

# Transmission of Map Data of Location-Based Services in Mobile Environment

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**Abstract:** Recently, in according as rapid improvement of telecommunication markets and wireless internet technology, Location-Based Services (LBS) have been discussed as new “Killer” application. The purpose of LBS is to determine location of user through mobile handset and to offer location information service to end-user.

This paper has suggested an efficient transmission scheme of maps data as one of the important content services relating to data transmission of LBS in mobile environment. The basic system consists of three parts: (1) GIS (Geographic Information System) Server for storing, processing and handling map data, (2) Middleware Server for transmitting of map data by request of client, and (3) Client for requesting map data to Server and displaying them on handset. Also, in order to transmit map data, we are to expand WKB (Well Known Binary) in conformance to Simple Feature Specification of OGC (Open GIS Consortium), and increase efficiency of data transmission by developing transmission data format to be able to transmit lightweight data and considering data compression technology.

**Keywords:** LBS, GIS, WKB, map, OGC, transmission, mobile

## 1. Introduction

Rapid development of telecommunication markets and wireless Internet technology make Location-Based Services (LBS) new “killer” application. The purpose of LBS is to determine user location with mobile handset or to offer location information service to mobile subscribers.

It would provide user’s mobile devices with high value-added information such as contents of ‘Friend finder’, Proximity & Content services, Routing service and Traffic service, etc.

Also, application technologies of LBS are public safety services like emergency & disaster service, telematics, distribution, and etc[1].

Most applications demand a map including a location requested in mobile devices. But the map-transmission-to-mobile-device has many limitation of efficiency.

Our study proposes efficient schemes of the map data transmission, which is an important element of LBS service in mobile environment.

A brief overview of research contents is as follows.

First, we design a reference system for the map data

transmission. This system consists of GIS server, middleware server, and client. The GIS server stores, manipulates and process map data (vector) in the mobile LBS system for the efficient map data transmission. A middleware server transmits the map data requested by the client from GIS server to client. A client presents the data provided by GIS server to a handset.

Especially, we propose that an efficient data compaction should be required for map data transmission in mobile environment.

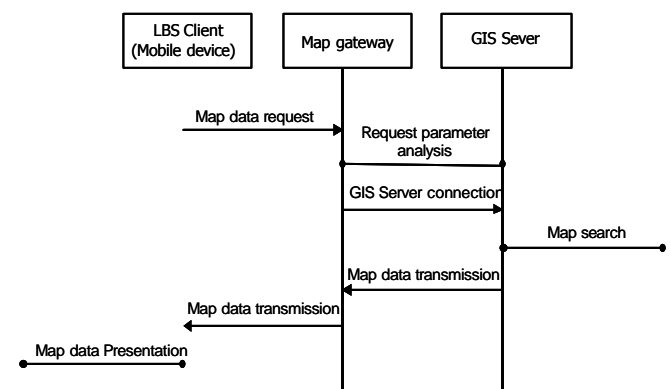
Second, the requirements for request, transmission and presentation of map data in mobile environment are described.

Here, there are two kinds of map data: vector data and image data. Vector data especially includes the position of interest (POI) data.

## 2. System architecture

The technical scope of this work covers, as described above, requesting map data to a server, transmitting and presenting them to mobile device in mobile environment. Where, there are two kinds of map data: vector data and image data. Vector data especially includes the position of interest (POI) data related to the transmission of position in mobile environment. POI data is the data that represent the position of interest and its geographical information and attribute.

The Figure 1 shows the time sequence diagram of system.



[Fig 1] Time sequence diagram of map service

At the request of map data from mobile client, a client transmits its request to map gateway. After the map gateway accepts and interprets the request, the gateway connects to a GIS server to search map and transmit the map data, result of map search, to the client.

## 2.1 GIS server

In mobile map service, the functional requirements of GIS server are as follows.

- Prompt response to client request
- Compaction of data packet to be transmitted
- Interoperability with heterogeneous system and expansibility

GIS server has to consider the interoperability with heterogeneous system in the way that adopts the "Simple Feature Specification" of the Open GIS Consortium (OGC).

Therefore, if data are maintained through WKB, exchange format of data is exactly carried on through WKB

Especially, the expansibility and interoperability is offered to support distributed environment.

## 2.2 map gateway

Map gateway is a middleware module that accepts and analyzes a client's request, and then exchanges data to GIS server through its interface.

Because multi-user can request a gateway simultaneously, the gateway must have its properties of multi-user stability, prompt response, and minimal system load.

The requirements of gateway are as follows.

- To provide HTTP-based service
- To transmit client's request through URL string
- To include a compiler to be able to interpret the string and classify it into 'command' or 'condition'

## 2.3 Client

Terminal client is a module that requests map data service to gateway and presents the data, result of its request, to its screen.

The main function of client is to let user request map data through user interface, and to present a WKB-type of map data.

# 3. Transmission of map data

## 3.1 Request of map data

At the request of map data from client, GIS server may consider following requirement.

First, map gateway provide function that analyzes and classifies information of request parameter be transmitted and should connect to offer map information on request in GIS serve.

Second, clients do not require selecting specific GIS server as request of map data.

On the other hand, as request map data to the client for request of vector data, client should require in gateway parameter about map bound, layer and format information to make map, version, information of services operation, attribute field name and attribute search condition of map layer, achieve request for compaction of map data

POI data additional, should request that X, Y coordinate value and search range with search guideline of POI and establishment to added information does use with geocoding[2].

For request map data of image type, client put out to parameter institute scale information on rendering map layers in gateway

## 3.2 Transmission of map data

Map gateway should transmit map data from GIS server to client.

And, the gateway can flexibly process abnormal responses, that is, no result data or very large data size, from GIS server.

Before transmission, map gateway may take limited environment into consideration to minimize map data. And, at the minimization of data, while the gateway must provide not only loss but also lossless data compression (encoder), mobile client must also support two kind of decompression (decoder)

Map data, result of map data request, is transmitted to client via map gateway. And, map gateway may transmit image map data into which vector map data is transformed. The vector map data is results retrieved after map data search

## 3.3 map data presentation

In order to present vector map, POI map and image map to a client, the following common requirements are necessary.

First, bi-directional transformation between a map data coordinate system and screen coordinate system of mobile client should be provided. Second, text string should be able to be presented and the function to set and get the property of the text string must also be provided. Third, the map should be able to be displayed by panning.

The following figure 2 shows procedure of functions that is necessary as displays map data at the mobile device. Especially, in order to present vector map data, a client should enable to display graphic vector objects such as point, line string and polygon additionally and to set and get the geometric property of the graphic vector objects.

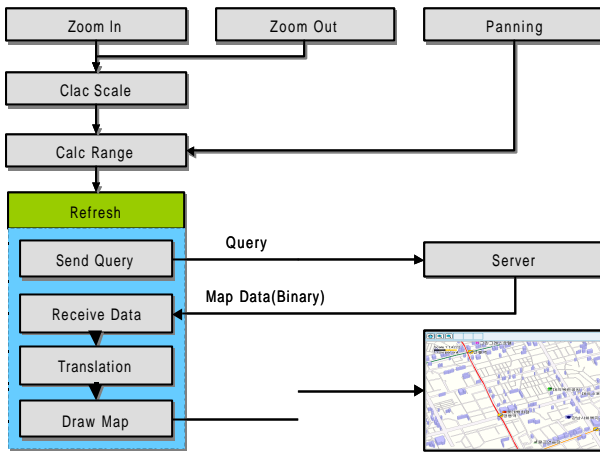


Figure 2. Processing of function to zoom in, zoom out and pan a picture

On the other hand, in order to present image map data, a client should enable to display the image in the center of screen and to display part of the image.

Furthermore, to present map data rapidly and efficiently, client may serve additional functions that are not mentioned above.

#### 4. Conclusion

In this research work, we designed a system that executes data request, transmission and presentation for map data transmission in mobile environment.

To describe in detail, we presented the technical and functional requirements of a map gateway that accepts and processes a request. A mobile device user who intends to request the vector maps data, image map data and POI data in wireless transmits these requests.

And, we constructed the sequence of map service in mobile device. The sequence of map service describes data flow between GIS server, map gateway and end user.

In this work, though we presented a guideline that is related to map data transmission in mobile environment, further study related to data minimization is needed.

#### References

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