

Application of OGC services to Digital Asia

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Abstract: A prototype of OGC Web Map Service and Web Feature Service is developed by NEC Aerospace Systems, Ltd. under the contract from NASDA and RESTEC. The server provides satellite imagery data taken by JERS-1 and ADEOS satellite, via OGC interfaces to the client. The related features are also available to the client through the Internet with OGC interfaces. The imagery, map and feature data is handled layer by layer at the client. OGC Web Map Service and Web Feature Service interoperability capability and applicability to Digital Asia Network are demonstrated.

Keywords: Digital Asia, GIS, OGC, WMS, WFS, Interoperability.

OGC Web Services (OWS) refers to an open standards-based online geo-spatial services framework that will enable seamless integration of online geo-processing and location services.

OWS will provide a vendor-neutral interoperability framework for web-based discovery, access, integration, analysis, exploitation and visualization of geo-data sources, sensor-derived information, location information, and geo-processing capabilities.

Figure 1 shows OGC web service concept.

1. Introduction

“Digital Asia” will be an information system over the Internet with Web technology. The system intends to provide people and community with easy access to geo-spatial information. Digital Asia Network (DAN) will be a part of the system, as a network infrastructure. By implementing an interoperability mechanism and/or protocol into DAN, up-to-date Geo-spatial Information and Remote Sensing Data will be shared through DAN among/between Asian countries, in a timely and cost effective manner [1]. Interoperability specifications being developed by OpenGIS® Consortium (OGC) will be such a mechanism.

NEC Aerospace Systems, Ltd. developed the prototype, partly under the contract from National Space Development Agency of Japan (NASDA) and Remote Sensing Technology Center of Japan (RESTEC) [2]. An application client accesses satellite imagery data taken by JERS and ADEOS through servers. The server provides OGC interoperable interfaces for clients, and clients get data from the server via OGC interoperable interfaces. The server also provides OGC interoperable interfaces to get related features. The client can get the feature data along with the satellite imagery. The imagery, map and feature are handled layer by layer at the client.

2. OGC Web services

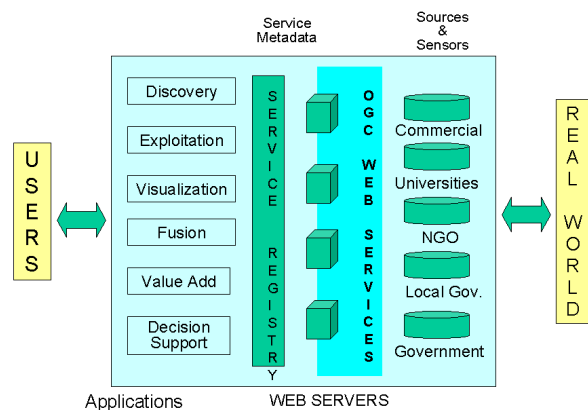


Fig. 1. OGC Web Service Concept.

OWS provides a framework for building network-connected geo-processing applications or for integrating geo-processing capabilities into other information applications [3].

1) Service Framework

The OpenGIS® Service Framework establishes common interfaces, exchange protocols, and services that can be utilized by any application. Services are categorized into Encoding, Registry Services, Data Services, Por-

trayal Services, Processing Services, and Application Clients [4] as shown in Figure2.

Asia

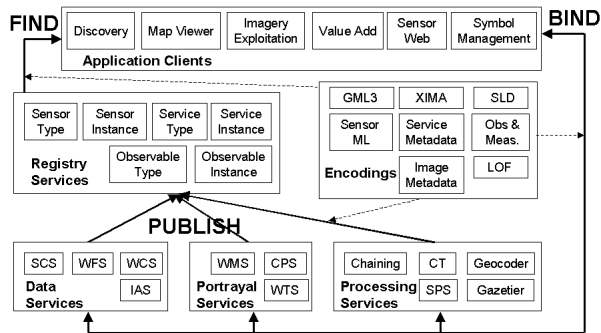


Fig.2. OGC Web Service Framework.

2) Development status of the implementation specifications

Based on the framework described above, OGC is developing implementation specifications for each service along with the reference model and the abstract specifications.

Development status of each OGC specification, as of June 2003 is summarized in Table 1.

Table 1. Development Status of OGC Specifications

Data Service	Status	Portrayal services	Status
WFS	IS	WMS	IS
WCS	-	CPS	-
SCS	-	WTS	DP
IAS	-		
Processing Service	Status	Encodings	Status
Chaining	-	GML-3	IS
Coordinate Trans.	IS	XIMA	DP
Geocoder	DP	SLD	IS
Gazetier	DP	Sensor ML	DP
Geoparser	DP	Service Metadata	-
		Image Metadata	-
		Obs & Meas	RP
		LOF	DP
		Catalog	IS
Registry Service	Status		
Web Registry Server	DP		

IS: Implementation Specification

DP: Discussion Paper

RP: Recommendation Paper

3. Application of OGC Services to Digital

OGC Web Service framework defines open interoperable online geo-spatial data services. By employing the OGC open interoperable services, geo-spatial and/or remote sensing data distributed over DAN becomes interoperable.

1) OGC services essential to Digital Asia

Among the OGC services, WMS and WFS provide powerful means to aggregate the map, imagery and feature distributed over the network. The services also provide means to display layered data at the user terminal. The registry services provide the way to find where the data is, and where the services are, for Digital Asia. The processing services provide common and interoperable understanding through the applications distributed over DAN, such as coordinate transformation, geo-coding, etc..

2) Web Map Service (WMS) and Web Feature Service (WFS)

The display capability of raster map and raster imagery is essential for Digital Asia applications. Since WMS provides a capability to display raster map and raster imagery on the client, WMS is very important to Digital Asia. Along with the raster map and imagery handled by WMS, the associated feature must be aggregated, handled and displayed. WFS provides this important capability to Digital Asia.

3) Web Coverage Service (WCS)

A remote sensing satellite usually equipped with multi-band or multi-spectrum sensors. Handling and analyzing multi-spectrum data is very important from an application point of view, since multi-spectrum data provide a lot of information that can not be obtained by a single band sensor. WCS is the service to handle with values and properties and is also a key component to Digital Asia. However, WCS is still in discussion paper status. The progress in OGC must be carefully followed.

4. Prototype development and its evaluation

WMS and WFS are essential for Digital Asia as mentioned above. NEC Aerospace Systems, Ltd. developed and evaluated a prototype of WMS based on the published OGC implementation specifications, partly under the contract from NASDA through RESTEC.

The WMS provides standard interface to get satellite imagery data taken by JERS-1 SAR and ADEOS AV-NIR through Internet by the client terminal. The capability to get the feature through WFS interface is also developed. EarthNavi® viewer developed by NEC Aerospace Systems, Ltd. is extended to accept WMS and WFS operations. Figure 3 shows a conceptual block

diagram of the prototype. Software both for the server and the client are developed. On the server side, PostgreSQL is selected as a database manager and PostGIS provides Web GIS extension capability. The extended EarthNavi® viewer is installed on the client.

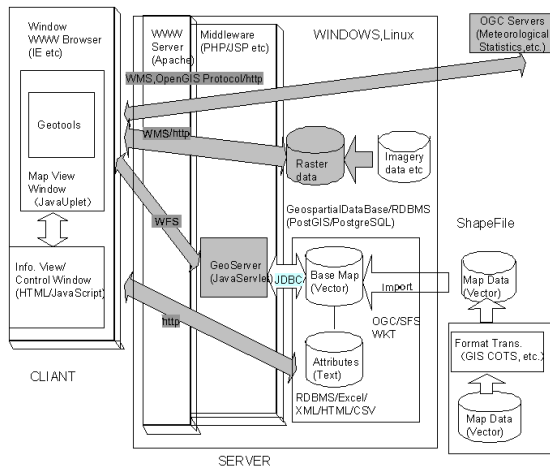


Fig. 3. WMS, WFS Server and Client Concept.

Imagery data is converted to the raster data, and the data is accessed from the client through WMS interface. The server also has a cascading WMS capability so that the client can get data from OGC servers distributed outside of this prototype server.

For the feature, WFS interface is provided, between the client and the server. Apache is selected as WWW server software at the server side.

Figure 4 shows an example output from the extended EarthNavi® displaying the satellite imagery got from WMS Server, along with the map and feature like a city boundary and coastlines etc. through OGC interfaces. Satellite imagery from JERS-1 SAR and ADEOS AV-NIR are displayed. The features including coastline and city boundary, are overlaid.

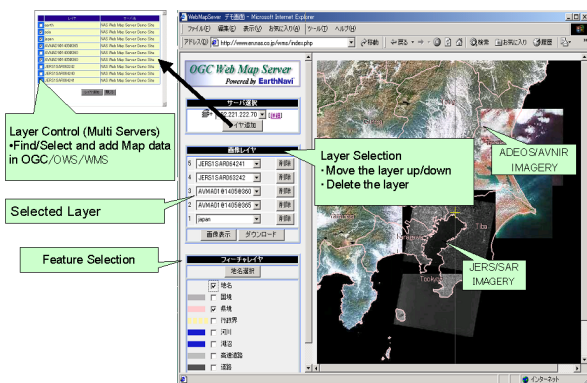


Fig. 4. Satellite Imagery with Feature by extended EarthNavi®/WMS .

It is demonstrated that WMS and WFS provide powerful means to aggregate the map, imagery and features

distributed over the network and means to display layered data at the user terminal.

WCS and Coverage Portrayal Service (CPS) for multi-spectrum sensor data handling are under development.

3. Conclusions

It is confirmed that OGC OWS framework and interoperable specifications provide the powerful means to share geo-spatial and/or remote sensing data distributed over DAN. The prototype is developed and evaluated. It is demonstrated that WMS and WFS provide standardized interfaces to aggregate the map, imagery and features distributed over the network. It is also demonstrated that they provide standardized interfaces to display layered data at the user terminal. These standardized interfaces will be employed by Digital Asia.

However, some of the important OGC specifications like WCS, handling satellite multi-spectrum data, are still under development. Although the implementation specifications for WMS and WFS are already available for public, they are still evolving, so it is very important to keep tracking the OGC activities.

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