

OGC's Open Location Services Initiative & Location Interoperability Forum: Putting them together

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Wireless carriers implement and manage servers according to ANSI, GSM and UMTS standards that are designed to calculate the position of mobile devices that are connected to the network. These servers, commonly known as the Location Servers, have different implementations depending on the wireless standards. For GSM and UMTS, the Location Server is known as the Gateway Mobile Location Center (GMLC), and in ANSI standards it is called the Mobile Positioning Center (MPC), Figure 1. Functionally, GMLC and MPC are the same.

A couple of years ago, when the [Location Interoperability Forum](#) (LIF) was established, the intent was to provide Location-Based Service (LBS) providers with a standard set of interfaces that hide the different implementations of the Location Server. The result of LIF's effort was the Mobile Location Protocol (MLP), Figure 1. The Mobile Location Protocol (MLP) defines a standard protocol that separates the underlying network technology from applications that require the location of mobile devices. It serves as the interface between Location Servers and Location-Based Services.

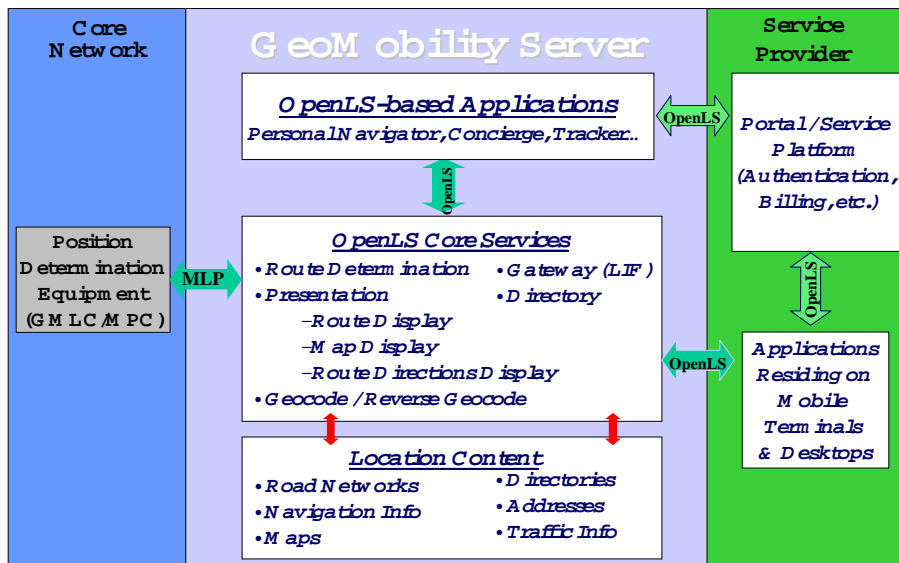


Figure 1 The Relationship between LIF's MLP, OGC's GeoMobility Server and ASPs

[Open GIS Consortium](#) (OGC) picked up where LIF started, and defined the common, core geospatial services and information model for LBS providers. OGC established the Open Location Service (OpenLS) Initiative in October 2000 for this purpose ([see their Web site](#)). (Hutchison 3G, Sun Microsystems, ESRI, Webraska, In-Q-Tel, Oracle and SignalSoft are sponsors of this initiative.) As shown in Figure 1, OpenLS provides standard interfaces for the Geocoding-ReverseGeocoding, Presentation, Route Determination (navigation), Gateway and Directory Services. OpenLS core services are bundled together in what is called the GeoMobility Server.

Location Interoperability Forum's MLP

LIF defines five different possible types of location services. Each implementation of a Location Server can select which services it needs to support. The services are described below.

Standard Location Immediate Service: This service allows applications to request a single location response from the Location Server. The request can also be served by asynchronously sending the location to the application until a timeout limit is reached.

Emergency Location Immediate Service: This service is used when a mobile subscriber initiates an emergency call. This service is mostly used by E911 applications.

Standard Location Reporting Service: In this service, the position is periodically sent to an application until a timeout is reached.

Emergency Location Report: This service is used when the wireless network automatically initiates position determination for an emergency call. The position and related data is then sent to the emergency application. The difference between the Emergency Location Immediate Service and this service is that the former is initiated by the subscriber, while this service is automatically triggered by the provider.

Triggered Location Reporting Service: This is an event-based service where the mobile subscriber's location is reported on the occurrence of a specific event.

OpenLS Core Services

The OpenLS Core Services are the foundational geospatial services that form the *Services Framework* for the GeoMobility Server.

Directory Service - This service provides subscribers with access to an online directory to find the nearest, or a specific, place, product or service. Through a suitably equipped OpenLS application, the subscriber starts to formulate the search parameters in the service request, identifying the place, product or service that they seek by entering the name, type, category, keyword, phone number, or some other 'user-friendly' identifier. A position must also be employed in the request when the subscriber is seeking the nearest place, product or service, or if they desire a place, product or service at a specific location or within a specific area. The position may be the current Mobile Terminal position, as determined through the Gateway Service (this service translates MLP into an OpenLS "Position"), or a remote position determined in some other manner. The directory type may also be specified (e.g. yellow pages, restaurant guide, etc). Given the formulated request, the Directory Service searches the appropriate online directory to fulfill the request, finding the nearest or specific place, product or service, depending on the search criteria. The service returns one or more responses to the query (with locations and complete descriptions of the place, product, or service, depending upon directory content), where the responses are in ranked order, based upon the search criteria.

Gateway Service - This is the interface between the GeoMobility Server and the Location Server that resides in the GMLC or MPC, through which OpenLS services obtain position data for Mobile Terminals. This interface is modeled after the MLP specified in LIF 3.0.0 for Standard Location Immediate Service.

Location Utility Service (Geocoder/ Reverse Geocoder) – This service performs as a geocoder by determining a geographic position, given a place name, street address or postal code. It also returns a complete, normalized description of the place (which is useful, say, when only partial information is known). The service also performs as a reverse geocoder by determining a complete, normalized place name/street address/postal code, given a geographic position. Both the geocoder and reverse geocoder may return zero, one, or more responses to a service request, depending on subscriber request information, the algorithm being employed, and the match criteria.

Presentation Service – This service renders geographic information for display on a Mobile Terminal. Any OpenLS Application may call upon this service to obtain a map of a desired area, with or without map overlays that depict one or more OpenLS Abstract Data Types (see below), such as Route Geometry, Point of Interest, Area of Interest, Location, Position and/or Address. The service may also be employed to render route directions from Route Maneuver List ADT and/or Route Instructions List ADT.

Route Determination Service – This service determines a route for a subscriber. The subscriber must use a navigation application service to set up the use of the service. They must indicate the start point (usually the position acquired through the Gateway Service, but this could be a planned trip from a specified location, say, from their home), and they must enter the endpoint (any location, like a place for which they only have the phone number or an address, or a place acquired through a search to a Directory Service). The subscriber may optionally specify waypoints, in some manner, the route preference (fastest, shortest, least traffic, most scenic, etc.), and the preferred mode of transport. The subscriber may optionally store a route for as long as needed, thus requiring the means to also fetch a stored route.

OpenLS Information Model

OpenLS defines a set of well-known Abstract Data Types (ADT) that are used by the Core Services, and form the *Information Framework* for the GeoMobility Server. The following ADTs are supported:

Address ADT – Address ADT contains address information for a geographic place. Addresses reference and uniquely identify particular points of interest and can serve as the basis for aggregating data for that location. The Address ADT consists of a street address (or intersection), place name (e.g. country, municipality, etc.), postal code, street locator, building locator, and supplemental address information. As used here, addresses are the means of referencing primarily residences and buildings, of all types, where a subscriber may conduct business.

Area of Interest (AOI) ADT – Contains an Area of Interest as defined by a named circle, bounding box, or polygon. Used to as a search parameter or can be displayed for a subscriber (e.g. Hot Zone).

Location ADT – The extensible, abstract type for all expressions of Location that can be used by OpenLS-based application services to specify the location of a target or a subscriber. Location is the root of a semantic tree that includes a Point, Position ADT, Address ADT, and POI ADT as its subtypes.

Map ADT - Map ADT contains a rendered map that results from the Map Portrayal Operation of the Presentation Service. It can then be used as input to other Presentation Services. Map ADT

consists of content information (format, width and height) and context information (bounding box, center point and scale).

Point of Interest (POI) ADT – A place or entity with a fixed position that may be used as a reference point or a target in an OpenLS service. The POI is the primary output from a Directory Service, and thus, it is also the “place” where one might obtain a product or service. It contains name, type, category, address, phone number, and other directory information about the place, product, and/or service.

Position ADT – Position ADT contains any observed or calculated position, in the broad semantic context of the use of the term. It primarily contains a geographic position and quality of position. Position is the primary output from a Gateway Service. Position maps to the semantics of the *Location*, *Shape* and *Quality of Position* elements, as defined in the Mobile Location Protocol (MLP) Specification (Version 3.0.0, Location Interoperability Forum). Thus, it contains the full definition of a position of a Mobile Terminal (Standard Location Immediate Service). Position may also be used by an OpenLS application service to represent any position of interest. Position is distinguished from POI, which is a well-known place with a position, name, address, etc.

Route Instructions List ADT – Route Instructions List ADT contains a list of travel instructions consisting of turn-by-turn directions and advisories along the route, ordered in sequence of their occurrence, and formatted for presentation to the user. Route Instructions List ADT is generated by the Route Determination Service and “presented” to a subscriber via a Presentation Service.

Route ADT – The Route ADT is actually three ADTs: Route Summary, Route Geometry, and Route Maneuver List. Route Summary contains the route’s overall characteristics, such as its start point, waypoints, end point, transportation type, total distance, travel time, and bounding box. Route Geometry contains a list of geographic positions along the route, ordered in the sequence of planned travel, starting with the position of the route’s origin and ending with the position of the route’s destination. The geometry includes the positions of all nodes along the route, including waypoints, maneuvers, and advisories. The geometry also includes intermediate points needed to describe the geometric shape of the route segments between each node in the route. Route Maneuver List contains the route’s turn-by-turn travel maneuvers and travel advisories along the route. Travel maneuvers include the information required to determine turn-by-turn directions to the traveler. Travel advisories consist of important travel conditions and points of interest that occur along the route. These three ADTs are generated by the Route Determination Service and “presented” to a subscriber as navigation information, e.g. as a route displayed over a map, via the Presentation Service, or they are used directly by a navigation application to guide a mobile subscriber to their destination.

Putting It All Together

In this section, we provide a simple use case that illustrates the relationship between GMLC/MPC (MLP), GeoMobility Server (GMS), the mobile subscriber and the operator’s environment. Figure 2 shows the general sequence for a service request by a subscriber who wants to access a list of restaurants near his/her location. He/she does not have any positioning capabilities on his/her device, and instead relies on the network. The position of the subscriber is provided by network elements (GMLC/MPC).

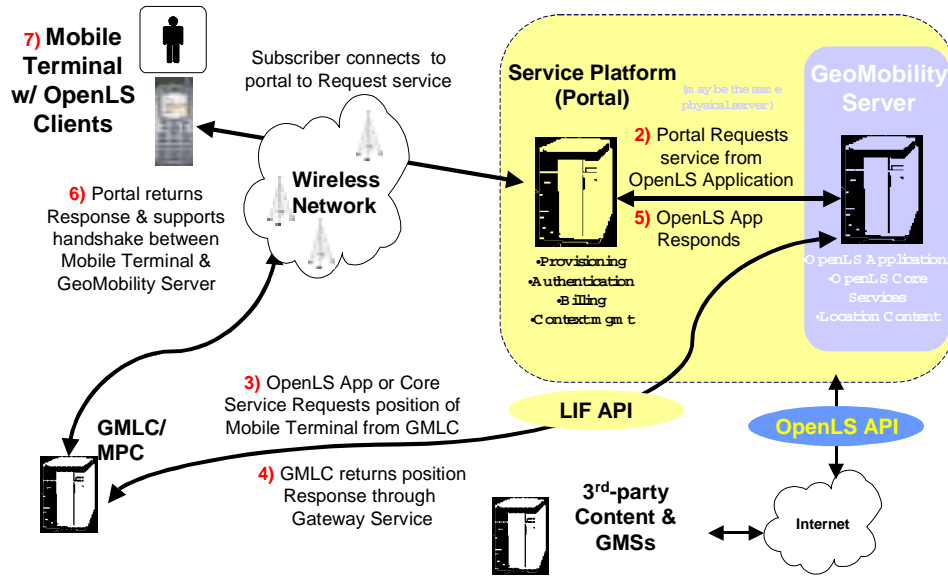


Figure 2 A Simple Use Case Involving MLP and OpenLS

1. A subscriber accesses the telecom operator portal via the wireless network.
2. The portal identifies the subscriber and the service requested by the subscriber and directs the request to a 'Restaurant Guide' application service running on the GeoMobility Server; this application can also be hosted on a 3rd party server.
3. Using MLP, the GeoMobility Server sends a request to a GMLC/MPC to get the position of the subscriber's Mobile Terminal.
4. The GMLC provides the Mobile Terminal position.
5. Knowing the subscriber position, the 'Restaurant Guide' application service sends a request, including the returned Mobile Terminal position in the form of a Position ADT, to a Directory Service that returns a list of restaurants within a certain radius around the estimated subscriber position. The request and the response to the Directory Service are based on OpenLS specifications.
6. The list of restaurants is sent back to the subscriber.
7. An application running on the Mobile Terminal allows the subscriber to view and interact with the list. [The next actions the subscriber is likely to take are to select a restaurant from the list and then ask for the directions and route map to assist them in driving from where they are to the chosen restaurant. Or, he/she may ask for a menu, and so on....]