Traffic And Tracking Web Service Based On GML And Interoperability

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Abstract

According as IT environment changes from client/server system to the open system based on web service technologies, the exchange of data and services between independent applications and service servers in web environment is observed Recently. In this points, it is necessary that Geographic Information Systems, Spatial Imagery Information Systems, Intelligent Transportation Systems, and Global Navigation Satellite Systems based on the location and geometry information are inter-related each other. But, the inter-relation of these systems is very difficult because of the closed system architecture, different information format, and the absence of interoperability technologies.

In this Paper, we describe 4S integration system based web service technologies that accept the international standard as WFS, WCS, WRS of OGC (OpenGIS Consortium) and UDDI, SOAP, WSDL of W3C. In detail, we study the system architecture design and implementation of traffic information service, routing service, and tracing service. These services are consisting of the data schema based on XML and GML, various functions of each layered service, each server platform, and web server. Specially, we represent that GML is being applied to a wide range of location-based services, telematics, and intelligent transportation

1. Introduction

Today, according as the volume of traffic increases gradually, efficient use of determinate road and request of control are increased. Research and development for this investment have done in worldwide. Specially, traffic information is very useful service depending on situation that high-speed data communication technology of Wireless LAN, IMT2000 etc.

The traffic information based on the location includes the past and the future estimate for position as well as the present. Field that can apply location information of the moving object efficiently is location-based traffic and tracing analysis services. That is, we can develop the variable traffic-application as producing the traffic information from the location of the moving object and analyzing this data and the geographic information. This effort enlarge the requirement about union with LBS (Location-Based Service) and ITS (Intelligent Transportation Systems).

In the paper, we describe the traffic and tracing services based on the moving object's location combining the intelligence traffic system and location based service. We study the base technologies research of each service in session 2. Session 3 presents the detailed design of systems. In session 4, our traffic and tracing service is implemented. Finally, we describe the conclusion of this paper in session 5.

2. Background

Is this paper, we develop our system based on OpenLS (OpenGIS Location Services) Architecture and GML (Geographic Markup Language) are proposed by OGIS (Open GIS Consortium Inc). This is used as the specification for implementing.

OGC (Open GIS Corsortium) is a not-for-profit, international consortium whose 2000 industries, government, and university members work to make geographic information an integral part of information systems of all kinds. This consortium produced the standard of LBS and GIS (Geographic Information Systems) for the interoperability, component-based development, and internet services[1]. This standard presents layered architecture of three services of the core, application, and portal[2][3]. In this architecture, the traffic and tracing services is the important part of core service layer [3]. These various functions of each layered service are applied to many application areas. Fig.1 presents the practical use of these services in traffic application area.

In Fig.1, web service for routing service is based on XML. That is, the standard XML (extensible Markup Language) schema about geographic, topological, and traffic information should be supported to offer the efficient web service. OGC propose GML of the standard schema based on XML[4][5].

GML is an XML encoding for the transport and storage of geographic information, including both the spatial and non-spatial properties of geographic features. GML uses the W3C XML Schema Definition Language to define and constrain the contents of its XML documents. The GML v3.0 Specification defines some basic conformance requirements for users to develop their own application schemas. Software applications

attempting to process any arbitrary GML user application schema must understand GML and all of the technologies upon which GML depends, including the W3C XML Schema[4]. This specification defines the XML Schema syntax, mechanism, and conventions that provide an open, vendor-neutral framework for the definition of geospatial application schemas and object. And, it allows profiles that support proper subsets of GML Framework descriptive capabilities.

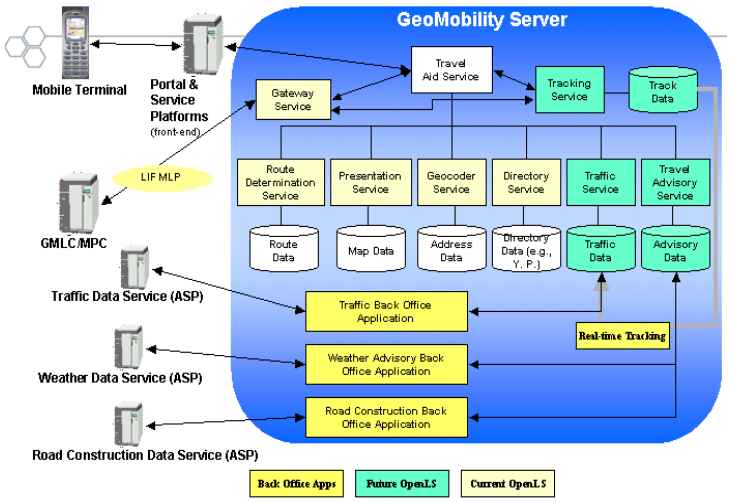

Figure 1. OpenLS Architecture

3. System Design

We describe the modeling of Open GIS Service Architecture using the UML. The UML is an attempt to standardize the artifacts of analysis and deign: Semantic models, syntactic notation, and diagram. The UML provides anyone involved in the production, deployment, and maintenance of software with a standard notation for expressing a system's blueprint. The UML is a language for specifying, visualizing, constructing, and documenting the artifacts of software system, as well as for business modeling and other non-software systems[8][9]. The components modeled using the UML are developed in object-oriented computing environment, ATL/COM and Visual C++. This developing environment provides the easiness of developing the application because of the language - independency.

Our traffic and tracing services based on the location is designed in distributed web service. This system receives the GML-styled document and parameter as the request of client and provides the vector data, GML-styled document, and image map data. There are three processing phases. PUBLISH phase is registering the service content

and functions to registering server. Clients send XML request is consisted of the service capability and functionality to registering server. This is FIND. Finally, Bind is connecting the client and service server

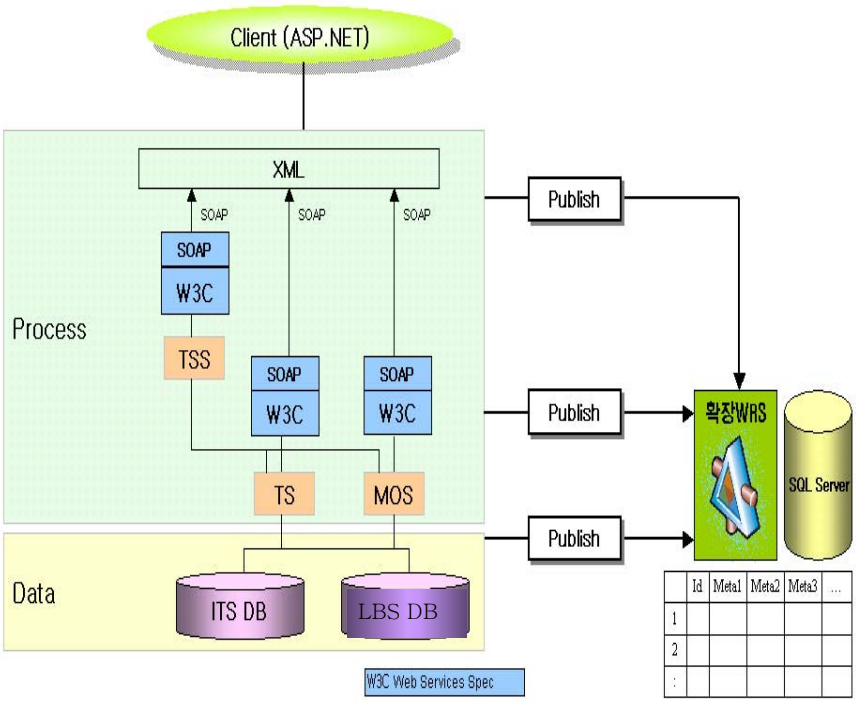

Figure 2. Web Architecture

Our traffic and tracing service service system do multitasking modules of server for processing tasks of each request at the same time each client when service request from multiplex clients is given. For this server architecture, web service modules and server modules are designed as components. Fig. 2 presents distributed web service modules.

Our web service system is consisted of WTS(Web Traffic Server) and WMOS(Web Mobile Object Server).

WMOS is composed of MOS(Moving Object Server), TSS(Travel Service Server), and SOAP-XML Web Server. MOS is collecting the location of moving objects. This location information have geographic coordinate, time. Identification number. TSS processes the request of tracing particular moving object. SOAP-XML Web Server receives SOAP request and return the XML-styled location information of moving object. Request processing phase is following. First, client call function based SOAP, and then SOAP module makes the message of doing location request. TSS is receiving this message from SOAP module, and distributes it in pre-created thread. The thread is connecting to MOS, and send the query for requesting the location information. Figure 3 presents

SOAP request and reply of WMOS and Figure 4 describes XML-styled location information.

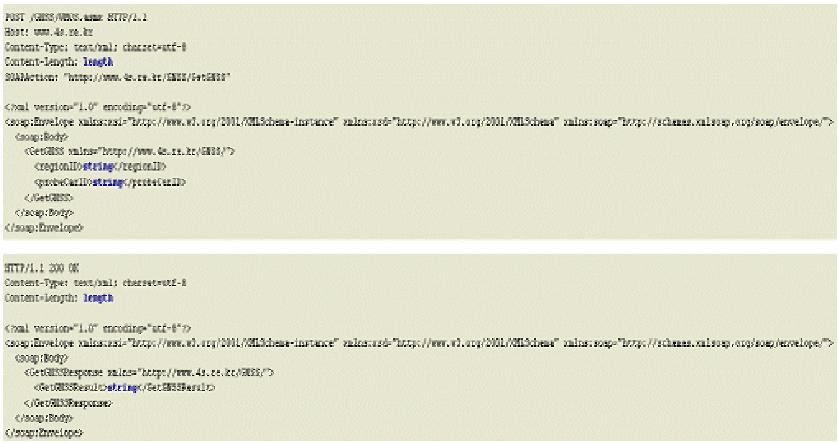

Figure 3. WMOS's SOAP examples

Figure 4. XML-styled location information

WTS is composed of TS(Traffic Server), TSS(Travel Service Server), and Web Server supporting SOAP and HTTP Web Server. TS is collecting the location of moving objects from MOS and processing this for making the velocity of the specific section of road. This velocity information is used to route the shortest path based time. SOAP-XML Web Server receives SOAP request and return the XML-styled location information of

moving object. Request processing phase is following. First, client call function based SOAP, and then SOAP module makes the message of doing traffic information request. TSS is receiving this message from SOAP module, and distributes it in pre-created thread. The thread is connecting to TSS, and send the query for requesting the traffic information. Figure 5 presents HTTP request and reply of WTS and Figure 6 describes XML-styled traffic information.

```
GET /ITS/WTS.asmx/GetITS?regionID=string&laneSize=string HTTP/1.1
Host: www.4s.re.kr
```

```
HTTP/1.1 200 OK
Content-Type: text/xml; charset=utf-8
Content-Length: length

<?xml version="1.0" encoding="utf-8"?>
<string xmlns="http://www.4s.re.kr/ITS/">string</string>
```

```
POST /ITS/WTS.asmx/GetITS HTTP/1.1
Host: www.4s.re.kr
Content-Type: application/x-www-form-urlencoded
Content-Length: length

regionID=string&laneSize=string
```

```
HTTP/1.1 200 OK
Content-Type: text/xml; charset=utf-8
Content-Length: length

<?xml version="1.0" encoding="utf-8"?>
<string xmlns="http://www.4s.re.kr/ITS/">string</string>
```

Figure 5. WTS's HTTP examples

Figure 6. XML-styled traffic information

4. Implementation

This system is implemented as server-side components providing traffic services and tracing services based on designed architecture in session 3. components have the layered architecture and relationship with each other. The result is provided as various format is subject to application environments.

Client-side application is developed in desktop PC and PDA to support mobile environment . For example, PDA clients have GDF as static road network data or download this from data server . And this data is displayed in device window . Client-side application will connect to server and request the real time traffic information . When data transmission is finished, this data is displayed in client's device. Figure 7 presents the example window of desktop PC

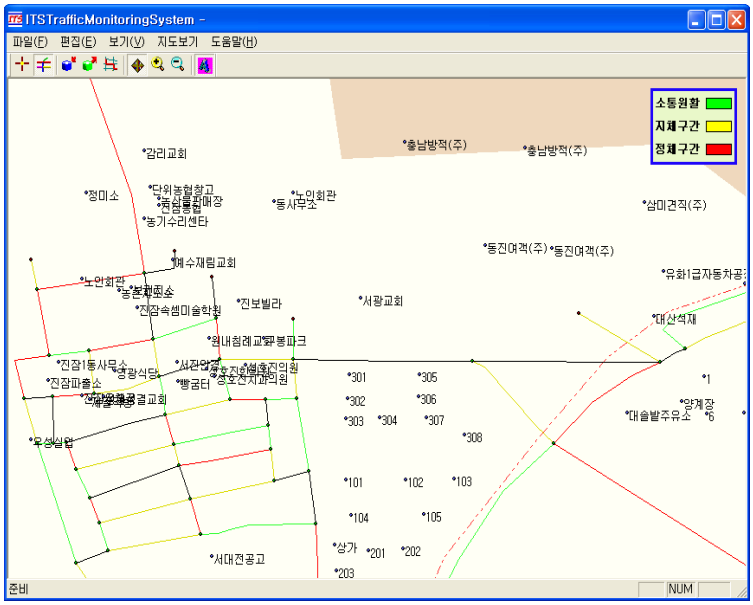

Figure 7. Execution

5. Conclusion

In this paper, we design and implement the location based traffic and tracing services as integrating LBS and ITS. This system is consists of WTS and WMOS. WTS is composed of TS(Traffic Server), TSS(Travel Service Server), and Web Server supporting SOAP and HTTP Web Server. And WMOS is composed of MOS(Moving Object Server), TSS(Travel Service Server), and SOAP-XML Web Server.

In addition, , we designed the system as multiple components using the UML and

developed it. The components designing the Open GIS Service were implemented with ATL/COM provides the environment of the language-independency . This components can be appropriately composed to the application, and they have advantages of the reusability. The reusability guarantees the low cost of the software development.

REFERENCES

[1] OpenGIS Consortium Inc, OpenGIS Guide Third Edition, pp 4-6, 1999.

[2] OpenGIS Consortium Inc, ML for Location Services (XLS) : The OpenLS Platform, 2002

[3] OpenGIS Consortium Inc, OpenLS Reference Architecture, 2002

[4] OpenGIS Consortium Inc, OpenGIS Geographic Markup Language (GML) Implementation Specification, 2002

[5] Henry S . Thompson, David Beech, Murray Maloney, and Noah Mendelsohn . Eds, ML Schema Part 1 : Structures, 2001

[6] Object Management Group, Inc ., OMG Unified Modeling Language Specification Version 1.3, pp.27-28, 1999.

[7] Quatrani, Terry, Visual Modeling with Rational Rose And UML, Addison Wesley, pp.5-6, 1998

[8] ISO TC204, Geographic Data Files, 1995