Chapter 89
National Geological Map WebGIS System Based on MapViewer

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Abstract To realize the Internet service of geological map, a online WebGIS service system with lightweight small-scale geological map was designed and realized which is based on the Oracle Spatial and MapViewer, combined with JQuery programming technology. This system realized multisource heterogeneous spatial data integration. Through the WebGIS system, the user can inquire and browse the different medium and small-scale geological map by using the IE browser, without the installation of GIS system.

Keywords WebGIS · Oracle spatial · MapViewer · Geological map

89.1 Introduction

There is a large number of geology map information in China. It is hard to share with the public because of the professionalism of GIS map. To adequately share this geological information, it should make use of the distributed database technique, WebGIS technique, standards-based Web service, data exchange and data

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transmission of cross-system and cross-platform, metadata, website design, and standards-based interoperability technology, etc [1]. In order to make the GIS more flexible, the system provided the function of data reviewing, data query, and data analyzing, through the Internet to publish data. The user can only set up the IE browser, and they can search and browse the related geological information according to the online service system for national medium and small-scale map with lightweight B/S model which were designed by using Oracle Spatial and MapViewer.

89.2 Introduction for the WebGIS Technique

WebGIS is the production of Internet technology and GIS technology. The traditional GIS become truly popular tools by using the Web. The user can browse and visit the WebGIS spatial data from any node of network, and do any spatial index and spatial analysis, so that the GIS find its way into every family.

89.2.1 WebGIS

At present, the WebGIS which is based on Internet technology has already become the important development direction for GIS. Compared with the traditional GIS software, WebGIS has the following features:

(1) Wide range of access. Because of the Web's advantages, the management of distributed data sources is easier to achieve for WebGIS, and users can visit the multiple GIS data from different servers at the same time.
(2) Platform independence and simplicity of operation. After using the common Web browser, users can independently visit the WebGIS data and will not have much concern for which machine and GIS software to use [2].
(3) Fully utilizing the network resources and simplify system deployment. The operation of complicated system deployment can be finished on the server, and the client can do business process by using the Web browser, which can reduce workload of system deployment and maintenance.

89.2.2 Commonly Used WebGIS System

The current WebGIS constructions use the three layers structure of data access layer (DAL), business logic layer (BLL), and user show layer (USL). The USL can do the geographic spatial data query and provide the result through webpage for users on the running of the IE browser. The BLL will transfer the HTTP requests

from the USL to retrieve commands and inquiry commands for geographic spatial data, referring the commands to the DAL, and referring the result which returned by DAL to the USL. The DAL is used to geographical spatial data input, storage, and query. There are mainly three types of products:

(1) Commercial software, such as ArcGIS Server, MapGIS IMS, etc. Those softwares have mature technology and functional integrity, but the price is too high.
(2) Open-source projects, such as Geo Server, Open Map, Map Server, Map Guide, etc. Those systems are different technical standard, which cannot guarantee mature technology, functional integrity, and completely free.
(3) Free WebGIS for conforming to OGC standard, such as the MapViewer of Oracle, which have mature technology and functional integrity, and basically free.

89.3 The WebGIS Based on MapViewer

89.3.1 Introduction for MapViewer

The full name of MapViewer is Oracle Fusion Middleware MapViewer. MapViewer is a free middleware [3] which is convenient for users of the Oracle Spatial database to develop GIS software. Cooperated with Oracle Spatial space database, the MapViewer run on the server as a service that can provide some functions for users, such as spatial information release, presentation graphics, personalized retrieval, etc. (as illustrated in Fig. 89.1).

89.3.2 The Release Process for Map Based on MapViewer

The WebGIS uses the MapViewer middleware to edit and define the geographical spatial data from the existing Oracle Spatial database of the Data layer, defining the display style and display mode for each layer with the user's browsing habits. It will break the limits of the scale, and all layers in the geological database will be uniformly edited to an individual FOI or a Tile. Through the response of the JavaScript API from the USL, the MapViewer will select qualified layer from the DAL, and referring the result to the USL, so that the MapViewer can realize the fusion for browsing the geological data.

Oracle Maps is the name for a suite of technologies provided by MapViewer, which mainly include map cache service, a feature of interest (FOI) service, and an Ajax-based JavaScript mapping client API.

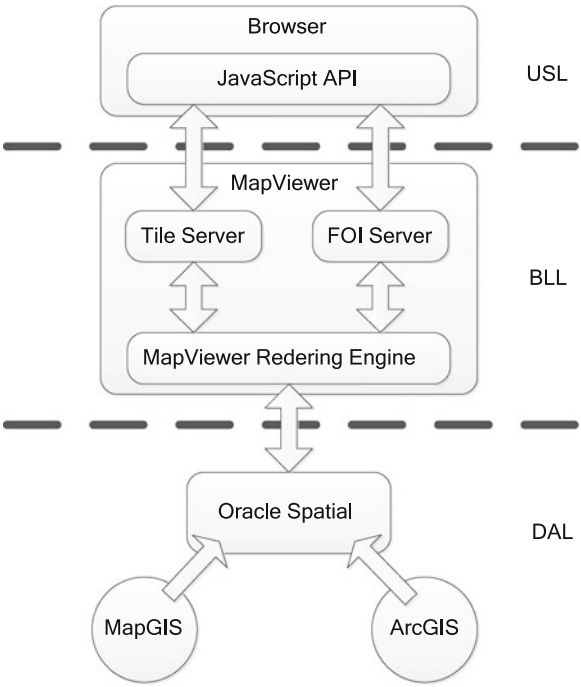

Fig. 89.1 The system framework based on MapViewer middleware

FOI Server. The map consists of some themes. These themes describe the different geographical objects, such as geological body, fault, etc. The map is formed from the superposition of these themes [4].

Sometimes, users need some layers they are interested by separately displaying instead of a range of themes by one-off display, such as contour and fault. These themes displayed separately are called a FOI. According to the request of users, the FOI server dynamically processes the information from the spatial data table and describes it.

Map Tile Server. Tile, namely the Tile Map, is a collection of pyramid static grid picture under the quad tree index, and it is formed by the themes according to the set representative fraction and zoom level in an orderly fashion. Tile popularly processes the static background map, which can pregenerate the map tile in order to improve the efficiency. Map Tile Server will produce static tiles according to application requirement, saved in the file system in the form of file, used by the host application servers, and shared to all users. Because of pregenerated and cached Tile, the client users can experience fast map viewing browsing performance [5].

89.3.3 Map Builder

Map Builder is a build tool for lightweight map, which can accomplish the map building based on Oracle Spatial, including building map symbol, defining appearance regular for spatial data, creating, or editing MapViewer object [5].

Spatial information in database is stored in the form of Point, Line, and Polygon. You can use Map Builder to define the pattern of these geometric primitives as required, including color, signs, map symbols, etc. You also can use Map Builder to manage and describe different spatial objects according to the different themes, such as geological body, contour, fault, etc. Users can select the data from map they needed through themes and the interaction between user and map will be more efficiently.

89.4 On MapViewer to Design the National Geological Map WebGIS System

89.4.1 The Small-Scale National Geological Map

Geologic map is with certain drawing principles by all kinds of geological characteristics boundaries, characteristic, occurrence, geological structure, and meaningful geological phenomenon. Geologic map has an important mean of displaying geological achievement, and is an important basis data for geological exploration.

The scale of the geologic map: 5,000,000, 1:2,500,000, and 1:1,000,000 mainly reflected the achievement of regional geological survey and geology for comprehensive research in China. As the production standard could not be unified at that time, the formats of geological data for different scales (including 1:5,000,000, 1:2,500,000, and 1:1,000,000) are MapGIS 6.5 and ArcView 3.1.

To solve the problems of multisource heterogeneous spatial data, this project had taken a method of uniformly integrating in DAL, using the MapGIS and ArcGIS to do some operation for original geological data, such as merging data, format conversion, and conversion process for projection [6], the geologic data will be converted to a SHP file of the Mercator projection at last. Then with the Map Builder we can directly import these files to Oracle Spatial database, and each SHP file corresponds to a table in the database.

To display the eventual geologic data to users, the system also need to define the eventual style. In the Map Builder, you can define the display style of point, line, and surface as required.

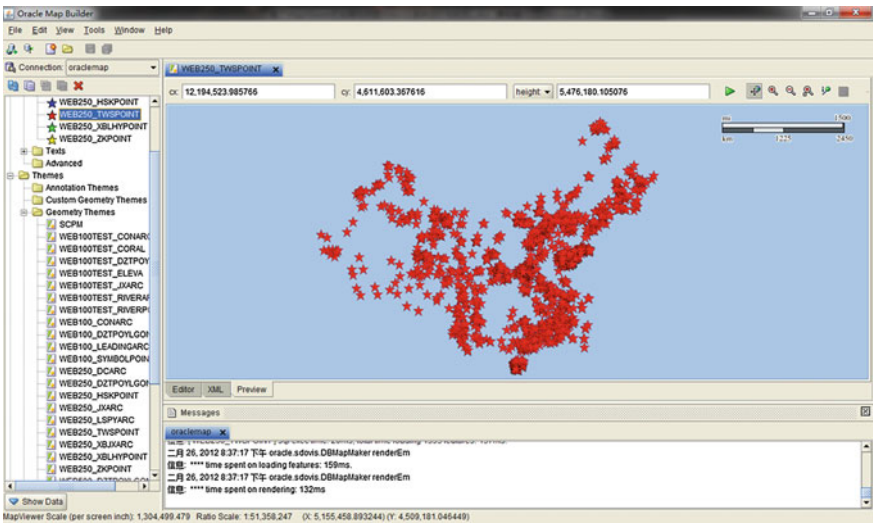

Fig. 89.2 The definition for isotope layer of FOI

89.4.2 The FOI Format of National Geological Map Layer

After importing data to the database, the system made these geological layers' point, line, and surface into FOI and displayed the geological data as defined, and the FOI provided the rule for which data should display in which way [4]. Users can see the FOI attached to the geographical base map. FOI realized the function of information extraction by clicking operation, and it is very convenience for users to consult.

Take isotope layer of FOI for example, it provided the display format of table WEB250_TWSPOINT (1:2,500,000 isotope tables) as "red star" in Map Builder, and the rendering as follows (Fig 89.2):

89.4.3 The Map Tile Format of National Geological Map Layer

To get the relevant geological data easily while displaying the geological spatial data, the system would use the Google Maps to display the geological data on the USL.

To improve the online display speed for geological body layer, it displays with the Map Tile format. After defining the geological body layer of FOI, it makes the Map Tile by using the data from the 19 level system of Google Maps. Meanwhile, it can directly get the information of geologic body by using Json.

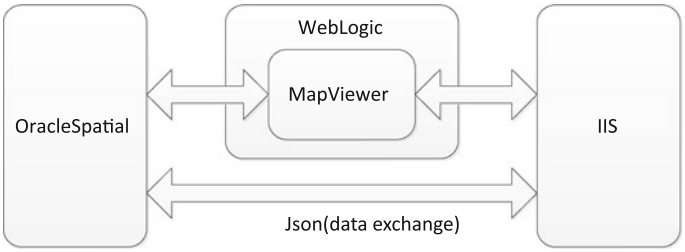

Fig. 89.3 The system architecture of website

89.5 Based on MapViewer to Realize the National Geological Map WebGIS System

89.5.1 Website Construction

This system is an on-line service system for lightweight Web GIS geologic map, grounded on the framework of the technical system of Oracle Spatial and MapViewer. The data resource of this system is Oracle Spatial data. The MapViewer middleware can provide a rendering service of graphical geological data to the website's foreground, which is running in the IIS. Meanwhile, through the function of fast geological information extraction by using Json technology, the system realizes the on-line query service of small-scale geologic map. The website's technical framework is as follows (Fig 89.3):

89.5.2 The Management for Website Running

Under the system structure of this website, the operational maintenance of foreground can be carried out by IIS. By entering the webpage of http://127.0.0.1:7001/mapviewer, the middleware layer can accomplish the management and maintenance of the system through MapViewer console, such as cache settings and data resource binding. The data resource layer can accomplish the definition of data format, follow-up data import, etc, by means of the visual spatial data management tool from Oracle Company.

89.5.3 Results

This website realizes the following main functions: Online presenting geological data, information extraction, searching for spatial data, etc.

89.6 Conclusions

A map Web servers design method is presented in this paper, which is based on Oracle Spatial and MapViewer. This method can realize the fusion of spatial data from multiple formats and multiple resources. This method also can provide the lightweight medium and small-scale maps for common Internet users. Moreover, by observing the OGC standard, this map service has good expandability. In order to realize a better geological map online service, the next working scheme is to extend the GIS data and distributed deploy.

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