LIF Standardization Activity

The Location Inter-operability Forum (LIF) was established in September 2000, with the mission to specify a framework for offering services using location information independent of radio interfaces, terminal types, positioning methods, etc. in mobile communications systems, and to enhance the interoperability among specifications endorsed by relevant standardization bodies thereby. Since its establishment, LIF has been working on creating the Mobile Location Protocol (MLP) specification as one of its top-priority issues. MLP is a protocol for transferring location information outside of the core network. In June 2002, LIF completed MLP ver.3.0, which was harmonized with the Work Item related to location information in 3GPP Release 5 and approved as a specification corresponding to 3GPP stage 3 (detailed protocol specification). The specification sets forth an information-forwarding protocol in order for the Gateway Mobile Location Center (GMLC) in the core network specified under 3GPP to provide the most basic location-based services to external service providers.

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1. Introduction

The Location Inter-operability Forum (LIF) is a standardization body established by Motorola, Ericsson and Nokia in September 2000. As of July 2002, six companies have the status of Sponsors and serve as board members at LIF: the three founding companies mentioned above plus Siemens, and two software development companies specializing in location information technologies, SignalSoft and Autodesk Location Service. All other members are categorized as Supporter members, about 100 companies, including mobile communications equipment vendors, mobile communications network operators, software vendors and content developers. NTT DoCoMo joined LIF in November 2001.

The mission of this Forum is to specify and promote a framework for offering services using common, "ubiquitous" location information independent of the protocol and radio interface of mobile networks, terminal types and positioning methods. LIF is distinctive that it concentrates on technologies related to location information for mobile communications systems, and emphasizes the assurance of interoperability based on a cross-sectional, integrated approach. Its actual activities center on the formulation of specifications of location-based application interfaces to be proposed to major external standardization bodies, specifications of conformance tests, guidelines for interoperability tests. It seeks harmonization with international standardization bodies dealing in their scope with location-based technologies such as the 3rd Generation Partnership Project (3GPP), the Wireless Application Protocol (WAP) Forum, the American National Standards Institute (ANSI), the Internet Engineering Task Force (IETF), the World Wide Web Consortium (W3C) and the Open GIS Consortium (OGC).

LIF's activity organization is directly placed under the management board consisting of the aforementioned six

companies. The organization consists of: the Standards Influencing Group (SIG), under which specification proposals are actually produced and discussions on related issues (such as roaming and privacy) take place; the Interoperability and Testing Group (ITG), which produces the framework of specifications of conformance and interoperability tests; the Network operator Advisory Group (NAG), which defines the requirements of mobile communications network operators; and the Public Relations and marketing Group (PRG), which is in charge of public relations.

Since its establishment, LIF has been working on the development of the Mobile Location Protocol (MLP) specification, setting its activity focus on the Application Program Interface (API) between mobile communications networks and location-information-related applications. LIF concentrated on formulating the MLP specification with the aim to propose a specification corresponding to stage 3 (detailed protocol specification) of the 3GPP LoCation Service (LCS), triggered by the 3GPP approval of the specification work relating to the interface between the Gateway Mobile Location Center (GMLC) and the LCS Client (Le interface) as a Work Item (WI) for its Release 5 specification suite in 2001. NTT DoCoMo actively contributed to the harmonization of MLP with the 3GPP specification. MLP was approved as a Normative Reference to the 3GPP LCS specification in the end of 2001, and the LIF MLP3.0 (LIF TS 101 Ver.3.0.0) specification [1] was completed in June 2002.

The following chapters summarize the MLP3.0 specification, MLP3.0 application examples, and the future standardization trends in LIF.

2. MLP Architecture

Configuration A in **Figure 1** shows the architecture of LCS using MLP according to 3GPP TS23.271 [2]. GMLC is a node specified in the 3GPP core network, and serves as a gateway node that exchanges latitude and longitude information of a mobile terminal positioned based on an arbitrary method outside of the network operator. The LCS Client generally corresponds to the so-

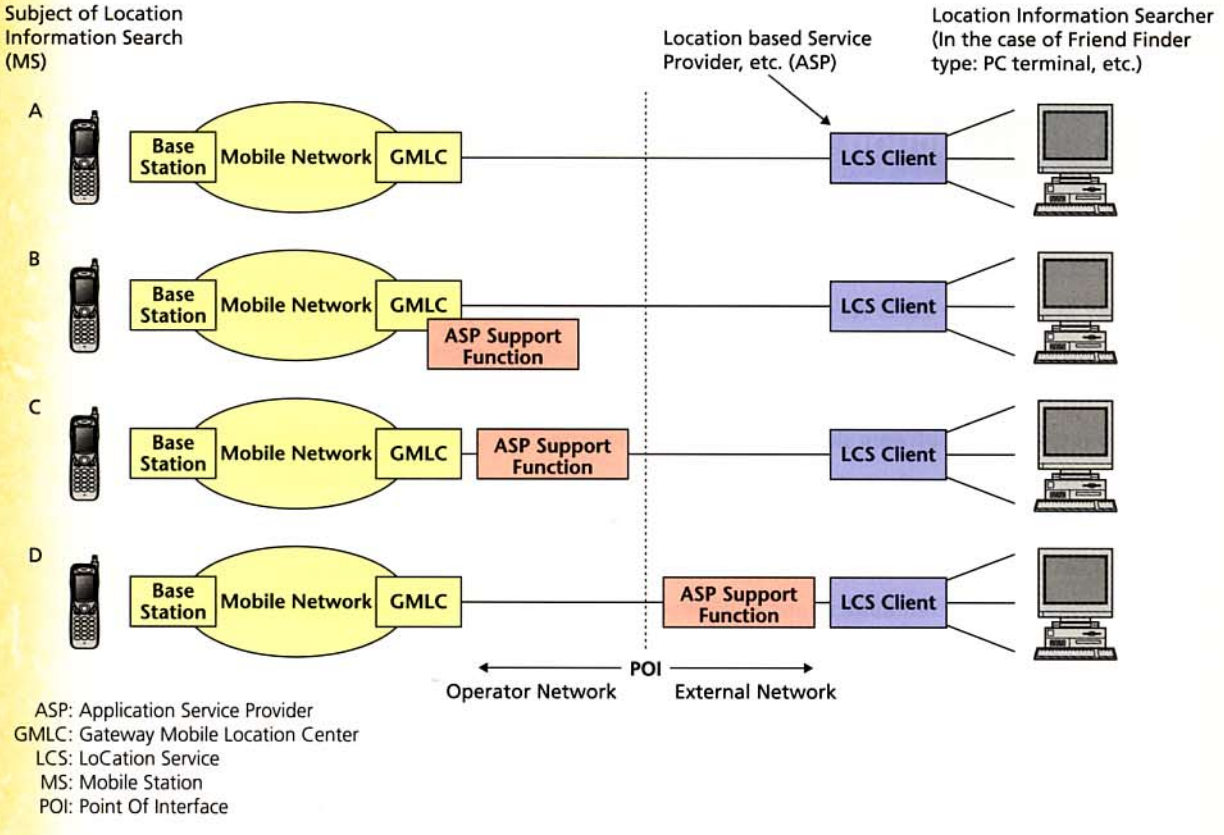


Figure 1 MLP Architecture

called Application Service Provider (ASP) i.e., a location-based service provider to end users (in this context, entities who acquire and use location information; specifically, home PC and mobile terminal users).

The service operation can be explained with reference to Friend Finder type –a basic location service configuration of MLP– as an example: an LCS Client that has received a request from the end user to search location information sends a positioning request to the GMLC, which, in turn, sends back the location information of the mobile terminal (on the left corner of Figure 1) to the LCS Client. LCS using MLP will be described in further detail in Chapter 3.

MLP also specifies an advanced service, the so-called Advanced MLP Service, which adds functions such as map display, address conversion and pedestrian navigation to the basic latitude-and-longitude location information handled by the GMLC, and defines the ASP support function for offering this Advanced MLP Service to the LCS Client. MLP presumes configurations B, C and D as alternatives to configuration A in Figure 1, according to the placement of the ASP support function. The choice of configuration is up to the network operator.

Configuration A does not have the ASP support function. The interface between the GMLC and the LCS Client only supports a protocol, the so-called Basic MLP for offering the basic functions required for LCS.

Configurations B and C assume that the ASP support function is located within the network operator: the former assumes that the function is integrated within the GMLC, whereas the latter assumes that the function is separated from the GMLC as an independent node. In these configurations, the network operator side offers the ASP support function node. This means that if network operators interwork with each other and unify their service specifications using Advanced MLP, the subscribers to these operators and the users of these services will be able to access a wide range of advanced services under Advanced MLP, and it will be easy to implement borderless services aimed at international roaming.

Configuration D is based on the service format of the DoCoMo Location Platform (DLP) scheme, and assumes that the ASP support function is implemented outside the network operator via a Point Of Interface (POI). NTT DoCoMo is considering the adoption of configuration D, in which the network operator offers only the basic location information to the LCS Client. As the LCS Client can freely develop applications, it is feasible to expect the emergence of a wide variety of applications, as demonstrated in i-mode. Also, it is expected that more ground-breaking location information contents could be cultivated by harnessing the market mechanism.

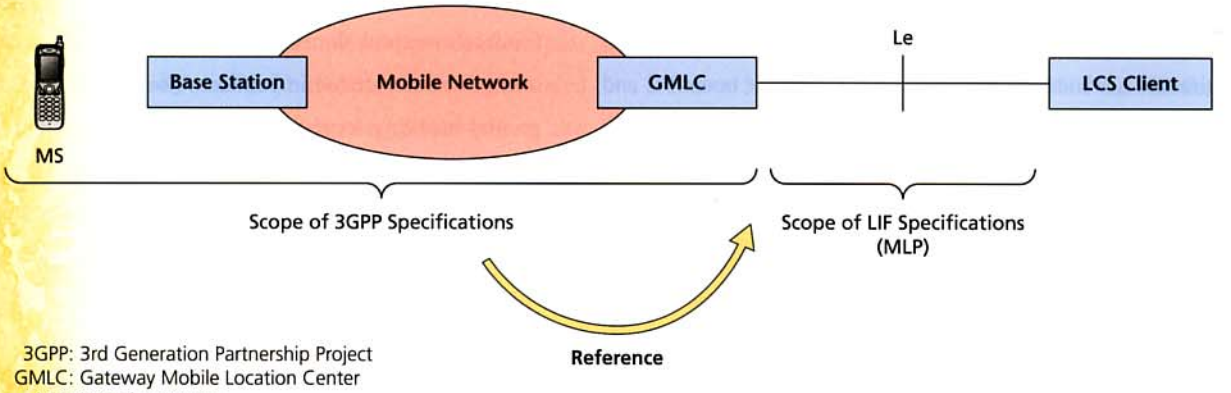
LIF MLP3.0 primarily considered harmonization with the 3GPP specification and focused on Basic MLP, that is, a protocol for offering basic location based services. Accordingly, it specified the basic functions of the external interface between the GMLC and the LCS Client (Le interface), which corresponds to the POI in configurations A and D.

3. MLP3.0 Overview

MLP3.0 specifies the detailed protocol for the Le interface that connects the GMLC (which offers location information on the mobile station (MS) defined under the 3GPP LCS architecture) and the LCS Client (which offers various services using location information). It is fair to say that the Le interface is an important interface for offering LCS. **Figure 2** shows the scope of the 3GPP specification and that of the LIF specification with respect to LCS.

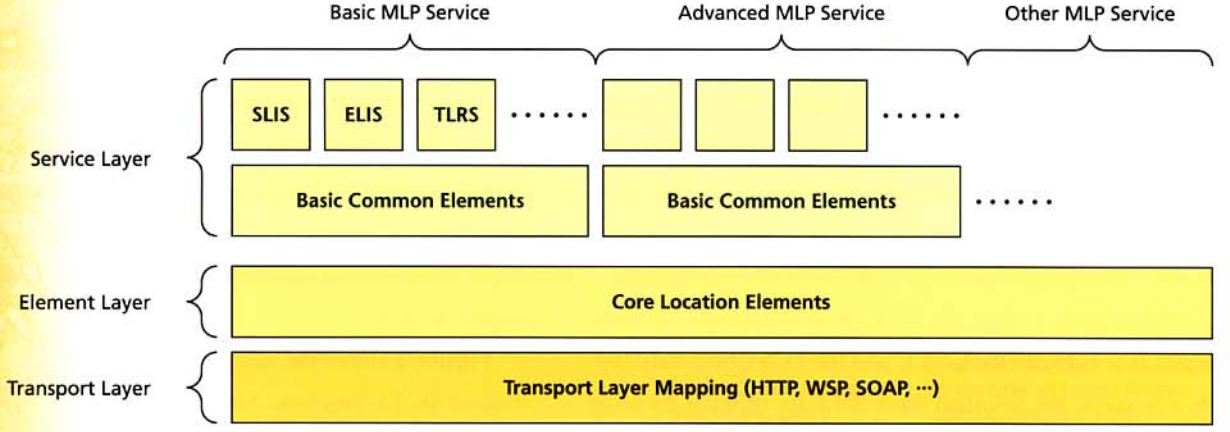
Figure 3 shows the composition of the MLP protocol specified as the Le interface. MLP specifies the protocol between the GMLC and the LCS Client based on a three-layer configuration, consisting of the Transport Layer, Element Layer and Service Layer. The detachment of the Transport Layer from the specification of MLP itself makes it possible to offer LCS in various transport environments, such as HyperText Transfer Protocol (HTTP) [3], Wireless Session Protocol (WSP) [4] and Simple Object Access Protocol (SOAP) [5].

The Element Layer, which offers basic functions, and its upper layer, the Service Layer, are written in eXtensible Markup Language (XML). As the functions common to location based services are extracted from the upper Service Layer and defined instead in the Element Layer, less work is required for redefining the common functions when adding new functions. Multiple MLPs can be defined in the Service Layer; the Basic MLP (which covers LCSs defined under 3GPP) and the Advanced MLP (which aims to enhance the convenience of LCSs) can be defined separately to each other, so that functions can be added to either of them without affecting the other. Additionally, Common Elements can be classified as the Sub



3GPP: 3rd Generation Partnership Project
GMLC: Gateway Mobile Location Center
LCS: LoCation Service
LIF: Location Inter-operability Forum
MLP: Mobile Location Protocol
MS: Mobile Station

Figure 2 3GPP and LIF Specifications



ELIS: Emergency Location Immediate Service
HTTP: HyperText Transport Protocol
MLP: Mobile Location Protocol
SLIS: Standard Location Immediate Service
SOAP: Simple Object Access Protocol
TLRS: Triggered Location Reporting Service
WSP: Wireless Session Protocol

Figure 3 MLP Three-layer Composition

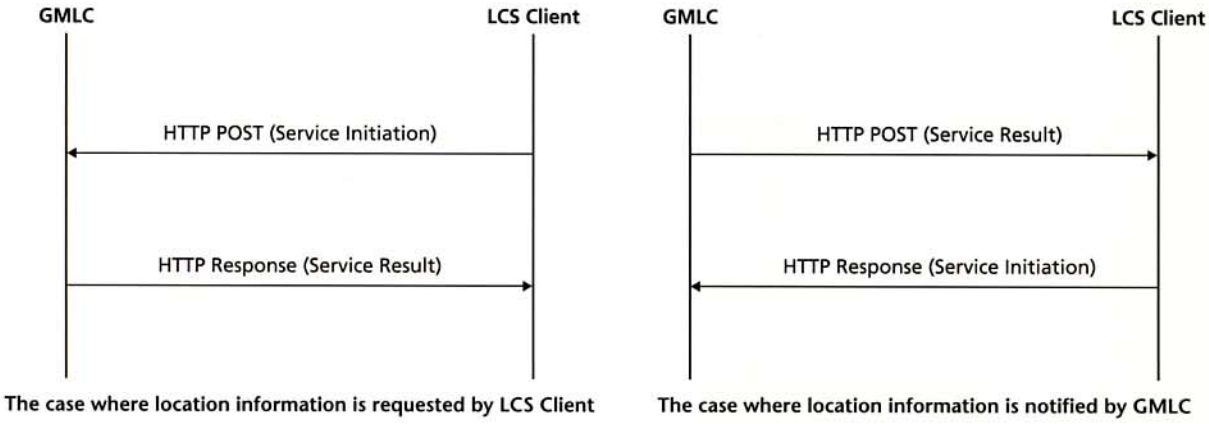
Layer for each of the services of the Service Layer, which makes it easy to reutilize the common functions in each MLP service framework.

MLP3.0 specifies five types of services shown in **Table 1** to make it possible to offer LCSs specified under 3GPP. It specifies two types of Friend Finder type services, which returns the location of the target MS in response to the positioning request from the LCS Client: the Standard Location Immediate Service (SLIS), and the Emergency Location Immediate Service (ELIS). It specifies two types of services that inform the LCS Client of the location of the MS: the Standards Location Reporting Service (SLRS) and the Emergency Location Reporting Service (ELRS). It also specifies a service that notifies the location of the MS according to events registered with the LCS Client: the Triggered Location Reporting Service (TLRS). There are three types of events supported by MLP3.0: time designation, cycle and MS operation. In regard to MS operation, the event of "UE available" can be designated. With respect to the types of MS operations in events, area monitoring, etc. is due to be added as soon as support is provided on the core network side under 3GPP specifications.

Figure 4 shows the basic sequence of MLP transferred over HTTP. In cases where the LCS Client makes a positioning request to the GMLC, the positioning request is notified to the GMLC by the LCS Client via HTTP POST,

Table 1 List of Location based Services specified by MLP

Service Name	Service Description
Standard Location Immediate Service (SLIS)	Returns the location information on the MS subject to search in response to a positioning request from the LCS Client.
Emergency Location Immediate Service (ELIS)	Returns the location information on the MS subject to search in response to a positioning request from the LCS Client in the event of an emergency call.
Standard Location Reporting Service (SLRS)	Sends the location information on the MS to the LCS Client according to the MS user's request.
Emergency Location Reporting Service (ELRS)	Sends the location information on the MS to the LCS Client in the event of an emergency call.
Triggered Location Reporting Service (TLRS)	Sends the location information on the MS to the LCS Client according to a registered event.



GMLC: Gateway Mobile Location Center
HTTP: HyperText Transport Protocol
LCS: LoCation Service

Figure 4 MLP Application based on HTTP

and the positioning results are returned to the LCS Client by the GMLC based on HTTP Response. In cases where the GMLC is to inform the LCS Client of the location according to the MS user's request, the location information is notified to the LCS Client by the GMLC via HTTP POST.

4. Location based Services using MLP

This chapter describes, with reference to examples, the applications of services that exchange location information between the network operator and the LCS Client using MLP mentioned above.

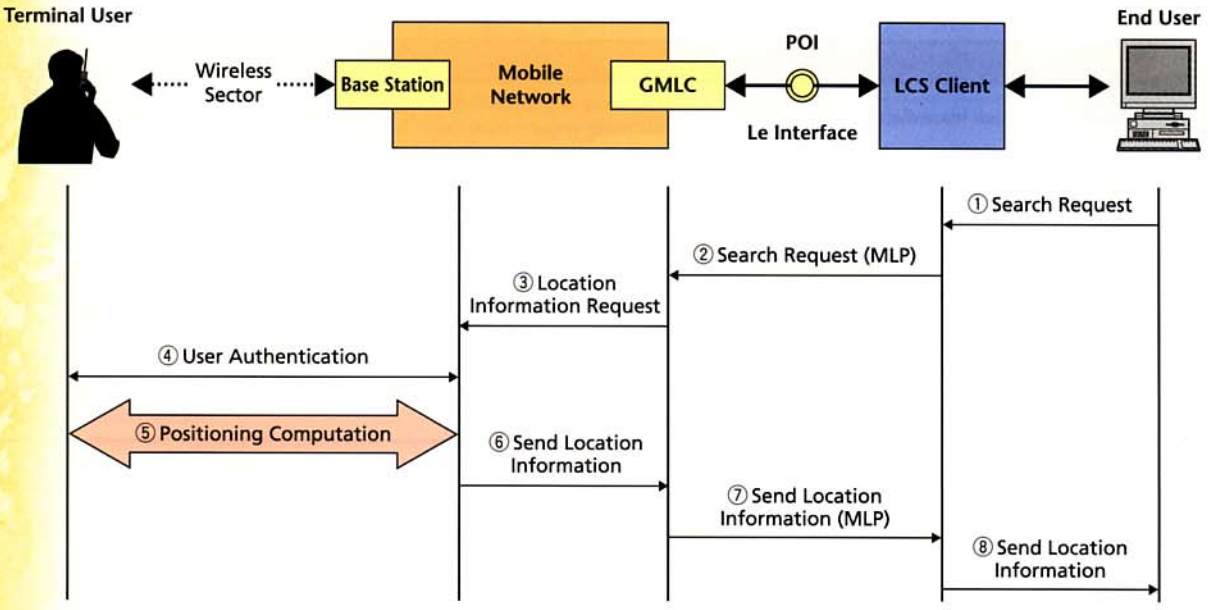
Location information can be used in various ways, such as the Friend Finder type service (which locates a third party's mobile terminal from another party) and the self-location notifying Service (in which the terminal user makes a positioning request to inform its positioning to a third party).

Application examples of the Friend Finder type service and the self-location notifying service in compliance with MLP and the service procedures under international standard 3GPP are shown in **Figures 5** and **6**, respectively, and are described below.

Application examples of Friend Finder type service include nursing services and family-care services, which require the person or child in need of care to keep the terminal with him/her all the time so that in the event of emergency, the position of the terminal can be searched and he/she can be taken into care.

Application examples of self-location notification include security firms' "rush-to-the-scene" service based on emergency calls and calls from the terminal user.

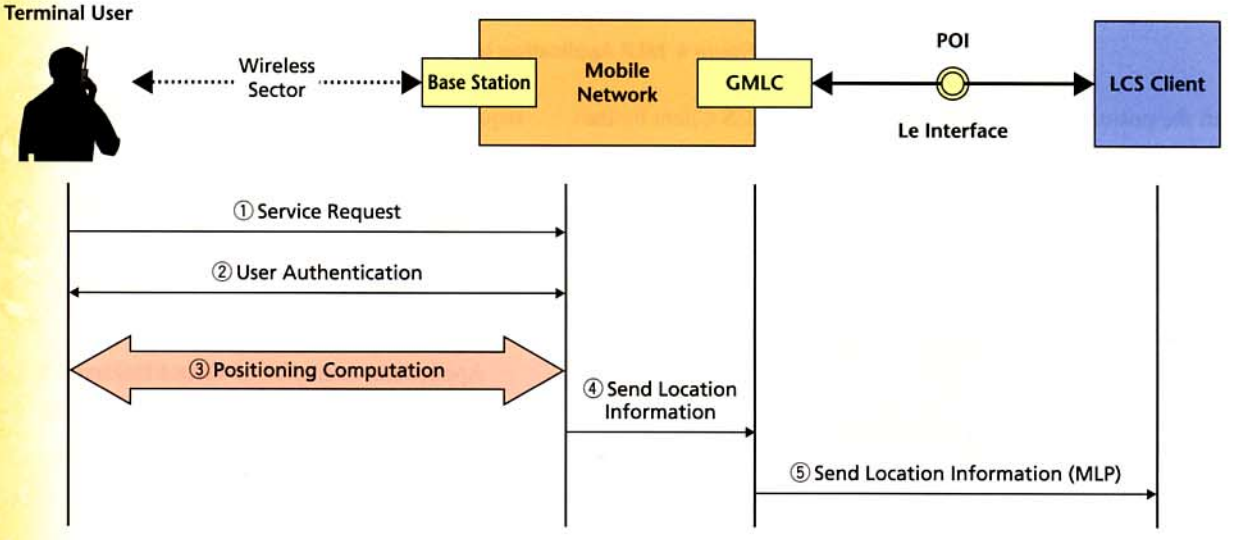
The demand for these services is already becoming apparent, and substantial growth is expected in the future.



① The end user transmits "Search Request" to the LCS Client with which it already has a subscription contract.
② The LCS Client transmits "Search Request" to the GMLC using MLP.
③ The GMLC transmits "Search Request" to the network.
④ User authentication in the network
⑤ Location of the terminal computed in the network
⑥ After the completion of positioning, the location findings are transmitted to the GMLC.
⑦ The GMLC transmits the positioning results to the LCS Client using MLP.
⑧ The LCS Client transmits the positioning results to the end user.

GMLC: Gateway Mobile Location Center
LCS: LoCation Service
MLP: Mobile Location Protocol
POI: Point Of Interface

Figure 5 Friend Finder Type Service using MLP



① Transmit service request signal to the network, triggered by the terminal user.
② User authentication in the network
③ Location of the terminal computed in the network
④ Location findings are transmitted to the GMLC.
⑤ Location information is transmitted using MLP to the LCS Client to which the user pre-registered.

GMLC: Gateway Mobile Location Center
LCS: LoCation Service
MLP: Mobile Location Protocol
POI: Point Of Interface

Figure 6 Self-Location Notifying Service using MLP

5. Future LIF Standardization Activities

LIF has completed the specification of MLP, and has made accomplishments in the first stage. LIF plans to work on roaming services associated with location information while assuring harmonization with 3GPP, as well as on Advanced MLP, which offers advanced optional LCSs.

As a forum consisting of experts on location information, LIF has formed a liaison with 3GPP, the WAP Forum, the GSM Association, and the Open GIS Consortium (OGC) in a year or so, and is gradually gaining public recognition. The WAP Forum became the Open Mobile Alliance (OMA) at the annual general assembly in June, and has started exploring its future as a forum for standardizing specifications targeting a wide range of mobile service applications, by consolidating a number of relatively small standardization forums relating to mobile service applications. LIF is one of such forums scheduled to be consolidated into OMA, and work on the consolidation task is currently under progress between the two forums. After this, LIF is expected to act as part of OMA's location information group, which shall take over LIF's present activities and accomplishments.

References

[1] LIF: TS101 Specification "Mobile Location Protocol", Version3.0.0, June 2002, http://www.locationforum.org/

[2] 3GPP: TS23.271 "Functional stage 2 description of LCS", Version 5.3.0, June 2002, http://www.3gpp.org/

[3] IETF: RFC2616 "HyperText Transfer Protocol-HTTP/1.1", June, 1999, http://www.ietf.org/

[4] WAP Forum: WAP-230-WSP "Wireless Session Protocol Specification", July 2001, http://www.wapforum.org/what/techni-cal.htm

[5] W3C: "Simple Object Access Protocol", http://www.w3c.org/