"

[6] 3GPP TS 22.030: "Man-Machine Interface (MMI) of the User Equipment (UE)"

[7] 3GPP TS 22.066: "Support of Mobile Number Portability (MNP); Service description; Stage 1"

[8] 3GPP TS 22.079: " Support of Optimal Routing; Stage 1"

[9] 3GPP TS 22.129: "Handover Requirements between UTRAN and GERAN or other Radio Systems"

[10] 3GPP TS 33.102: "Security Architecture"

[11] 3GPP TS 22.011: "Service Accessibility"

[12] 3GPP TS 22.016: "International mobile Station Equipment Identities (IMEI)"

[13] 3GPP TS 24.008: " Mobile Radio Interface Layer 3 Specification"

[14] 3GPP TS 22.003: "Circuit Teleservices supported by a Public Land Mobile Network (PLMN)"

[15] 3GPP TS 21.133: "Security Threats and Requirements"

[16] 3GPP TS 33.120: "Security Principles"

[17] 3GPP TS 22.042: "Network Identity and Time Zone, Service Description, Stage 1"

[18] 3GPP TS 42.009: " Security Aspects"

[19] 3GPP TS 31.102: "USIM Application Characteristics"

[20] 3GPP TS 23.221 “Architectural Requirements”

[21] 3GPP TS 22.002: “Circuit Bearer Services (BS) supported by a Public Land Mobile Network (PLMN)”

[22] 3GPP TS 22.060: “General Packet Radio Service (GPRS)”

[23] 3GPP TS 29.002: “Mobile Application Part (MAP) specification ”

[24] 3GPP TR 23.972: "Circuit Switched Multimedia Telephony".

[25] 3GPP TS 22.140: "Multimedia messaging service; Stage 1".

[26] 3GPP TS 22.226: “Global Text Telephony, Stage 1.”

[27] 3GPP TS 22.228: "IP multimedia (IM) CN subsystem, stage 1"

[28] RFC 3261: "SIP: Session Initiation Protocol"

[29] 3GPP TR 21.905: “ Vocabulary for 3GPP Specifications”

[30] 3GPP TS 26.233: "Packet Switched Streaming Service (PSS) ; General Description"

[31] 3GPP TS 26.234: "Packet Switched Streaming Service (PSS) ; Protocols and Codecs"

[32] 3GPP TR 22.934: "Feasibility study on 3GPP system to Wireless LAN interworking"

[33] RFC 2486: "The Network Access Identifier"

[34] TS 51.011: "Specification of the Subscriber Identity Module - Mobile Equipment (SIM-ME) interface", Release 4

3 Definitions, symbols and abbreviations

3.1 Definitions

Definitions are given in 3GPP TR 21.905 [29].

3.2 Abbreviations

For the purposes of this TS, the following abbreviations apply:

ME Mobile Equipment
PC Personal Computer

Further abbreviations are given in 3GPP TR 21.905 [29].

4 General

4.1 Aims of 3GPP specifications

It shall be capable of delivering audio, text, video and graphics direct to people and provide them with access to the next generation of information based services. It moves mobile and personal communications forward from existing systems, delivering massmarket low-cost digital telecommunication services.

The aims are:

- to enable users to access a wide range of telecommunications services, including many that are today undefined as well as multi-media and high data rates.
- to facilitate the provision of a high quality of service (particularly speech quality) similar to that provided by fixed networks;
- to facilitate the provision of small, easy to use, low cost terminals with long talk time and long standby operation;
- to provide an efficient means of using network resources (particularly radio spectrum).

4.2 Standardisation of Service Capabilities

Existing systems have largely standardised the complete sets of teleservices, applications and supplementary services which they provide. As a consequence, substantial re-engineering is often required to enable new services to be provided and the market for services is largely determined by operators and standardisation. This makes it more difficult for operators to differentiate their services.

3GPP shall therefore standardise service capabilities and not the services themselves. Service capabilities consist of bearers defined by QoS parameters and the mechanisms needed to realise services. These mechanisms include the

functionality provided by various network elements, the communication between them and the storage of associated data. This TS provides a conceptual description of a service architecture and architecture requirements which aim to provide service capabilities. It is intended that these standardised capabilities should provide a defined platform which will enable the support of speech, video, multi-media, messaging, data, other teleservices, user applications and supplementary services and enable the market for services to be determined by users and home environments.

4.2.1 Provision of service capabilities in shared networks

The provision of services and service capabilities that is possible to offer in a network shall not be restricted by the existence of the network sharing It shall be possible for a core network operator to differentiate its service offering from other core network operators within the shared network.

It shall be possible to control the access to service capabilities offered by a shared network according to the core network operator the user is subscribed to.

4.3 Efficient Use of Network Resources

Service capabilities shall take account of the discontinuous and asymmetric nature of most teleservices and user applications in order to make efficient use of network resources (particularly radio resources).

Service capabilities shall be provided in a wide range of radio operating environments (where a radio environment is characterised in terms of propagation environment, mobile equipment relative speeds and traffic characteristics - see [2]). Although 3GPP aims to minimise the number of radio interfaces and to maximise commonality between them, it may utilise several radio interfaces, each optimised for different environments. Each radio interface might provide differing service capabilities. 3GPP specifications include UTRAN radio interface supporting two modes (TDD and FDD)and GERAN radio interface.

3GPP specifications shall provide a mechanism which will enable a piece of user equipment (UE) to adapt to different radio interfaces as necessary and to determine the service capabilities available. The specifications shall also provide a mechanism which will enable a UE to select radio interfaces capable of providing appropriate service capabilities.

4.4 Compatibility with Global Standards

3GPP specifications aim to be compatible with IMT-2000 and to provide global terminal mobility (roaming), enabling the user to take his/her terminal to different regions of the world and to be provided with services. It is probable that different regions of the world will adopt different radio interface technologies. IMT-2000, as a global standard, should therefore enable a IMT-2000 terminal to determine the radio interface technology and the radio interface standard used in a region. Global terminal roaming also requires the global standardisation of service capabilities. As far as possible the method of indication of the radio interface standard and available service capabilities shall be aligned with IMT-2000.

3GPP specifications shall enable users to access the services provided by their home environment in the same way via any serving network provided the necessary service capabilities are available in the serving network.

The 3GPP specifications will be available for the partner organisations to adopt as their regional standards. For example in Europe, ETSI may adopt them as standards for both GSM and UMTS.

4.5 Virtual Home Environment

The 3GPP specifications aim to provide the user with a comprehensive set of services and features, which have the "same look and feel" wherever they are used. For further information see 3GPP 22.121 [2]. Especially the VHE shall provide for:

- a generic set of services / features and access capabilities, if the required service capabilities are available in the visited network;
- the means for serving network, home environments and user to re-use existing system capabilities to define their own specific features / services;

- user personalisation of features / services;
- a personalised service set being used via all access and transport networks, subject to physical limitations;
- the ability for the user to have access to personalised services from any suitable UE;
- regional or network based variations, enhancements to the basic services;
- future evolution of 3GPP specification itself.

4.6 Functionality of Serving Network and Home Environment

The following functionality shall be the responsibility of the home environment:

- User Authentication.
- SIM/USIM Issue.
- Billing.
- User Profile/VHE Management.

The following functionality shall be the responsibility of the serving network:

- Radio or other means of access.
- Transport and signalling.

The following functionality may be the responsibility of either the serving network, the home environment or an appropriate combination of both

- Service Control.
- QoS negotiation.
- Mobility management, including roaming.
- Automatic establishment of roaming agreements.

4.7 PLMN Architecture

The network is logically divided into a radio access network and a core network, connected via an open interface. From a functional point of view the core network is divided into a Packet Switched CN Domain, IP Multimedia (IM) CN subsystem and a Circuit Switched CN Domain. IM CN subsystem utilises PS CN domain (GPRS) bearer services.

CS CN domain supports bearer independent transport. There is no difference in service offering or UE functionality due to different transport.

For further information see 3GPP TS 23.221 [20].

4.8 Interworking Between PLMN and Wireless LANs

4.8.1 General

WLAN-3GPP system interworking is defined as a wireless IP connectivity service where the user obtains access via a Wireless LAN technology. It shall be possible to deploy the WLAN as an integral part of the 3GPP system or the two systems can be separate.

The 3GPP system shall be capable of interworking with one or more WLANs and a WLAN shall be capable of interworking with one or more 3GPP systems see figure 0.

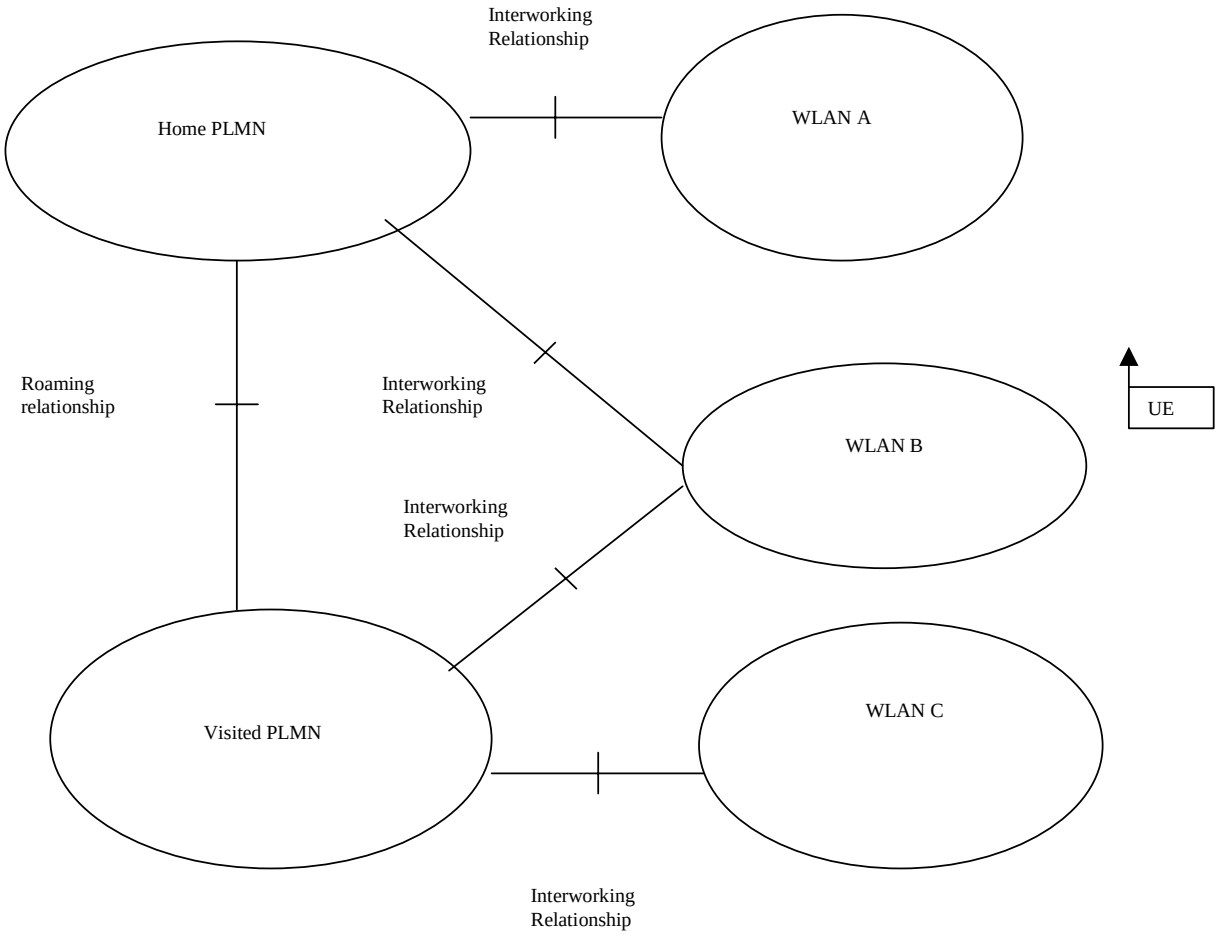

Figure 0: WLAN-3GPP system Interworking Relationships

Selection of the network is defined in TS 22.011 [11]

The service is subject to a 3GPP system subscription see section 15. Both IPv4 and IPv6 connectivity via a Wireless LAN (WLAN) shall be supported.

It is an operator decision as to the level of interworking supported. This can be broadly grouped as:

1. 3GPP based access control and charging. The user shall be able to access general internet services and/or corporate intranets. (Scenario 2 of TR 22.934 [32])

2. Access to 3GPP PS based services, e.g. IMS. (Scenario 3 of TR 22.934 [32])

3. Access to 3GPP PS based services with service continuity. The user mayor may not notice a disruption in service, depending upon the level of service continuity supported. This is further defined in TS 22.129 [9]. (Scenarios 4 and 5 of TR 22.934 [32])

NOTE: Further information on these levels of interworking and the use cases supported can be found in TR 22.934 [32].

In addition to the general requirements on I-WLAN defined in the present document, the following requirements apply:

1. When enabling access to 3GPP services that require separate authentication and access control, such as IMS, the service authentication and access control mechanisms for that service shall be used.

2. It should be possible to provide access via I-WLAN on deployed WLAN devices.

4.8.2 Simultaneous Connection to I-WLANs and 3GPP systems

The 3GPP system shall support simultaneous connection to an I-WLAN and to the 3GPP systems for the following scenarios:

- For an integrated WLAN/3GPP device the user shall be able to make or receive a CS domain call without the need to drop the connection to the I-WLAN and visa versa.
- For an integrated WLAN/3GPP device the user shall be able to connect to both the PS domain and to the I-WLAN at the same time, to access different services. For example, this will allow the user to access the Presence service via the 3GPP system and the internet via the I-WLAN.
- The user shall be able to connect simultaneously to the 3GPP system and the I-WLAN with multiple devices (which have separate UICCs) on the same subscription.

4.9 Network Sharing

Network sharing shall be transparent to the user.

The specifications shall support both the sharing of:

(i) radio access network only;

(ii) radio access network and core network entities connected to radio access network

NOTE: In a normal deployment scenario only one or the other option will be implemented.

It shall be possible to support different mobility management rules, service capabilities and access rights as a function of the home PLMN of the subscribers.

5 Evolution

5.1 Support of 2G services

The 3GPP specifications shall be capable of supporting existing 2G services in a manner which is transparent to the users of these services.

5.2 Provision and evolution of services

Since a phased approach has been adopted, the same general service principles shall apply to each phase. Support of services from an end user perspective is understood to be an important driver for established mobile users to stay with their existing operator while taking the new services into use. It is therefore important to enable operators to offer continued support of legacy services in future releases. Previous release services shall as a principle also be supported in the following releases.

Networks shall be capable of providing a specified core set of capabilities.

The core set of capabilities should permit home environment to offer a range of distinctive services including those which cannot be implemented on systems based on previous release specifications.

It shall be possible for the home environment to develop services with full roaming capability.

The radio interface should not unnecessarily restrict the development of new services (within physical limitations).

The standard shall provide a mechanism which allows a terminal to be easily upgraded so that it can access new services which are within the physical limitations of the terminal.

6 Classification of services

In the CS CN domain, the basic services are divided into circuit teleservices (3GPP TS 22.003 [14]) and bearer services (3GPP TS 22.002 [21]) and they can utilise standardised supplementary services (3GPP TS 22.004 [5]).

GPRS (22.060 [22]) provides IP bearer services. SMS, USSD and UUS can also be considered as bearer services for some applications.

IP multimedia services are the IP based session related services, including voice communications. IP multimedia sessions use GPRS as a bearer.

Value added non-call related services include a large variety of different operator specific services/applications. They are usually not specified by 3GPP. The services can be based on fully proprietary protocols or standardised protocols outside 3GPP.

In order to create or modify the above services (both call and non-call related services) operators may utilise toolkits standardised by 3GPP (such as CAMEL or LCS) or external solutions (e.g. Internet mechanisms). Pre-paid is an example of an application created with toolkits that may apply to all of the above services categories.

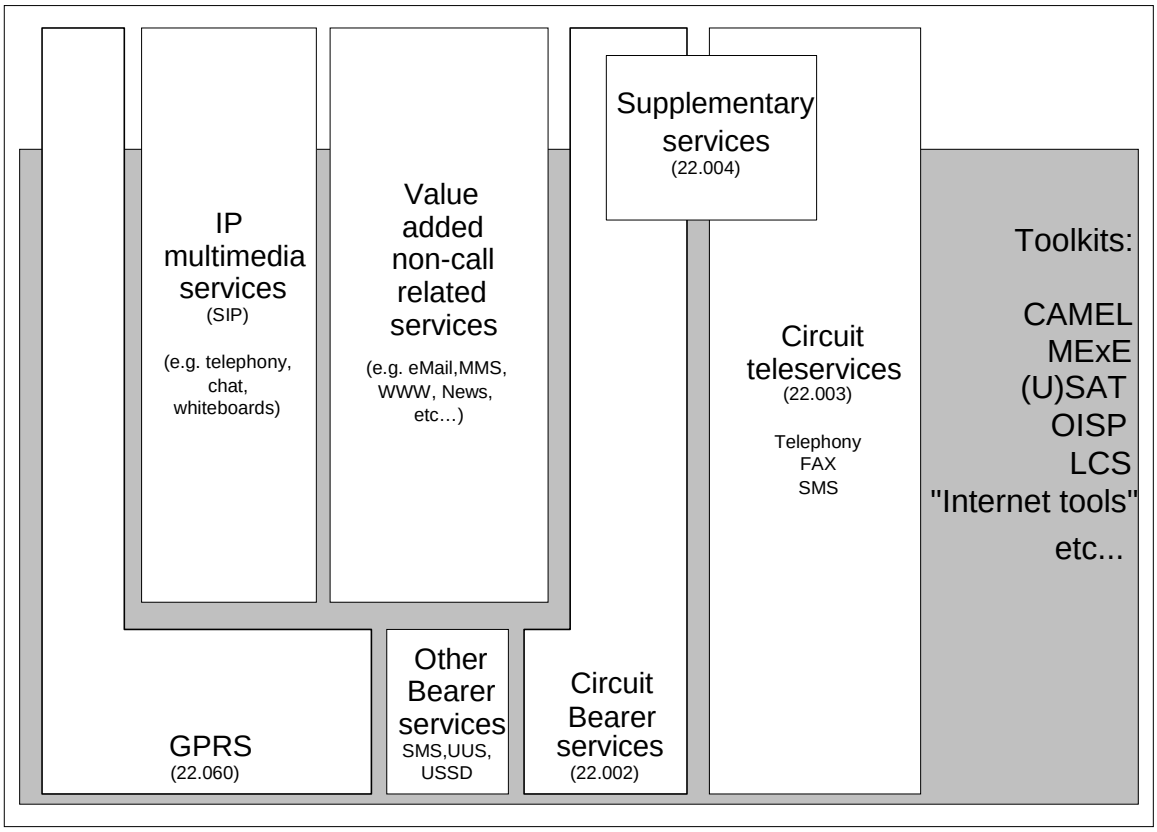

Figure 1: Service classification

7 Principles for new service capabilities

7.1 General

3GPP specifications shall enable the user of a single terminal to establish and maintain several connections simultaneously. It shall efficiently cater for applications which have variable requirements relating to specific QoS parameters (e.g. throughput) whilst meeting other QoS targets. It shall also cater for applications which are able to take adapt to a range of variations in QoS.

7.2 Multimedia

3GPP specifications shall support development of multimedia services and provide the necessary capabilities.

Multimedia services combine two or more media components (e.g. voice, audio, data, video, pictures) within one call. A multimedia service may involve several parties and connections (different parties may provide different media components) and therefore flexibility is required in order to add and delete both resources and parties.

Multimedia services are typically classified as interactive or distribution services.

Interactive services are typically subdivided into conversational, messaging and retrieval services:

Conversational services are real time (no store and forward), usually bi-directional where low end to end delays (< 100 ms) and a high degree of synchronisation between media components (implying low delay variation) are required. Video telephony and video conferencing are typical conversational services."

Messaging services offer user to user communication via store and forward units (mailbox or message handling devices). Messaging services might typically provide combined voice and text, audio and high-resolution images.

Retrieval services enable a user to retrieve information stored in one or many information centres. The start at which an information sequence is sent by an information centre to the user is under control of the user. Each information centre accessed may provide a different media component, e.g. high resolution images, audio and general archival information.

Distribution services are typically subdivided into those providing user presentation control and those without user presentation control.

Distribution services without user control are broadcast services where information is supplied by a central source and where the user can access the flow of information without any ability to control the start or order of presentation e.g. television or audio broadcast services.

Distribution services with user control are broadcast services where information is broadcast as a repetitive sequence and the ability to access sequence numbering allocated to frames of information enables the user (or the user's terminal) to control the start and order of presentation of information.

7.2.1 Circuit Switched (CS) multimedia calls

The following basic requirements are be supported for CS multimedia [24]:

- CS multimedia shall be based on a 3GPP specific subset of H.324M.
- All call scenarios shall be supported, i.e. Mobile Originating and Mobile Terminating call against Mobile, ISDN and PSTN call party.
- Single and multiple numbering schemes shall be supported.
- Fallback to speech (TS 11 [14]) shall be supported from 3.1kHz Ext. PLMN multimedia bearer, i.e. if setup of the multimedia call fails the call will be set up as a speech call.
- Service change and fallback shall be supported for UDI/RDI multimedia bearer and speech, to allow fallback to a less preferred service if the preferred service is unsupported, and to change the service between speech and multimedia during the call.
- CS Multimedia call is a Bearer Service, which utilises Synchronous Transparent Data service.
- Different bitrates as specified at 3GPP TS 22.002 [21] shall be supported.
- Supplementary services apply to multimedia calls as for Synchronous Transparent Data service according to 3GPP TS 22.004[5].
- When accepting a multimedia call with service change, the user shall be able to request a service change to speech before the call is answered, such that the multimedia path is never actually connected through to the user's phone.

- The user shall be able to deny a service change to multimedia during the call.

7.2.2 IP multimedia (IM) sessions

IP multimedia services are not the evolution of the circuit switched services but represent a new category of services, mobile terminals, services capabilities, and user expectations. Any new multimedia service, which may have a similar name or functionality to a comparable standardised service, does not necessarily have to have the same look and feel from the user's perspective of the standardised service. Voice communications (IP telephony) is one example of real-time service that would be provided as an IP multimedia application.

The following basic requirements are be supported for IP multimedia [27]:

- IP multimedia session control shall be based on SIP [28].
- All session scenarios shall be supported; i.e. Mobile Originating and Mobile Terminating sessions against Internet/Intranet, CS or IM Mobile, ISDN, PSTN call party.
- MSISDN and SIP URL numbering and addressing schemes shall be supported.
- IP multimedia applications shall as a principle, not be standardised, allowing service provider specific variations.

7.2.3 Multimedia Messaging Service (MMS)

The following basic requirements are be supported for MMS:

- Store-and-forward multimedia messaging service with mobile and non-mobile users [25].
- MMS shall be capable of supporting integration of different types of messaging (e.g. fax, SMS, Multimedia, voicemail, e-mail etc.) in a consistent manner.
- Streamed and batch delivery for both message download from the network to the terminal, and messages upload from the terminal to the network.

7.2.4 Text Conversation

Global Text Telephony (GTT) is a feature that enables real-time text conversation [28].

- GTT enables real time, character by character, text conversation to be included in any conversational service, Circuit Switched as well as IP based.
- It is possible to use the text component in a session together with other media components, especially video and voice.
- Interworking with existing text telephony in PSTN as well as emerging forms of standardised text conversation in all networks is within the scope of this feature.
- The text media component can be included initially in the session, or added at any stage during the session.
- The text component is intended for human input and reading, and therefore supports human capabilities in text input speed. The character set support is suitable for the languages the users communicate in.
- GTT specifies limited interoperation with Multimedia Messaging Services including a possibility to divert to messaging in case of call failure and sharing user interface equipment and external UE interfaces.

7.2.5 Packet Switched Streaming Service

The following basic requirements are to be supported for streaming :

- The streaming service uses a client / server model which is transparent to the PLMN. The client controls the

initiation and execution of the service.

- The streaming service [29] shall use existing standards (codecs and protocols [30]) where these are available.
- The streaming service utilises the PS Domain with the QoS requirements as specified in 3GPP TS 22.105 [1].

7.3 Service Management Requirements

3GPP specifications shall include standardised protocols enabling service management. It shall enable control, creation and subscription of service capabilities and services, and the management of user profiles.

7.4 Automatic Device Detection

The home environment should be automatically notified when a user, identified by a SIM/USIM, has changed ME and should be informed of the identity of the new ME. This should be applicable to any ME. It should also be possible to achieve Automatic Device Detection for users using any SIM/USIM.

Note: The purpose of this is to enable an automatic configuration of terminals by the operator for specific applications/services if so needed. The procedure for such an automatic configuration need not to be standardized by 3GPP.

The notification that a user has changed ME shall be given as early as possible.

8 Service architecture

In order to provide standardisation of service capabilities a service architecture shown by Figure 2 is envisaged

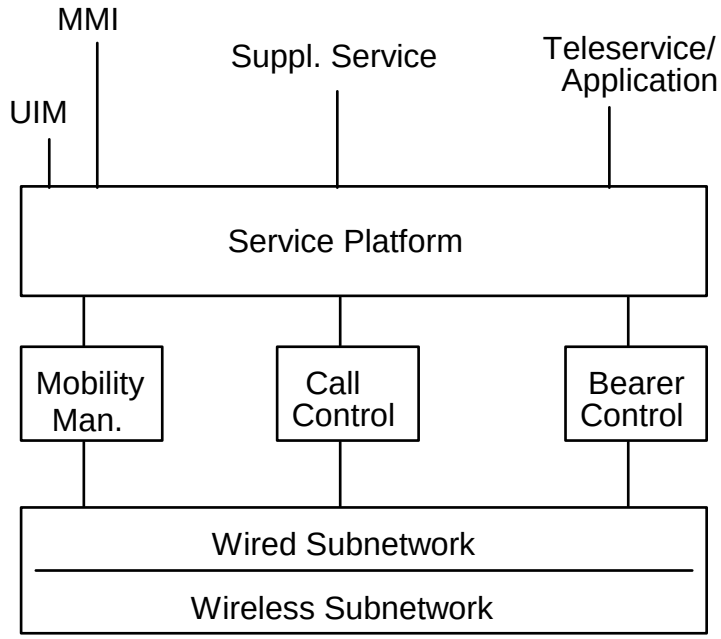

Figure 2: Service Architecture

A number of bearers shall be provided that can differ in flexibility and offer different capabilities. Bearers may be characterised by parameters such as “throughput”, “delay tolerance”, “maximum bit error rate”, “symmetry” etc. These bearers enable information to be transferred appropriate to the provision of teleservices, and end user applications generally, via subnetworks which typically provide different specified qualities of service.

The assignment and release of bearers is provided by the bearer control function. Provision should be made for several

bearers to be associated with a call and for bearers to be added to a call and/or to be released from a call following call establishment. The bearers should be independent of radio environments, radio interface technology and fixed wire transmission systems.

Adaptation/Interworking functions are required in order to take account of the differences between the bearers used for the provision of a teleservice/application in the fixed network and the bearers. Adaptation/Interworking functions are required which take account of the discontinuous and/or asymmetrical nature of most teleservices/applications.

The service platform shall provide interfaces (to serving networks and home environments) appropriate to the support, creation and control of supplementary services, teleservices and user applications. The service platform will also provide interfaces enabling subscribers to control supplementary services, teleservices and user applications.

Supplementary service provision and control will be independent of radio operating environment, radio interface technology and fixed wire transmission systems.

As far as possible, the service platform is required to enable new supplementary services, teleservices and/or end user applications to be supported at minimum cost, with minimum disruption of service and within the shortest possible time.

9 Quality of Service (QoS)

The Quality of Service (QoS) parameters should be identified together with appropriate parameter values which set targets to be reached when designing 3GPP specifications, and which also will serve as guidelines for network design and service provision.

The QoS for call set-up time, as an example, can be defined in terms of a mean value and as a percentage of cases which should not exceed a certain time limit. Further information can be found in 3GPP TS 22.105[1].

10 Emergency Calls

10.1 General requirements

It shall be possible to establish an emergency speech call. Emergency calls will be routed to the emergency services in accordance with national regulations for where the subscriber is located. This may be based upon one or more default numbers stored in the ME. It shall be allowed to establish an emergency call without the need to dial a dedicated number to avoid the mis-connection in roaming case, such as menu, by use of a 'red button', or a linkage to a car air bag control. Emergency Calls shall be supported by the UE without a SIM/USIM being present. No other type than Emergency calls shall be accepted without a SIM/USIM.

The Emergency service is required only if the UE supports voice.

Note: It will be left to the national authorities to decide whether the network should accept emergency calls without the SIM/USIM.

It shall be possible to initiate emergency calls to different emergency call centers, depending on the type of emergency. The following types of emergency calls shall be possible:

- Police
- Ambulance
- Fire Brigade
- Marine Guard
- Mountain Rescue
- Spare, at least [three] different types

When a SIM/USIM is present, subscriber specific emergency call set-up MMI shall be provided. The Home

Environment operator shall specify preferred emergency call MMI(s) (e.g. 911 for US citizens or 110, 118 and 119 for Japanese citizens). This shall be stored in the SIM/USIM and the ME shall read this and use any entry of these digits to set up an emergency call. It shall be possible to store more than one instance of this field.

Note: Release '98 and earlier SIM cards have the capability to store additional emergency call set-up MMI. However in many cases this has not been used.

It shall be possible to tie any emergency call number, specified in the preferred emergency call MMI(s) above, to any single emergency call type or to any combination of emergency types. The association between emergency numbers and emergency call type shall be able to be programmed by the Home Environment operator into the SIM/USIM.

Example:

19 Police (Albania)

100 Police and Fire Brigade (Greek cities)

100 Ambulance and Fire Brigade (Belgium)

112 Police and Ambulance (Italy)

112 General emergency call, all categories (Sweden)

115 Fire Brigade (Italy)

114 Ambulance (Austria)

Note: if the UE does not recognise the emergency call MMI(s) (i.e. the dialled number is not stored in SIM/USIM) but the serving network recognises the dialled number as an emergency call number used in the country, a normal call set up takes place over the radio interface and after the serving network has recognised the emergency number the call is routed as an emergency call.

The user friendly MMI that specifies the type of emergency directly (e.g. menu) should be supported for use in any (i.e. home or visited) PLMN to avoid the mis-connection in roaming case. This shall be allowed both with and without SIM/USIM being present.

The serving network may download additional emergency numbers to the UE in order to ensure that local emergency numbers are known to the UE. The UE shall regard these emergency numbers as valid in that country only (as identified by the MCC) and shall discard them when a new country is entered.

10.1.1 Identification of emergency numbers

The ME shall identify a number dialled by the end user as a valid emergency number if it occurs under one or more of the following conditions.

a) 112 and 911 shall always be available. These numbers shall be stored on the ME.

b) Any emergency number stored on a SIM/USIM when the SIM/USIM is present.

c) 000, 08, 110, 999, 118 and 119 when a SIM/USIM is not present. These numbers shall be stored on the ME.

d) Additional emergency numbers that may have been downloaded by the serving network when the SIM/USIM is present.

10.1.2 Domains priority and selection for UE attempts to emergency call

A CS and IMS capable UE attempting an emergency call should give priority to the CS Domain. In case the call attempt fails, the UE should automatically make a second attempt on the other domain.

10.2 Emergency calls in the CS CN Domain

A CS CN Domain shall support the emergency call teleservice as defined in 3GPP TS 22.003 [14] (TS12).

If a UE supports TS11(Telephony)[14], then it shall also support TS12(Emergency Calls)[14].

10.3 Emergency Calls in the PS CN Domain

Without the IM CN subsystem, emergency calls are not supported in the PS CN domain.

10.4 Emergency calls in the IM CN subsystem

It shall be possible for the IM CN subsystem to support IMS emergency calls.

Note: Other forms than speech for emergency services are for further study.

10.5 Emergency Calls when Attached via an I-WLAN

Any attempt to make an emergency call shall be handled as defined for a PS CN domain network in section 10.3.

11 Numbering principles

The following network addressing schemes listed below shall be supported at the relevant domains:

- E.164,
- E.168,
- E.212,
- X.121
- Internet (including e.g. IP address).

When the UE is connected via a I-WLAN, the addressing shall be based on Network Access Identifier (NAI) format (user@realm) as defined in RFC 2486 [33].

11.1 Number portability

11.1.1 Requirements for CS CN domain

Some numbering schemes shall be fully independent of the supporting serving network and the home environment, allowing users to transfer this number to another home environment. For further information see 3GPP TS 22.066 [7].

An MSISDN shall be allocated to each new user at the start of a subscription. This number may be allocated from one of several numbering domains. For example:

- home / serving environment numbering scheme;
- national numbering scheme;
- regional numbering scheme;
- global numbering scheme.

A user shall be able to move subscription from one home environment to another without changing the MSISDN provided that the new home environment offers service in the same geographic domain. It is envisaged that home environment s will be able to allocate MSISDNs from each of these domains as required.

11.1.2 Requirements for PS CN domain

None identified.

11.1.3 Requirements for IM CN subsystem

It shall be possible to offer number portability for E.164 numbers within IM CN subsystem. For further information see 3GPP TS 22.066 [7].

11.2 Evolution path

Since 3GPP specifications aim to be aligned with IMT-2000, a primary goal in numbering is the provision of global user numbering in line with steps taken by the ITU - SG2.

The numbering scheme and network implementation chosen shall allow for international/global evolution.

11.3 Void

11.4 Void

11.5 Void

11.6 Private numbering

A user may wish to use private numbers for the purposes of calling frequent numbers. Therefore there is a requirement for the use, by the user, of Private Numbering Plans (PNPs). These schemes may belong to the user himself, to a home environment or a third party.

11.7 Numbering schemes

11.7.1 Multiple numbering scheme

The standards shall support the possiblity of allowing the bearer service associated with an MT call to be implicitly defined by the destination MSISDN, for example to use a different MSISDN to establish voice, fax or data . It will be possible for multiple MSISDNs to be associated with a single subscription.

11.7.2 Single numbering scheme

The standards shall support the possibility of allowing MT calls of different bearer types (eg voice, fax, data) to be routed to a single MSISDN. It is recognised that the implementation of this may depend on the availability of bearer information associated with an incoming call from the adjoining transit network. In particular the standards will support this possibility in the case of an adjoining ISDN transit network.

11.8 Optimal routing for CS CN domain

The implementation of the numbering scheme used shall allow for optimal routing; i.e. routing shall not take place simply on the number dialled. See 3GPP TS 22.079 [8] for some scenarios.

11a Identification Requirements

11a.1 Subscriber Identification

In 3GPP the identity of a subscriber is encoded in a identity module application which is contained on a UICC or on a GSM SIM card. The UICC or GSM SIM card is a removable component of the User Equipment. Three types of identity modules are used in the 3GPP system:

- Universal Subscriber Identity Module (USIM)
- IMS Subscriber Identity Module (ISIM)
- Subscriber Identity Module (SIM) according to GSM

General requirements:

- In the 3GPP system each subscriber shall be uniquely identifiable.
- The serving networks shall be able to authenticate any subscriber that roams onto their network
- If a UE, that is registered on the serving network, contains a GSM SIM card or a UICC containing a identity module application, the serving network shall be able to identify the associated home PLMN.

Note 1: UE support of GSM SIM is optional.

Note 2: See the chapter (USIM, UICC and Terminal) of the present specification for a reference, which GSM phase SIMs need to be supported by the network.

11a.2 Terminal Identification

It is a requirement that the terminal can be uniquely identified by the home environment and serving network. This shall require a terminal identity scheme which uniquely identifies each terminal, see 3GPP TS 22.016[12].

11a.3 Home Environment / Serving Network Identification

Home / serving environments need to route communication to the current location of the user. This shall require a identity scheme which uniquely identifies the serving environment and shall be used for routing purposes.

12 Human Factors and user procedures

The User Interface (MMI) from the end-user's point of view should be as flexible as possible while still meeting the general service requirements. In addition it should be capable of being updated so as to meet new services which are still to be envisaged.

In general the following principles should be encompassed:

- activation of services should be as simple as possible with minimum input expected from the user;
- feedback, to the user from the various services, should be meaningful;
- any error recovery procedures provided should be simple to understand and execute.
- input from the user and information to the user should be provided in alternative selectable modes in order to match user capabilities, preferences and situation.

However, a detailed specification for the User Interface shall not be defined. In particular given the global nature of the third generation systems, for different regions of the world, different criteria will determine the implementation of the

User Interface. Also it is unlikely that there will be a single common handset which will meet all the service requirements and therefore a common User Interface would be impractical.

Given the flexibility of the services, there should be a wide range of User Interface possibilities. These possibilities include simple terminals with a single on/off button through to complex terminals providing support to hearing/visually impaired users.

Control of supplementary services (3GPP TS 22.004 [5]), may use MMI procedures specified in 3GPP TS 22.030 [6] and existing MMI related UE features (Annex A) may also be used. In particular the following features are highly desirable for uniform UE implementation where appropriate:

- Mapping of numeric keys to European alphabetic keys to ensure compatible mnemonic dialing as defined in 3GPP TS 22.030 [6],
- "+" key function to enable one key international access as defined in Annex A
- Structure of the MMI as described in 3GPP TS 22.030 [6]
- Presentation of IMEI (International Mobile Equipment Identity) as defined in 3GPP TS 22.030 [6]

13 UICC, USIM and Terminal

This clause defines the functional characteristics and requirements of the User Service Identity Module (USIM) and ISIM (IM Services Identity Module). The USIM/ISIM are applications residing on a UICC.

13.1 The USIM/ISIM and User Profiles

13.1.1 The USIM

Every USIM shall have a unique identity and shall be associated with one and only one home environment.

It shall be possible for a home environment to uniquely identify a user by the USIM.

The USIM shall be used to provide security features.

For access to services, provided by PS or CS CN domains, a valid USIM shall be required. Optionally, SIM according to GSM phase 2, GSM phase 2+, 3GPP release 99, 3GPP release 4 specifications may be supported.

The USIM shall be able to support SIM Application Toolkit as specified in 3GPP TS 22.038 [3].

The USIM shall reside on a UICC, 3GPP specifications shall adopt both of the GSM SIM card physical formats. Other formats may also be supported. USIM specific information shall be protected against unauthorised access or alteration.

It shall be possible to update USIM specific information via the air interface, in a secure manner.

Access to the IMS services shall be possible using the USIM application in the event of no ISIM being present on the UICC. If an ISIM is present on the UICC it shall be used to access the IMS.

Access via a I-WLAN shall be possible using earlier releases (than the current release) of the UICC or using a SIM.

Annex A describes a number of features that may optionally be supported by the UE and thus USIM.

13.1.2 User Profiles

It shall be possible for a user to be associated with one or a number of user profiles, which the user can select and activate on a per call basis. The user profile contains information which may be used to personalise services for the user.

It shall be possible for one or more user profiles associated with the same user to be active simultaneously so that the user may make or receive calls associated with different profiles simultaneously. Activation of profiles shall be done in a secure manner, for example with the use of a PIN.

For terminating calls the correct profile shall be indicated by the user address used (e.g. MSISDN), each profile will have at least one unique user address associated with it. For originating calls the user shall be able to choose from the available profiles, the appropriate one for the call. A profile identity will need to be associated with the call for accounting and billing purposes. User profile identities need not be standardised but a standardised means is required for indicating that a particular profile is being used.

Simultaneous use of the same user profile on multiple terminals for the same type of service shall not be allowed.

User profiles associated with different home environments shall not share the same user address.

13.1.3 UICC usage in GERAN only Terminals

In Release 5 and later, terminals supporting only GERAN shall support USIM.

Note: It is strongly recommended that manufacturers implement SIM support on GERAN only terminals until the population of SIMs in the market is reduced to a low level.

13.1.4 Multiple USIMs per UICC

The standard shall support more than one USIM per UICC even when those USIMs are associated with different home environments. Only one of the USIMs or the SIM shall be active at a given time. While the UE is in idle mode, it shall be possible for the user to select/reselect one USIM application amongst those available on the UICC. At switch on, the Last Active USIM shall be automatically selected. The Last Active USIM shall be stored on the UICC. By default if there is no Last Active USIM defined in the UICC, the user shall be able to select the active USIM amongst those available on the UICC.

The standard must not prevent the coexistence of USIM applications, each associated with different home environments on the same UICC, so long as the security problems which arise from such a coexistence are solved.

13.1.5 The ISIM

Access to the IMS services shall be possible using an ISIM application.

The ISIM shall be sufficient for providing the necessecary security features for the IMS and IMS only.

The ISIM shall reside on a UICC. ISIM specific information shall be protected against unauthorised access or alteration.

It shall be possible to update ISIM specific information via the air interface, in a secure manner.

In Rel5 the ISIM application shall require the presence of a USIM application on the same UICC.

13.2 The UICC

Access to services via 3GPP system or via an I-WLAN with a single UICC shall be possible.

13.2.1 The UICC and Applications other than the USIM or ISIM

It shall be possible for the UICC to host other applications in addition to the USIM or ISIM, see figure 3. Service providers, subscribers or users may need to establish additional data or processes on the UICC. Each application on an UICC shall reside in its own domain (physical or logical). It shall be possible to manage each application on the card separately. The security and operation of an application in any domain shall not be compromised by an application running in a different domain. Applications may need to use their own security mechanisms which are separate to those specified by 3GPP e.g. electronic commerce applications.

Examples of UICC applications are: USIM, ISIM, off-line user applications like UPT, electronic banking, credit service, etc.

Applications should be able to share some information such as a common address book.

It shall be possible to address applications, which reside on the UICC, via the air interface.

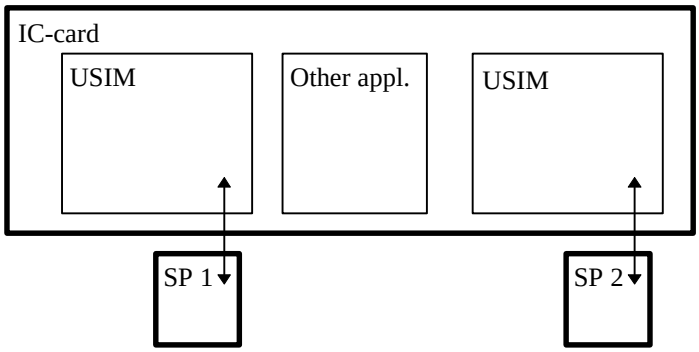

Figure 3 Example of a Multifunction UICC

13.3 Terminals and Multiple UICCs

A single terminal may support the use of multiple UICC (e.g with applications like USIM and/or banking, credit card,...). Only one UICC shall be active at a time to access a PLMN. In case the active UICC contains more than one USIM, the requirements of 11.1.4 shall apply.

If the UICC with the active USIM is removed from the mobile terminal during a call (except for emergency calls), the call shall be terminated immediately. If the UICC with an active ISIM is removed during an IMS session the IMS session shall be terminated.

14 Types of features of UEs

3GPP specifications should support a wide variety of user equipment, i.e. setting any limitations on terminals should be avoided as much as possible. For example user equipment like hand-portable phones, personal digital assistants and laptop computers can clearly be seen as likely terminals.

In order not to limit the possible types of user equipment they are not standardised. The UE types could be categorised by their service capabilities rather than by their physical characteristics. Typical examples are speech only UE, narrowband data UE, wideband data UE, data and speech UE, etc..

In order to enhance functionality split and modularity inside the user equipment the interfaces of UE should be identified. Interfaces like UICC-interface, PCMCIA-interface and other PC-interfaces, including software interfaces, should be covered by references to the applicable interface standards.

UEs have to be capable of supporting a wide variety of teleservices and applications provided in PLMN environment. Limitations may exist on UEs capability to support all possible teleservices and information types (speech, narrowband data, wideband data, video, etc.) and therefore functionality to indicate capabilities of a UE shall be specified.

The basic mandatory UE requirements are:

- Support for USIM. Optional support of GSM phase 2, 2+, 3GPP Release 99 and Release 4 SIM cards [34]. Phase 1, 5V SIM cards shall not be supported. Support for the SIM is optional for the UE, however, if it is supported, the mandatory requirements for SIM shall be supported in the UE;

  Note 1: There is no Release 5 specification for the SIM, and therefore references to "SIM" apply to earlier releases.

  Note 2: It is strongly recommended that manufacturers implement SIM support on terminals supporting GERAN until the population of SIMs in the market is reduced to a low level.

- Home environment and serving network registration and deregistration;
- Location update;
- Originating or receiving a connection oriented or a connectionless service;

- An unalterable equipment identification; IMEI, see 3GPP TS 22.016 [12];
- Basic identification of the terminal capabilities related to services such as; the support for software downloading, application execution environment/interface, MExE terminal class, supported bearer services.
- Terminals capable for emergency calls shall support emergency call without a SIM/USIM.
- Support for the execution of algorithms required for encryption, for CS and PS services. Support for non encrypted mode is required;
- Support for the method of handling automatic calling repeat attempt restrictions as specified in 3GPP TS 22.001 [4];
- At least one capability type shall be standardised for mobile terminals supporting the GERAN and UTRAN radio interfaces.
- Under emergency situations, it may be desirable for the operator to prevent UE users from making access attempts (including emergency call attempts) or responding to pages in specified areas of a network, see 3GPP TS 22.011 [11];
- Ciphering Indicator for terminals with a suitable display;

  The ciphering indicator feature allows the UEto detect that ciphering is not switched on and to indicate this to the user. The ciphering indicator feature may be disabled by the home network operator setting data in the SIM/USIM. If this feature is not disabled by the SIM/USIM, then whenever a connection is in place, which is, or becomes unenciphered, an indication shall be given to the user. Ciphering itself is unaffected by this feature, and the user can choose how to proceed;
- Support for PLMN selection.
- Support for handling of interactions between toolkits concerning the access to UE MMI input/output capabilities;

  Whenever an application (e.g. a SAT/MExE/WAP application) requires the access to the UE MMI input/output capabilities (e.g. display, keyboard,…), the UE shall grant this access subject to the capabilities of the UE. This shall not cause the termination of any other applications (e.g. WAP browser or MExE/SAT application) which were previously using these UE resources. The UE shall give the user the ability to accept or reject the new application. In the case that the application request is rejected, the access to the UE MMI input/output capabilities is returned to the applications which were previously using these UE resources. If the user decides to continue with the new application, then when this new application is terminated, the access to the UE MMI input/output capabilities shall be returned to the UE to be re-allocated to applications (e.g. the preceding application which was interrupted). Subject to the capabilities of the UE, the user shall have the ability to switch the MMI input/output capabilities between applications.

  Note: Rejecting a request to access the UE MMI input/output capabilities by an application does not necessarily mean that it is terminated, but only that the access to the UE MMI input/output capabilities are not granted to this application. Handling of rejection (termination, put on hold,…) is the responsibility of the application.

Annex A describes a number of features which may optionally be supported by the UE.

15 Relationship between subscription and service delivery

15.1 Subscription

A subscription describes the commercial relationship between the subscriber and the service provider.

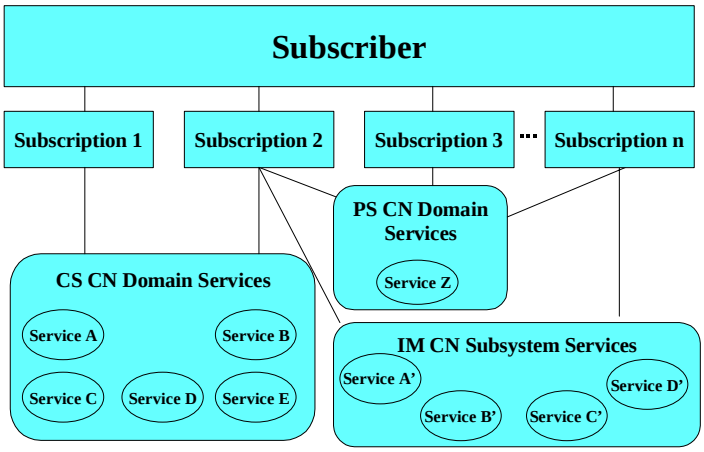

Figure 4: Subscriber, subscription and services relationship

A subscription to a network operator may provide the user with access to one or more domains. A Subscription shall identify the set of services, within particular domains, to which the user has access (see figure 3); each subscription may specify a different set of services. These services may be provided by the CS CN Domain and/or a PS CN Domain and/or an IM CN subsystem. Subscriptions relate to services such as Basic Services (e.g. Teleservices, Bearer services), GPRS services and IM-Services (IP-based multimedia services), which are typically provided by network operators, and to value added services which typically are provided by network operators and/or other entities that provide services to a subscriber

The subscription identifies:

- the services and related services information that are made available to the subscriber by the service provider ;

In addition a subscription to a network operator may identify:

- the domains to which the user has been granted access by the network operator. In particular, the GPRS service profile and information on the allowed QoS parameter ranges shall be contained in the subscription.

- the identity of the subscriber within these domains.
  Note: The identity of a subscriber in the CS CN domain and PS CN domain (e.g. her IMSI) may potentially be different to her identity in the IM CN subsystem

- the radio access technologies over which the subscriber may access their services e.g. I-WLAN.

15.2 Other concepts associated with services

Provision of services:
An action to make a service available to a subscriber. The provision may be:

- general: where the service is made available to all subscribers (subject to compatibility restrictions enforced) without prior arrangements being made with the service provider;

- pre-arranged: where the service is made available to an individual subscriber only after the necessary arrangements have been made with the service provider.

Withdrawal:
An action taken by the service provider to remove an available service from a subscriber's access. The withdrawal may be:

- general: where the service is removed from all subscribers provided with the service;

- specific: where the service is removed on an individual basis from subscribers provided with the service.

NOTE: Access to the IM subsystem requires IP connectivity provided, for example, through provision of the PS CN domain.

15.3 Requirements concerning service delivery

In general it is a requirement to allow the use of independent services simultaneously (i.e. Basic, GPRS, IP multimedia and operator specific).

1. The network usage shall be based on the services identified within the subscription, the terminal capabilities and, where applicable, roaming agreements between operators.

2. The Home environment shall be able to decide on the service delivery in a roaming scenario. I.e. it shall control how services are delivered in line with the subscription.

3. If an offered or required service (e.g. voice) could be provided with different technologies within the serving network, the decision on service delivery shall be based on preferences identified in the user profile and serving network capabilities and conditions (e.g. load).

4. If the user profile does not allow an alternative service delivery method and the requested delivery method is not available in the serving network the service shall not be provided to the subscriber. This applies also to data bearer services with defined QoS parameters (or parameter ranges).

Examples:

- A terminating voice call for a subscriber with a dual/multi mode terminal (e.g.UTRAN/GERAN) could be delivered in a hybrid network as IM service or CS voice call (TS11). The delivery decision is based on the preferences of service delivery within the user profile and the network conditions. If there is no preference information of the Home environment available the decision is made only on the network conditions from the serving network.

- A terminating data service (e.g. GPRS with QoS for real time audio) where the network cannot provide the QoS at call setup. Both the originating and terminating application shall be informed about the possible QoS configuration for that call. The further handling (setup continuation, termination) depends on the decisions of the applications.

16 Charging principles

The cost of the call may cover the cost of sending, transporting, delivery and storage. The cost of call related signalling may also be included. Provision shall be made for charging based on time, destination, location, volume, bandwidth and quality. Charges may also be levied as a result of the use of value added services.

It shall be possible for information relating to chargeable events to be made available to the home environment at short notice. The requirements shall include:

- Immediately after a chargeable event is completed;

- At regular intervals of time, volume or charge during a chargeable event.

Standardised mechanisms of transferring charging information are required to make these requirements possible.

It should be possible for multiple leg calls (e.g. forwarded, conference or roamed) to be charged to each party as if each leg was separately initiated. However, in certain types of call, the originating party may wish/be obliged to pay for other legs (e.g. SMS MO may also pay for the MT leg.).

Provision shall be made for the chargeable party to be changed during the life of the call. There shall be a flexible billing mechanism which may include the use of stored value cards, credit cards or similar devices.

The chargeable party (normally the calling party) shall be provided with an indication of the charges to be levied (e.g. via the called number automatically or the Advice of Charge supplementary service) for the duration of the call (even

though the user may change service environment)The user shall be able to make decisions about the acceptable level of accumulated charge dynamically or through their service profile.

If a user is to be charged for accepting a call then their consent should be obtained. This may be done dynamically or through their service profile.

Charging in the 3GPP system shall not be compromised when access is via an I-WLAN.

Charging and accounting solutions shall support the shared network architecture so that end users can be appropriately charged for their usage of the shared network, and network sharing partners can be allocated their share of the costs of the shared network resources.

17 Roaming

17.1 Assumptions

In order to roam, the following applies:

- Mobile terminal can connect to the radio access network.
- Authentication (charging/billing network) must occur in order to get access to services (except for emergency calls).
- The services offered to a roaming subscriber may be restricted by the capabilities of the visited network, and the roaming agreement between the visited and the home environment.

17.2 Principle

Long term evolution of the IM CN subsystem shall not be restricted by the short/mid term inter-domain roaming requirements.

17.3 Requirements

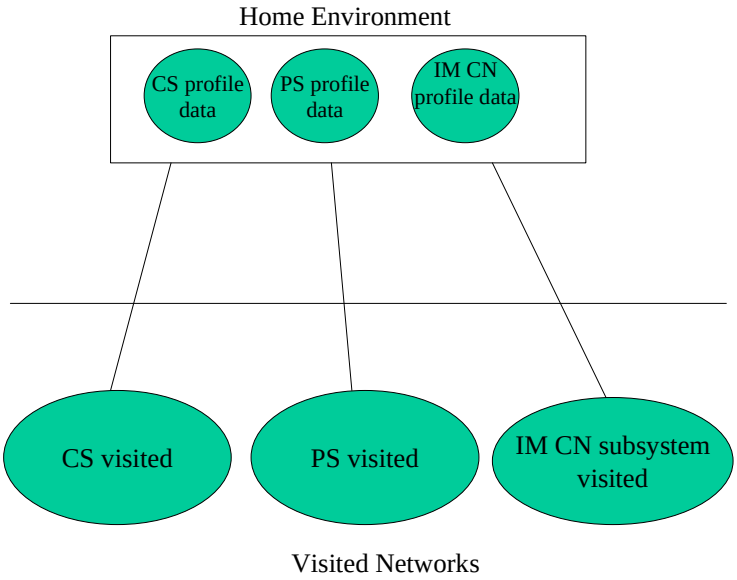

Figure 5: Roaming requirements

- The personalised services & capabilities available in a visited network are dependent upon the subscription options

in the home environment. This does not preclude the visited network offering additional services, or access to content providers.

- Roaming from this release's home environment to CS (this release or earlier) visited network is required
- Roaming from this release's home environment to IM CN subsystem visited network is required
- Roaming from this release's home environment to PS (this release or earlier) visited network is required
- Roaming from previous releases' home environment (or earlier) to this release CS visited network is required
- Roaming from previous releases' home environment (or earlier) to this release PS visited network is required
- Roaming from the home environment to I-WLANs is required. The I-WLAN may be part of the home environment or a visited network. The interworking shall support the case where a 3GPP operator does not operate the I-WLAN.

Note: When an operator allows a subscriber to roam to different domains, the home environment needs to provide subscription data to the visited network . The mapping between service data of the different domains is not standardised; it is determined by the home environment and may be influenced by roaming agreements.

18 Handover Requirements

Any handover required to maintain an active service while a user is mobile within the coverage area of a given network, shall be seamless from the user’s perspective. However handovers that occur between different radio environments may result in a change of the quality of service experienced by the user.

It shall be possible for users to be handed over between different networks subject to appropriate roaming/commercial agreements.

For further information see 3GPP TS 22.129 [9].

19 Network Selection

Network selection procedures are defined in 3GPP TS 22.011 [11].

Other procedures may be offered by the UE.

20 Security

Security matters are considered in 3GPP TS 21.133 [15] and 3GPP TS 33.120 [16].

Annex A (normative): Description of optional user equipment features

A.1 Display of called number

This feature enables the caller to check before call setup whether the selected number is correct.

A.2 Indication of call progress signals

Indications shall be given such as tones, recorded messages or visual display based on signalling information returned from the PLMN. On data calls, this information may be signalled to the DTE.

Call progress indicators are described in 3GPP TS 22.001 [4].

A.3 Country/PLMN indication

The country/PLMN indicator shows in which PLMN the UE is currently registered. This indicator is necessary so that the user knows when "roaming" is taking place and that the choice of PLMN is correct. Both the country and PLMN will be indicated. When more than one visited PLMN is available in a given area such information will be indicated.

The PLMN name is either:

- Stored in the ME and associated with the MCC+MNC combination received on the broadcast channel;
- NITZ (see 22.042 [17]) (in which case it overrides the name stored in the UE);
- stored in the USIM and associated with the MCC+MNC combination, and optionally the LAI, received on the broadcast channel (in which case it overrides the name stored in the UE and – if present – the NITZ name).

It shall be possible to store on the USIM at least 10 PLMN Identifications (MCC+MNC combination and optionally the LAI) for which the same PLMN name shall be displayed.

The PLMN name stored in the USIM has the highest priority, followed by the PLMN name provided by NITZ. The PLMN name stored in the ME has the lowest priority.

A.4 Service Provider Name indication

The service provider name is stored in the USIM in text and/or optionally graphic format. It shall be possible to associate at least 10 PLMN Identifications (MCC+MNC combination and optionally the LAI) with the same SP Name.

When registered on the HPLMN, or one of the PLMN Identifications used for Service Provider Name display:

(i) The SP Name shall be displayed;

(ii) Display of the PLMN Name is optional (i.e. the Service Provider name shall be displayed either in parallel to the PLMN Name or instead of the PLMN Name).

When registered on neither the HPLMN, nor one of the PLMN Identifications used for Service Provider Name display:

(i) The PLMN name shall be displayed;

(ii) Display of the SP Name is optional.

If the UE is unable to display the full name of the Service Provider the name is cut from the tail end. The storage of Service Provider name and options, and choice of options, shall be under control of the network operator.

A.4a Core Network Operator Name indication

It shall be possible for the UE to display the name of the core network operator the user has selected.

NOTE: The display of the core network name in relation to the display of PLMN name and service provider name is FFS.

A.5 Keypad

A physical means of entering numbers, generally, though not necessarily, in accordance with the layout shown in figure A.1.

See also 3GPP TS 22.030 [6] (Man-Machine Interface).

Additional keys may provide the means to control the UE (e.g. to initiate and terminate calls).

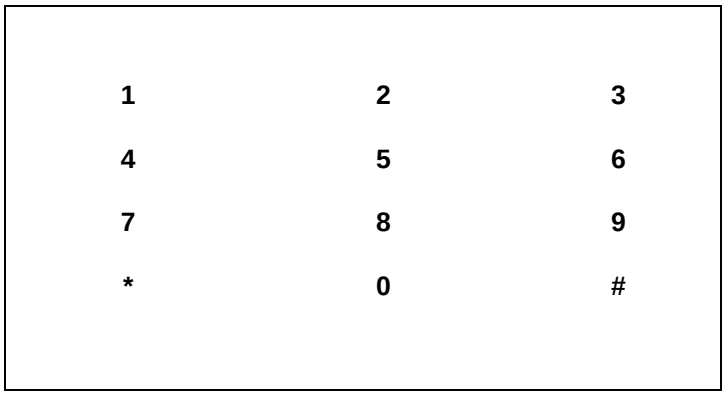

Figure A.1

A.6 Short message indication and acknowledgement

This feature allows the delivery of short messages to a UE from a service centre. Such messages are submitted to the service centre by a telecommunications network user who can also request information of the status of the message by further interrogation of the service centre. The service centre then transmits the message to an active UE user.

The UE must therefore provide an indication to the user that a message has been received from the service centre and must also send an acknowledgement signal to the PLMN to show that this indication has been activated. The PLMN then returns this acknowledgement to the service centre.

The short message service teleservice is described in specification 3GPP TS 22.003 [14].

A.7 Short message overflow indication

An indication shall be given to the user of the short message service when an incoming message cannot be received due to insufficient available memory.

A.8 International access function

Provision is made for a direct, standard method of gaining international access. For this purpose the UE may have a key whose primary or secondary function is marked "+". This is signalled over the air interface and would have the effect of generating the international access code in the network. It may be used directly when setting up a call, or entered into the memory for abbreviated dialling.

This feature is of benefit since the international access code varies between CEPT countries, which might cause

confusion to a user, and prevent the effective use of abbreviated dialling when roaming internationally. Users may still place international calls conventionally, using the appropriate international access code.

A.9 Service Indicator (SI)

An indication is given to the user that there is adequate signal strength (as far as can be judged from the received signal) to allow a call to be made.

A.10 Dual Tone Multi Frequency (DTMF)

The UE shall be capable of initiating DTMF in accordance with specifications 3GPP TS 22.003 [14]. Optionally, the UE may provide a suppress function which allows the user to switch off the DTMF function.

A.11 On/Off switch

The UE may be provided with a means of switching its power supply on and off. Switch-off shall be "soft", so that on activation, the UE completes the following housekeeping functions: termination of a current call, detach (where applicable) and storing required data in the SIM/USIM before actually switching off. As far as possible, this procedure should also apply on power failure (e.g. remote switch-off or low battery).

A.12 Sub-Address

This feature allows the mobile to append and/or receive a sub-address to a Directory Number, for use in call set-up, and in those supplementary services that use a Directory Number.

A.13 Short Message Service Cell Broadcast

The Short Message Service Cell Broadcast enables the mobile equipment to receive short messages from a message handling system.

The short message service cell broadcast teleservice is described in specification 3GPP TS 22.003 [14]

A.14 Short Message Service Cell Broadcast DRX

This feature enables a mobile equipment to save on battery utilization, by allowing the mobile equipment to not listen during the broadcast of messages the subscriber is not interested in.

A.15 Support of the extended Short message cell broadcast channel

This feature allows a mobile equipment by supporting of the extended Short message cell broadcast channel to enhance the capacity of the service. The support of the extended channel has low priority, i.e. the UE can interrupt the reading of this channel if idle mode procedures have to be executed.

A.16 Network Identity and Timezone

The feature provides the means for serving PLMNs to transfer current identity, universal time and the local timezone to mobile equipments, and for the mobile equipments to store and use this information. This enhances roaming by permitting accurate indication of PLMN identities that are either newer than the ME or have changed their name since the ME was sold. Additionally time and timezone information can be utilized by MEs as desired.

The network name time and timezone information will normally be transferred from the network to the ME:

1) Upon registering on the network.

2) When the UE geographically relocates to a different Local Time Zone.

3) When the network changes its Local Time Zone, e.g. between summer and winter time.

4) When the network changes its identity.

5) At any time during a signalling connection with mobile equipment.

Further details of this feature are described in 3GPP TS 22.042 [15].

A.17 Network's indication of alerting in the UE

This feature provides the means for serving PLMNs to transfer to a UE an indication that may be used by the UE to alert the user in a specific manner in the following cases:

- mobile terminating call
- network initiated USSD
- network initiated Mobile Originated (MO) connection, if the ME supports the "network initiated MO connection " feature.

Eight different indications are defined, whether the mobile terminating traffic is a call or USSD or related to the network initiated MO connection procedure. These indications are sent by the network and received by the UE:

- Three of these indications are used as levels, reflecting some kind of urgency: level 0 indicates that the UE shall not alert the user for USSD and remain silent in the case of call, level 2 shall be considered by the UE as more important than level 1 for the purpose of alerting the user.
- The five other indications are used as categories, identifying different types of terminating traffic. The UE shall inform the user in a specific manner for each of these five categories. Nevertheless, the possible forms of the alert (different ringing tones, displayed text, graphical symbols...) is still up to the mobile manufacturer (some forms of alerts can be simultaneously used, e.g. ringing tones and text on the display).

The management of the feature by the UE requires for the handling of categories that :

- the SIM/USIM stores for each category an informative text (maximum 25 characters per category) describing the type of terminating traffic associated with the category. This information could be used by the UE when alerting the user (display on the screen). It is necessary for the network operator to be able to change the meaning of each category.
- The user has the ability to set up his/her own association between the type of terminating traffic (identified by each category) and the different types of alert provided by the UE. To help the user in this choice, the UE uses the informative text associated with each category (as stored in the SIM/USIM). The UE should keep this association when switched off.

  Default settings should also be defined in the ME for the following cases :

  - when the UE receives a call, USSD or a request for a network initiated MO connection with no alerting indication,
  - when the UE receives a call, USSD or a request for a network initiated MO connection with a category of alerting not defined in the SIM/USIM.

  These default settings should be separated per type of mobile terminated traffic received (call, USSD or request for a network initiated MO connection).

A UE supporting the feature shall act according to the following points in case of mobile terminating traffic :

- when a mobile terminating traffic is received without any indication (level or category), the ME shall act as if it was not supporting the feature, i.e. use a default alert (e.g. associated with this type of mobile terminating traffic).
- if a level is indicated, the UE shall use an alert enabling the user to differentiate between the three levels.

- if a category is indicated, then :

  - if the SIM/USIM used in the UE does not store any information on that feature, the UE shall ignore the category received with any mobile terminating traffic and act as if it was not supporting the feature, i.e. use a default alert (e.g. associated with this type of mobile terminating traffic).

  - if the category is not defined in the SIM/USIM, the UE shall act as if it was not supporting the feature, i.e. use a default alert (e.g. associated with this type of mobile terminating traffic).

  - if the category is defined in the SIM/USIM, the UE shall use the alert associated with this category. In addition, it would be very useful for the user to be notified of the informative text associated with this category (e.g on the display).

Some interactions between this feature and other services related to alerting are described below :

- the call waiting service has priority on this feature, i.e. the call waiting tone will be played and not the alert derived by this feature. If possible, two different indications should be given to the user (e.g. the call waiting tone and a text on the display indicating call waiting, and in addition a text relative to the type of the new call received).

- the presentation of the calling line identity takes priority on this feature, if it is not possible to display this information and another information related to this feature.

- In case of interaction between this feature and UE specific features to alert the user (e.g. whole silent mode), the user should still be able to differentiate between the different levels or different types of terminating traffic, even if the alert itself may be changed.

A.18 Network initiated Mobile Originated (MO) connection

The "Network Initiated Mobile Originated connection" feature allows the network to ask the mobile equipment to establish a mobile originated connection. The serving PLMN provides the mobile equipment with the necessary information which is used by the mobile equipment to establish the connection.

Currently only the network initiated mobile originated call feature is specified. It is mandatory for a UE supporting CCBS and is used in the case of a CCBS recall.

A.19 Abbreviated dialling

The directory number or part of it is stored in the mobile equipment together with the abbreviated address. After retrieval the directory number may appear on the display.

Abbreviated dialling numbers stored in the UE or USIM may contain wild characters.

If wild characters are used to indicate missing digits, each wild character shall be replaced for network access or supplementary service operation, by a single digit entered at the keypad. The completed directory number is transmitted on the radio path.

A.20 Barring of Dialled Numbers

This feature provides a mechanism so that by the use of an electronic lock it is possible to place a bar on calling any numbers belonging to a pre-programmed list of numbers in the SIM/USIM.

Barred Dialling Numbers stored in the /USIM may contain wild characters.

Under control of PIN2, "Barred Dialling Mode" may be enabled or disabled. The selected mode is stored in the SIM/USIM.

Under PIN2 control, it shall be possible to add, modify or delete a particular "Barred Dialling Number" (BDN) and to allocate or modify its associated comparison method(s). This BDN may have the function of an abbreviated dialling number / supplementary service control (ADN/SSC), overflow and/or sub-address.

When BDN is inactive, no special controls are specified, and the barred dialling numbers may be read (though not modified or deleted, except under PIN2 control) as if they were normal abbreviated dialling numbers. Access to keyboard and normal abbreviated dialling numbers (including sub-address) is also permitted.

When Barring of Dialled Numbers is active:

- Considering a number dialled by the user, if it exists a BDN for which there is a successful comparison (see below) between that BDN and the dialled number, then the ME shall prevent the call attempt to that number. If there is no BDN to fulfil those conditions, the call attempt is allowed by the ME.

With each BDN is associated one (or a combination of) comparison method(s) used between that BDN and the number dialled by the user. At least three different comparison methods are possible:

- The comparison is made from the first digit of that BDN, from the first digit of the dialled number and for a number of digits corresponding to the length of the BDN.

- The comparison is made from the first digit of that BDN, from any digit of the dialled number and for a number of digits corresponding to the length of the BDN.

- The comparison is made backwards from the last digit of that BDN, from the last digit of the dialled number and for a number of digits corresponding to the length of the BDN.

- If a BDN stored in the SIM/USIM contains one or more wild characters in any position, each wild character shall be replaced by any single digit when the comparison between that BDN and the dialled number is performed.

- If a BDN contains a sub-address, and the same number without any sub-address or with that sub-address is dialled, the ME shall prevent the call attempt to that number.

- Numbers specified as "barred" may only be modified under PIN2 control.

- If the ME does not support barring of dialled numbers, the UE shall not allow the making or receiving calls. However, this feature does not affect the ability to make emergency calls.

If "Fixed Number Dialling" and "Barring of Dialled Numbers" are simultaneously active, the dialled number shall be checked against the two features before the ME allows the call attempt. In that case, a dialled number will only be allowed by the ME if it is in the FDN list and if the comparison between that number and any number from the BDN list is not successful.

The UE may support other selective barrings, e.g. applying to individual services (e.g. telephony, data transmission) or individual call types (e.g. long distance, international calls).

A.21 DTMF control digits separator

Provision has been made to enter DTMF digits with a telephone number, and upon the called party answering the UE shall send the DTMF digits automatically to the network after a delay of 3 seconds (± 20 %). The digits shall be sent according to the procedures and timing specified in 3GPP TS 24.008 [13].

The first occurrence of the "DTMF Control Digits Separator" shall be used by the ME to distinguish between the addressing digits (i.e. the phone number) and the DTMF digits. Upon subsequent occurrences of the separator, the UE shall pause again for 3 seconds (± 20 %) before sending any further DTMF digits.

To enable the separator to be stored in the address field of an Abbreviated Dialling Number record in the SIM/USIM, the separator shall be coded as defined in 3GPP TS 31.102 [19]. The telephone number shall always precede the DTMF digits when stored in the SIM/USIM.

The way in which the separator is entered and display in the UE, is left to the individual manufacturer's MMI.

MEs which do not support this feature and encounter this separator in an ADN record of the SIM/USIM will treat the character as "corrupt data" and act accordingly.

A.22 Selection of directory number in messages

The Short Message Service (SMS), Cell Broadcast Service (CBS), Multimedia Message Service (MMS), Network Initiated USSD or Network Response to Mobile Originated USSD message strings may be used to convey a Directory Number, which the user may wish to call.

A.23 Last Numbers Dialled (LND)

The Last "N" Numbers dialled may be stored in the SIM/USIM and/or the ME. "N" may take the value up to 10 in the SIM/USIM. It may be any value in the ME. The method of presentation of these to the user for setting up a call is the responsibility of the UE but if these numbers are stored in both the SIM/USIM and the UE, those from the SIM/USIM shall take precedence.

A.24 Service Dialling Numbers

The Service Dialling Numbers feature allows for the storage of numbers related to services offered by the network operator/service provider in the SIM/USIM (e.g. customer care). The user can use these telephone numbers to make outgoing calls, but the access for updating of the numbers shall be under the control of the operator.

NOTE: No MMI is envisaged to be specified for these numbers and it is left to mobile manufacturer implementations.

A specific example of Service Dialling Numbers is the storage of mailbox dialling numbers on the SIM/USIM for access to mailboxes associated with Voicemail, Fax, Electronic Mail and Other messages.

A.25 Fixed number dialling

This feature provides a mechanism so that by the use of an electronic lock it is possible to place a bar on calling any numbers other than those pre-programmed in the SIM/USIM.

Under control of PIN 2, "Fixed Dialling Mode" may be enabled or disabled. The mode selected is stored in the SIM/USIM.

Fixed Dialling Numbers (FDNs) are stored in the SIM/USIM in the Fixed Dialling Number field. FDN entries are composed of a destination address/Supplementary Service Control. Destination addresses may have the format relevant to the bearer services/teleservices defined in [21] and [14]. FDN entries may take the function of an Abbreviated Dialling Number/Supplementary Service Control (ADN/SSC), Overflow and/or sub-address. Fixed Dialling Numbers stored in the SIM/USIM may contain wild card characters.

The Fixed Dialling feature is optional, however when Fixed Dialling Mode is enabled, an ME supporting the feature shall;

- Prevent the establishment of bearer services/teleservices to destination addresses which are not in FDN entries on a per bearer service/teleservice basis. The list of bearer services/teleservices excluded from the FDN check shall be stored in the SIM/USIM. Those bearer services/teleservices are characterised by their service code as described in [23]. For instance if the SMS teleservices is indicated in this list, SMS can be sent to any destination. By default, the ME shall prevent the establishment of any bearer service/teleservice to destination addresses which are not in FDN entries.

- Only allow modification, addition or deletion of Fixed Number Dialling entries under control of PIN2.

- Allow the establishment of bearer services/teleservice to destination addresses stored in FDN entries. For SMS, the Service Center address and the end-destination address shall be checked.

- Support the reading and substitution of wildcards in any position of an FDN entry, via the ME MMI.

- Allow the user to replace each wildcard of an FDN entry by a single digit, on a per call basis without using PIN2. The digit replacing the wildcard may be used for network access or supplementary service operation.

- Only allow Supplementary Service (SS) Control (in Dedicated or Idle mode) if the SS control string is stored as

an FDN entry.

- Allow the extension of an FDN entry by adding digits to the Fixed Dialling number on a per call basis.
- Allow the emergency numbers (see Section 8.4) to be called, even if it is not an FDN entry.
- Allow normal access to ADN fields (i.e. allow ADN entries to be modified, added or deleted) and the keyboard.
- Allow use of ADNs subject to the FDN filter.

When FDN is disabled, an ME supporting FDN shall;

- Allow FDN entries to be read as though they were normal ADN entries.
- Only allow modification, addition or deletion of Fixed Number Dialling entries under control of PIN2.
- Allow normal access to ADN fields and the keyboard.

If the ME does not support FDN, the UE shall not allow the making or receiving of calls when Fixed Dialling is enabled. However, emergency calls (112 and other user defined emergency numbers) shall still be possible.

NOTE: Wildcards are stored on the SIM/USIM. The wildcard coding is given in 3GPP TS 31.102 [19].

A.26 Message Waiting Indication

A short message may be used to provide and indication to the user about the status and number of types of messages waiting on systems connected to the PLMN. The ME shall present this indication as an icon on the screen, or other MMI indication, and store the indication status on the SIM/USIM to allow the status to be retained through power off/on, SIM/USIM movement between UEs etc..

The ME shall be able to accept and acknowledge these message waiting status short messages irrespective of the memory available in the SIM/USIM.

Annex B (informative): Change history

Change history					
SMG No.	**TDoc. No.**	**CR. No.**	**Section affected**	**New version**	**Subject/Comments**
SMG#22	302/97	001	4.6 (Role Model)	3.1.0	SMG3 queried the separation of network operator into core and access, which, on examination, SMG1 find unhelpful
SMG#22	319/97 (SMG1 WPC 125/97)	002		3.1.0	Editorial Changes: FLMPTS was replaced by IMT 2000, 2 new references given, additional clarifications.
SMG#22	320/97	003	8.5, 9.3, 9.5, 17	3.1.0	Changes on Emergency Calls, User identification, Multiple profiles and additional handover requirements.
After SMG#23	SMG1 433u/97 965/97	004		Draft 3.2.0	Based on Approved Changes at SMG#22 Distributed at SMG1 in Dresden Nov 3-7, 97 to be Approved at SMG#24
SMG#24	966/97	005	Sections 8, 9, 11	3.2.1	Restructuring of sections 8,9 and 11 to gather all requirements relating to multiple subscriptions into one section and to improve the clarity.
SMG#24	967/97	006	Section 8.1	3.2.1	To improve the accuracy of text on numbering principles and minor editorial change to section 8.1
SMG#27	98-0551	007	Section 4.6 and misc.	3.3.0	Removal of commercial role model from the specification in order to improve clarity
SMG#27	*98-0552 (Not Approved)*	*008*	*New Section 18 (Not Applied)*	*3.3.0*	*To include requirements for network selection in service principles: NOT APPROVED > NOT APPLIED*
Pre- SMG#28	*(SMG1 Tdoc 98-0893)* 99-040	008 r4 Rejected	New Section 18 Applied	[Draft 3.4.0]	Added Network Selection section - Agreed by correspondence - Jan 13, 1999 - Prepared with CRs applied with revision marks
SMG#27	98-0553	009	Section 4.3	3.3.0	To remove unnecessary reference to IN and B-ISDN
SMG#27	98-0682	010	Section 11	3.3.0	To improve the clarity of service requirements for multiple user profiles
Pre-SMG#28	*(SMG1 Tdoc 98-0869)* 99-040	011	Sections 1, 2, 3, 4, 9, 10, 12, 17	Draft 3.4.0	Clean up for UMTS phase 1 Agreed at SMG1 Rome
Pre-SMG#28	*(SMG1 Tdoc 98-852)* 99-040	012	Sections 3,8,9,11,14,15	Draft 3.4.0	Changes in IC card and terminal service requirements Agreed at SMG1 Rome
Pre-SMG#28	*(SMG1 Tdoc 98-0894)* 99-040	013r1	Section 3.2 & 4.3	Draft 3.4.0	Clarification of general requirements for efficient use of radio resources Agreed by correspondence - Jan 13, 1999 - Prepared with CRs applied with revision marks
NOTE				Draft 3.4.0	SMG1 agreed only

Change history					
SMG No.	**TDoc. No.**	**CR. No.**	**Section affected**	**New version**	**Subject/Comments**
pre-SMG#28	99-040	015 Rejected	17	Draft 3.4.0	According to the outcome of the SMG 1 ad-hoc meeting on handover issues it is proposed that inter-operator handover is not required for UMTS phase 1.(rejected by smg#28)
SMG#28	99-305	008r5	Revised Section 18	3.4.0	Network Selection presented at SMG#28 in 2201_008r4 was further revised and Approved at SMG#28.
NOTE				3.4.0	Removal of Section 12 on UPT with CR 011 causes a skip section from Section 11 to 13.

Change history											
TSG SA#	**SA Doc.**	**SA1 Doc**	**Spec**	**CR**	**Rev**	**Rel**	**Cat**	**Subject/Comment**	**Old**	**New**	**WI**
SP-03	SP-99104	S1-99202	22.101	A016		R99	B	Control of supplementary services (GSM 02.04), may use MMI procedures specified in GSM 02.30 and existing GSM MMI related MS features (GSM 02.07) may also be used.	3.4.0		
Post-SA#3			22.101			R99		Updated Logo, …	3.5.0	3.5.1	
SP-04	SP-99229	S1-99387	22.101	021		R99	B	MultiNumbering: It will be possible for multiple MSISDNs to be associated with a single subscription.	3.5.0	3.6.0	
SP-04	SP-99226	S1-99395	22.101	020	7	R99	B	Emergency: To route the call to the appropriate emergency service if more than one emergency number is supported in a country.	3.5.0	3.6.0	
SP-05	SP-99439	S1-99737	22.101	025		R99	B	Support of SAT by USIM	3.6.0	3.7.0	
SP-05	SP-99439	S1-99816	22.101	024		R99	B	Clarification on the usage on 2G SIM and 3G USIM	3.6.0	3.7.0	
SP-05	SP-99435	S1-99851	22.101	022		R99	C	Clarification of Emergency Call requirements	3.6.0	3.7.0	
SP-06	SP-99524	S1-991031	22.101	029		R99	B	Emergency Call	3.7.0	3.8.0	
SP-06	SP-99527	S1-991038	22.101	028		R99	C	FDN	3.7.0	3.8.0	
SP-06	SP-99519	S1-991026	22.101	026		R99	D	Mainly editorial update for GSM/3GPP use.	3.7.0	3.8.0	
SP-07	SP-000060	S1-000112	22.101	030		R99	A	Support of encryption in GPRS mobile stations	3.8.0	3.9.0	
SP-07	SP-000070	S1-000137	22.101	031		R99	F	Fixed Dialing Number (FDN)	3.8.0	3.9.0	
SP-08	SP-000210	S1-000271	22.101	033		R99	D	Network selection procedures removed from section 16, reference to 22.011 added	3.9.0	3.10.0	
SP-08	SP-000200	S1-000350	22.101	035		R99	B	Emergency Calls and numbers used	3.9.0	3.10.0	
SP-08	SP-000201	S1-000362	22.101	038		R99	F	CS multimedia support	3.9.0	3.10.0	
SP-08	SP-000202	S1-000326	22.101	039		R99	F	Clarification for USIM Application selection	3.9.0	3.10.0	
SP-08	SP-000210	S1-000270	22.101	034		R00	D	Network selection procedures removed from section 16, reference to 22.011 added	3.9.0	4.0.0	
SP-08	SP-000200	S1-000351	22.101	036		R00	B	Emergency Calls and numbers used	3.9.0	4.0.0	
SP-08	SP-000213	S1-000352	22.101	037		R00	B	Emergency Call enhancements	3.9.0	4.0.0	
SP-09	SP-000383	S1-000603	22.101	040		R4	B	Multimedia messaging	4.0.0	4.1.0	
SP-09	SP-000383	S1-000605	22.101	041		R4	C	Service Management requirements	4.0.0	4.1.0	
SP-09	SP-000430	S1-000700	22.101	042	1	R4	F	General corrections and clarifications to 22.101 for Release 2000	4.0.0	4.1.0	
SP-09	SP-000383	S1-000598	22.101	046		R4	D	Editorial changes to 22.101 for Release 2000	4.0.0	4.1.0	
SP-09	SP-000430	S1-000698	22.101	047	1	R4	C	Numbering Principles	4.0.0	4.1.0	
SP-09	SP-000383	S1-000620	22.101	048		R4	C	Service evolution	4.0.0	4.1.0	

SP-09	SP-000391	S1-000573	22.101	049		R4	D	Emergency Call	4.0.0	4.1.0	
SP-09	SP-000405	S1-000649	22.101	050		R4	B	Text Conversation	4.0.0	4.1.0	
SP-09	SP-000383	S1-000625	22.101	043		R5	F	Classification of services	4.0.0	5.0.0	
SP-09	SP-000383	S1-000622	22.101	044		R5	B	IP multimedia services	4.0.0	5.0.0	
SP-09	SP-000383	S1-000621	22.101	045		R5	B	IP multimedia session for	4.0.0	5.0.0	
SP-09	SP-000430	S1-000699	22.101	051		R5	C	IM Number portability	4.0.0	5.0.0	
SP-09	SP-000430	S1-000701	22.101	052		R5	F	Introduction of IM CN	4.0.0	5.0.0	
SP-09	SP-000383	S1-000704	22.101	053		R5	F	Subscription	4.0.0	5.0.0	
SP-09	SP-000383	S1-000705	22.101	054		R5	F	Roaming	4.0.0	5.0.0	
SP-10	SP-000533	S1-000799	22.101	059		Rel-5	A	Deleting Encrypted USIM-ME interface	5.0.0	5.1.0	TEI4
SP-11	SP-010053	S1-010072	22.101	063		Rel-5	A	Handling of interactions between applications requiring the access to UE resources	5.1.0	5.2.0	Service Clean up R99
SP-11	SP-010054	S1-010208	22.101	065		Rel-5	A	PLMN name indication	5.1.0	5.2.0	TEI4
SP-11	SP-010055	S1-010179	22.101	067		Rel-5	A	CR to 22.101 on Introduction of CPHS features	5.1.0	5.2.0	UICC1-CPHS
SP-11	SP-010056	S1-010210	22.101	069		Rel-5	A	Display of service provider name in the UE	5.1.0	5.2.0	TEI4
SP-11	SP-010057	S1-010250	22.101	070		Rel-5	C	CR to 22.101 on Clarifications on IMS emergency call support	5.1.0	5.2.0	EMC1-PS
SP-12	SP-010262	S1-010505	22.101	072		Rel-5	A	Replacement of references to 23.121 for R4 onwards	5.2.0	5.3.0	TEI4
SP-12	SP-010258	S1-010574	22.101	073		Rel-5	C	Subscription and Provisioning	5.2.0	5.3.0	TEI5
SP-12	SP-010255	S1-010577	22.101	075		Rel-5	A	Addition of a Streaming paragraph	5.2.0	5.3.0	PSTREAM
SP-12	SP-010263	S1-010351	22.101	077		Rel-5	A	CS Multimedia fallback to speech	5.2.0	5.3.0	TEI4
SP-12	SP-010253	S1-010595	22.101	080		Rel-5	A	Clarification of PLMN Name Indication and Service Provider Name Indication feature.	5.2.0	5.3.0	SPANME
SP-13	SP-010441	S1-010832	22.101	084		Rel-5	A	Addition of a statement on parameter storage on the SIM/USIM.	5.3.0	5.4.0	TEI4
SP-13	SP-010436	S1-010889	22.101	086	1	Rel-5	F	Definition of Home Environment	5.3.0	5.4.0	VHE1
SP-15	SP-020052	S1-020609	22.101	087		Rel-5	B	CR 22.101 Rel.5 B Service change and fallback for UDI/RDI multimedia calls	5.4.0	5.5.0	SCUDIF
SP-15	SP-020049	S1-020510	22.101	088		Rel-5	C	CR to 22.101on IMS access	5.4.0	5.5.0	43000
SP-15	SP-020051	S1-020613	22.101	089		Rel-5	C	CR to 22.101 on on USIM support in Rel-5 GSM only terminals	5.4.0	5.5.0	UICC1
SP-15	SP-020050	S1-020658	22.101	090		Rel-5	C	CR to 22.101 on Access to IMS services using ISIM Note: special dispensation was given by SA #15 to allow some leeway on the section numbering.	5.4.0	5.5.0	TEI/ISIM
SP-15	SP-020045	S1-020457	22.101	092	-	Rel-5	A	Editorial CR to correct terms and references	5.4.0	5.5.0	CORRECT
SP-15	SP-020126		22.101	093		Rel-5	F	Correction of references to obsolete SIP RFC 2543 IETF specification	5.4.0	5.5.0	IMS-CCR
SP-16	SP-020381		22.101	095	1	Rel-5	F	CR to 22.101 v5.5.0 on REL5 clean up	5.5.0	5.6.0	IMS
SP-16	SP-020255	S1-020848	22.101	096		Rel-6	D	CR to 22.101 v5.5.0 on Editorial for REL6	5.5.0	6.0.0	IMS
SP-17	SP-020557	S1-021849	22.101	103		Rel-6	F	Clarification of SIM support in Rel-6	6.0.0	6.1.0	TEI4
SP-17	SP-020557	S1-021755	22.101	104		Rel-6	B	CR to 22.101 Removal of implementation details for directory number in SMS and other services	6.0.0	6.1.0	TEI6
SP-17	SP-020557	S1-021775	22.101	105		Rel-6	F	CR to 22.101 Rel-6 Clean up of IMS Rel 6 to re-instate requirements	6.0.0	6.1.0	IMS
SP-18	SP-020658	S1-022064	22.101	107		Rel-6	B	CR to 22.101 on IMS number portability rev of 1909	6.1.0	6.2.0	IMS
SP-18	SP-020658	S1-022119	22.101	108		Rel-6	B	CR to 22.101 Rel 6 on	6.1.0	6.2.0	EMC1

								Emergency calls			
SP-18	SP-020666	S1-022263	22.101	109		Rel-6	B	CR to 22.101 on WLAN interworking	6.1.0	6.2.0	WLAN
SP-18	SP-020651	S1-022340	22.101	113		Rel-6	A	CR to 22.101 on Support of SIM and USIM in REL-6	6.1.0	6.2.0	TEI5
SP-19	SP-030022	S1-030215	22.101	114	-	Rel-6	B	Simultaneous connection to 3GPP systems and I-WLANs	6.2.0	6.3.0	WLAN-CR
SP-19	SP-030035	S1-030269	22.101	115	-	Rel-6	B	Requirements for Network Sharing in Rel-6	6.2.0	6.3.0	NTShar-CR
SP-19	SP-030148	S1-030257	22.101	117	-	Rel-6	A	CR to 22.101 Rel 6 on SIM support	6.2.0	6.3.0	TEI5
SP-20	SP-030351		22.101	125	1	Rel-6	A	Alignment of Subscriber Identification requirements to current implementation	6.3.0	6.4.0	TEI5
SP-21	SP-030457	S1-030911	22.101	128	-	Rel-6	A	Clarification on USIM-based access to IMS	6.4.0	6.5.0	IMS
SP-21	SP-030492	S1-031049	22.101	132		Rel-6	C	Cleanup and modifications on identification of emergency numbers in 22.101 Rel-6	6.4.0	6.5.0	EMC1
SP-21	SP-030534	S1-031061	22.101	134	1	Rel-6	A	Support of Release 4 SIM in Release 6	6.4.0	6.5.0	TEI5
SP-22	SP-030700	S1-031339	22.101	135	-	Rel-6	B	Automatic Device Detection	6.5.0	6.6.0	TEI
SP-22	SP-030700	S1-031342	22.101	136	-	Rel-6	C	Correction of Core Network emergency call requirements	6.5.0	6.6.0	EMC1
SP-22	SP-030687	S1-031344	22.101	137	-	Rel-6	C	Clarification of emergency call requirements	6.5.0	6.6.0	EMC1
SP-22	SP-030790	-	22.101	141	-	Rel-6	A	Removal of unnecessary numbers from the ME default emergency number list (Rel-6)	6.5.0	6.6.0	EMC1