OPEN LBS PLATFORM ARCHITECTURE

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ABSTRACT

Location Based Services, or LBS refers to value-added service by processing information utilizing mobile user location. With the rapidly increasing wireless internet subscribers and world LBS market, the various location based applications are introduced such as buddy finder, proximity and security services. As the killer application of the wireless internet, the LBS has preconsidered technology about location determination technology, LBS middleware server for various application, and diverse contents processing technology.

This paper describes the open architecture for LBS platform ensuring interoperability among the wireless networks and various location-based application services and the functional requirements for the LBS platform. The LBS platform in a narrow sense provides a standard interfaces for location management and network management for location services as follows, positioning (location acquisition through network or/and handset), location managing, location based functions, profile management, authentication and security, location based billing, information roaming between carriers and the system monitoring independent to specific network or ISP/CPs(Content Providers).

Keywords : LBS(Location Based Services), Mobile Service, PDT, Location, LBS Platform

1. INTRODUCTION

With the spread use of mobile phone or handsets, the location-based services is emerging technology with the development of mobile network, various mobile handsets, and information services technology such as mobile GIS, ITS, GPS, GNSS and so on.

There are about 23.87 millions of wireless internet subscribers in Korea with 1,100 billion won of sales at the end of 2001[Lee2002].

According to the forecasting reports, LBS taking a position for the killer application of wireless internet[Softbank2002]. The Ovum report forecast the world LBS market will be increased to $19,000 million in 2006 from $110 million in 2002, about 125% of growth rates[Ovum2000].

The location based services on the mobile phone is familiar such as buddy finder, proximity service under cell based positioning technology leaded by major three carriers in Korea, SKT, KTF, LGT. These cell based location service is limited to wide range of accuracy about 500 meters to several kilometers for location information. For the quality of location services, the GPS based location services is started by

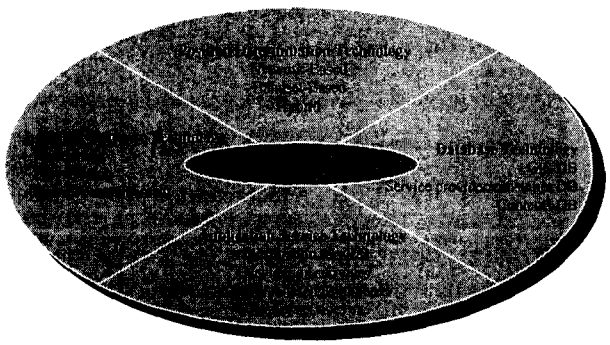

Figure 1. Related Technology of LBS
(Source:Softbank Research,2002)

three carriers in this year, *nGelEye* of KTF, *NATE GPS*, *NATE Drive* of SKT, and the LGT preparing location services. The location services provided by each carrier are privacy system and the services could not be shared through network or information although the wireless network could be accessed. So that the open LBS platform is needed with the national policy to opening wireless internet[Choi2002].

LBS Technology

For the location-based services, several categories of information technologies are integrated to service system shown in figure 1. The three kinds of PDT(Position Determination Technology) are under studying and developing such as network-based, handset-based, and hybrid. The network-based PDT uses signal of base station of subscriber's network. The handset-based method using the GPS receiver built in handset and the hybrid method make up for the complementing a strength and weakness of above two methods. Location Gateway Technology is for managing location information retrieved through GMLC/MPC and network control. Location based value added services need various kinds of contents such as digital map, real time traffic information, yellow pages, weather forecasting, and so on. The formats of these content are heterogeneous and varied sizes, so the conversion and presentation techniques for more sensitive services are needed. The location-based applications are boundless. Typical applications are public safety services such as emergency rescue service, disaster and calamity service, telematics combining ITS and location information, location-based commerce such as logistics, mobile approval and various information service system.

This paper describes the architecture of LBS platform that is core technology for LBS. The LBS platform takes charge of the managing location information and supporting fundamental and additional functions for location-based services. The main focus is the scope and functional requirements of LBS platform.[PLT2002]

2. LBS system

The system providing value added information services utilizing mobile user location should be organized with sub systems of mobile network, position tracking, mobile terminal and information technology. The figure 2 depicts the systemetic view of location-based service system. The elements and technology for LBS consisted of PDT, LBS server and LBS applications.

The wireless PDT determines the location of mobile terminal using a wireless network and/or GPS receiver. The main issues of the PDT are accuracy of location and response time of determining location of moving objects(mobile terminal).

LBS server is the middleware of LBS system supporting elementary and additional functions for various location based application services. The LBS

middleware consisted of several servers grouping functional modules. The location server takes charge of the location management and network management for LBS. The location server is though of LBS platform in a narrow sense. In this paper the LBS platform considered to location server. The location data server is in charge of mobile object data management for real time service. The main memory database and spatial indexing techniques are applied to managing moving objects location data. The location application server providing a common interface for utilities for LBS, such as geocoding/reverse geocoding, gazetteer, mapping, POI(Point of Interest), routing, tracking and push services. The content server holds the management of diverse contents for converting to mobile platform such as WIPI, BREW, WITOP etc., and processing to limited resource of mobile handsets.

The various LBS applications are possible using location information such as safety/security services, telematics, location based commerce, and value added information services. Each service has requirements for quality of service arranged by the application service WG of LBS subcommittee in Table 1[APP2002] referring technical specifications of 3GPP and the documents about the E-911 of FCC[3GPP2002][FCC2001].

3. Open LBS Platform Architecture

As the kernel of LBS system, the LBS platform taking charge of major roles for location services such as request/response for location information, location management, profile management, provisioning and authentication, roaming and network management. With the required functionality, the LBS platform ensures the interoperability with a wireless networks, mobile handset platforms and various contents. The

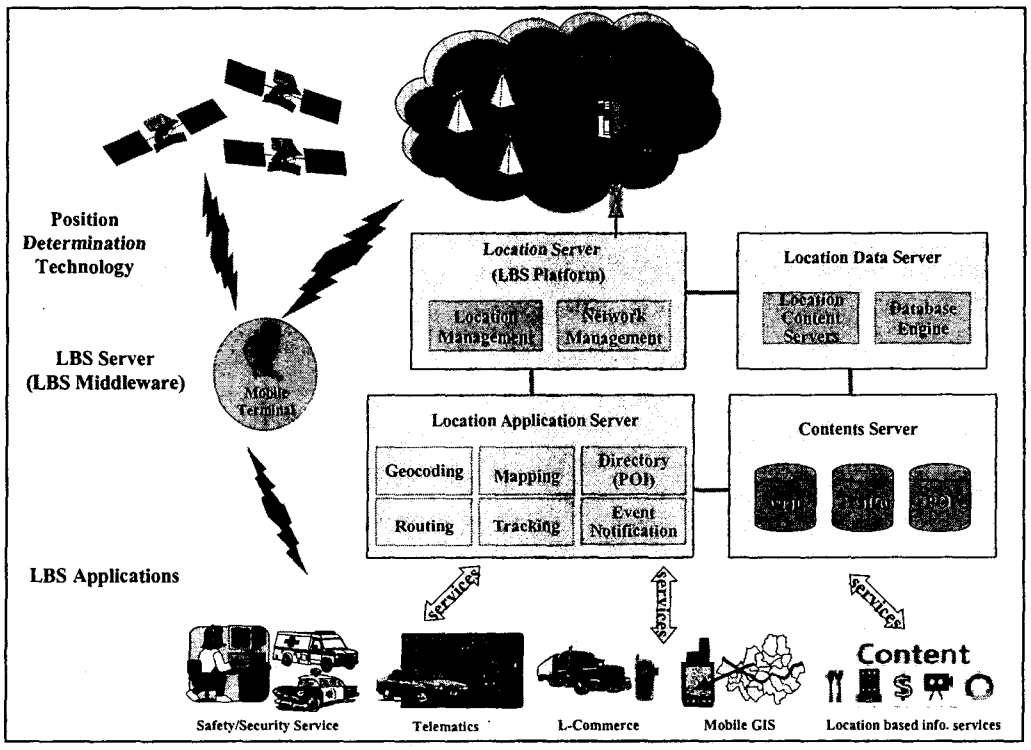

Figure 2. Location-based Services System

Table 1. QoS of Location based Services

Service	Service Authorization	Privacy	Horizontal accuracy	Vertical accuracy	Response time	Period Location reporting
Emergency service	Not needed	Safety center	Network-based 100M(67 %) 300M(95 %) Handset-based 50 M(67 %) 150 M(95 %)	Not applied (future 5m-15m)	5sec	Required (1-10min.)
Emergency Alert service	Needed	Service provider	125m	Not applied (future 5m-15m)	5sec	Required (1-10min.)
Car tracking service	Needed	Service provider	125m-Cell ID	Not applied	5sec	Required (1-10min.)
Fleet Tracking service	Needed	Service provider	10m – 125m	Not applied (future 5m-15m)	5sec	Required (1-10min.)
Personal Tracking service	Needed	Service provider	10m – 125m	Not applied (future 5m-15m)	5sec	Required (1-10min.)
Navigation service	Needed	Service provider	10m – 50m	Not applied	5sec	Required (1-10min.)
Yellow Page service	Needed	Service provider	125m-Cell ID	Not applied	5sec	Not required
Push service	Needed	Service provider	125m-Cell ID	Not applied	5sec	In the case of Required (1-10min.)

LBS platform should be designed to open architecture presented in Figure 3 to complete the requirements.

The major roles of the LBS platform are as follows.

First, Interface functions to wireless network. The interface to GMLC/MPC for acquiring the location information and the interface to wireless IP platform for portal service are needed.

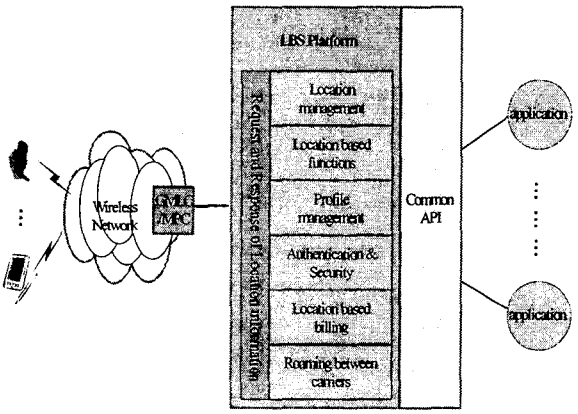

Figure 3. LBS platform Architecture

Second, the LBS platform provides a common API interface for supporting various location based applications. The promising API is XML based common interfaces.

And the last is the provision of application server. The LBS platform could include the application server in a broad sense, but the application server need a huge amount of memory, so the application server is departed from LBS platform in general.

In this paper describes the functional requirements for LBS platform in detail in a narrow sense of LBS platform containing only location server in Figure 2.

Request and response of location information

The most major functionality of LBS platform is response to request about location information independent to position determination technology and wireless network. The request types are LIR(Location Immediate Request) and LDR(Location Deferred Request), and the response types are IR(Immediate Response) and DR(Deffered Response), correspondingly.

Location Managing

The LBS platform should be support cash functionality for quick response of location

information. And the priority of request of location could be managed for emergency services or request from a large majority.

Location based function

The location based functions are included the followings,

- request and response of personal location
- request and response of group location
- location tracking of personal or group
- moving path in the specified time interval of personal or group
- trigging with the specified area and time intervals
- activation/deactivation of trigging

Profile management

The LBS platform supports functions for managing user profile providing carriers or application providers. The user profile contains information about user class, access rights, data location, distribution and recovery, billing and QoS policy, etc.

Authentication and Security

The LBS platform prepares the installations for restriction to access of unproved user and safety for location information from unproved use.

Information roaming between carriers

For the roaming service between carriers, the information for the location, user authentication, and billing services should be provided and maintained through the networks and service applications.

Others

The LBS platform maintains the LBS system, so that the system monitoring and statistical management functionalities are need such as load balancing and fault tolerance.

4. Closing Remarks

This paper describes the technology about the location based services and the functional requirements for the LBS platform that the kernel for the location services, especially for the open architecture ensuring interoperability between networks and applications adopting national open policy of wireless internet.

The LBS platform in a narrow sense, the location server must be provides the functions about location management and network management for location services.

For the integrated system, the LBS include many types of information technologies, so that the standadization about the location-based services are required and processed in several institutes such as 3GPP/3GPP2, LIF(Location Interoperability Forum), OGC OpenLS, OMA(Open Mobile Alliance), and the LBS subcommittee of KWISF(Korea Wireless Internet Stardardization Forum) in Korea.

As the killer application of the wireless internet, the location-based services could be the next major software in the world.

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