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An Integrated WebGIS-Based Mangement Platform of Geopark

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Abstract: After a careful examination and an extensive investigation of the Geopark development, all data of geological heritage, relevant research, tourism information and science education are integrated by the technologies of ArcGIS, MapServer and database software, based on the detailed analysis and design of system architecture, database design, map file handling, user interface design and system design features, so that a WebGIS-based management platform of Geopark can be created and all related information can be locally managed but remotely accessed. The platform has good usability, platform independence and scalability, can help administrators manage geological park easier.

Keywords: ArcGIS Server, geopark, management platform, WebGIS.

1. INTRODUCTION

Geoheritage refers to the process of evolution of the Earth, in the internal and external stress geological formation, development and legacy. It can be used to trace the evolution of the Earth's geological history and is important geological phenomena [1, 2]. Geopark was founded by UNESCO. Special significance Geological Sciences, rare natural attributes, high ornamental value aesthetics and the geological heritage landscape of a certain size and distribution range are as its main body. The purpose of establishing Geopark is to maximize the development of the local economy and help people understand the evolutionary history of the living environment (Cited from Chris Woodley-Stewart, Geopark Manager, North Pennines AONB, United Kingdom). As of September 2009 to date, 65 geologicals have been added to the online world Geopark geological park, where China has 22 world geological parks. Thus, China is located in the world in the protection of the world's geological construction and geological heritage.

Construction and development Geopark important both to protect geological heritage, but also the development of new tourism resources to effectively support local economic development and employment of local residents to expand and improve the level of awareness of the protection of the residents of the geological heritage, conservation awareness and enthusiasm. Actively planning to establish Geopark Meanwhile, authorities and experts have gradually realized the need for a geographic information system (GIS) technology as the main application of information technology in this field and urgency, he proposed and established for geological parks individual information systems, in terms of geological park management, planning, etc. Information technology has been actively explore and practice [3, 4]. The downside is that most of these systems or emphasize internal business transaction management, or to highlight the performance of three-dimensional simulation mode, a small range of services to benefit narrow face.

WebGIS is a modern technology, which provides a real-time, accurate and convenient location information, and which is widely used in the department of electric power, environment protection, traffic translation and city planning. Now, the system, developed and published with WebGIS technology, is not only promoting the ability of management and protection of the tour resource, but also providing convenient to the tourist's outgoing and hunting for touring information, so that raising the service quality.

Based on a lot of references on abroad, This article discusses the implementation techniques and trends on WebGIS. By comparing various popular WebGIS secondary development technology, regardless of the system on the basis of overall demand, decided to adopt ArcGIS, MapServer, databases, and other related technologies combination as a system solution. Data base of this system is MXD files and graphics data of ShapeFile file format. Attribute data stored in an Access database and use ADO.NET data access technology. Because the system involves a lot of pictures, thus, the system uses the file system to store the picture. In addition, the system incorporates the more popular Ajax technology. Implementation of these two programs is different degrees of speeding up access speed network and enhances the user experience.

Based on the detailed analysis and design of system architecture, database design, map file handling, user interface design and system design features, initially established a geological park management system. In addition, the system reserves the interface link existing geological park site, users can easily get through this link latest information from the existing site. System is user-friendly, easy to operate, with good usability, platform independence and scalability.

2. WebGIS

WebGIS (Web Geographic Information Systems) refers to the geographic information systems of internet-based platforms, the client application software using network proto-

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cols used in the Internet. Geographic information system generally consists of multi-host, multi-database and multiple clients to connect to the Internet and distributed composition, including the following four parts: WebGIS browser, WebGIS server, WebGIS S Editor, WebGIS Information Agency

WebGIS via the Internet to publish geospatial data and applications to achieve spatial data sharing and interoperability, such as online inquiries for GIS information and business processes. WebGIS client uses a Web browser, such as IE, FireFox. WebGIS is the use of Internet technology to expand and improve a new technology of GIS. WebGIS's core is embedded HTTP standard application system in GIS, spatial information management and publishing Internet environment. WEBGIS can be multi-host, multi-database distributed deployment, through Internet/Intranet interconnected, is a browser/server (B/S) structure. Server provides information and services to the client, and the browser (client) have access to a variety of spatial information and application functionality.

WebGIS is the development product of Internet technology in GIS. GIS's functions can be extended through the Web, to truly become a tool for public use. From Any node of the Web, Internet users can browse the site WebGIS spatial data, producing thematic maps, as well as a variety of spatial search and spatial analysis, so that GIS will be every household.

WebGIS is the use of Web technology to expand and improve a technology of geographic information systems. It is a network-based client / server system, use the Internet to exchange information between the client and the server. It is a distributed system, the user and the server can be distributed in different locations and different computer platforms. WebGIS main role is to publish spatial data, spatial query and retrieval, spatial model service, organize Web resources.

WebGIS has the following characteristics:

(1) Globalization server applications

Worldwide, an Internet user of an arbitrary WWW node can access a variety of GIS services provided by the WebGIS server, even can be globally GIS data update.

(2) Real popular GIS

Due to the explosive growth of the Internet, Web services are in every household, WebGIS to more users with the opportunity to use the GIS. Now the popular WebGIS platform: ARCIMS; Mapgis IMS; Super Map IS; TopMap World; MapXtreme and etc. mature products at home and abroad. WebGIS can use a common browser for browsing, querying, but also through a plug (plug-in) on your browser, ActiveX controls and Java Applet to access WebGIS functions. Browsers and plug-ins are free, easy to get, and a significant widening of the range of potential users of GIS. The previous GIS due to high costs and technical difficulties, few experts have often become a professional tool, it is difficult to promote.

(3) Good scalability

WebGIS can easily integrate with other seamlessly information services in the Web, can create flexible GIS applications.

(4) Cross-platform features

Before WebGIS, although some vendors for different operating systems (such as: Windows, UNIX, Macintosh) provides the appropriate GIS software versions, respectively, but no one really has a cross-platform GIS software features. The Java-based WebGIS can do "write once, run anywhere". The characteristic of cross-platform is on its head.

According to current WebGIS framework to analyze, mainly in two kinds:

(1) WebGIS of picture style, also called raster maps, vector map can also be achieved, mainly by VML;

(2) Vector map-based controls. (ActiveX, Java Applet).

Both have advantages and disadvantages development. Especially Based controls will be many restrictions. Since the release of Google Maps, maps of tile style is more popular.

WebGIS basic features

(A) WebGIS is an integrated global client / server network system.

(B) WebGIS applies client / server concept to perform GIS analysis tasks.

(C) WebGIS is an interactive system.

(D) WebGIS is a distributed system.

(E) WebGIS is a dynamic system.

(F) WebGIS is a cross-platform system

Taken together, the current WebGIS so have the following basic characteristics:

(1) Transmission protocol is HTTP.

(2) The main operational tasks are executed on the server, such as mapping, spatial database query, and spatial analysis.

(3) Clients typically use generic browser which able to explain HTML.

(4) Provide geographic information services, the remote server regards the WWW server information as an important juncture in and out of.

(5) Markup language WWW used plays in the GIS information and communication between the browser and the server in an important position, even if other data formats, HTML or other markup language was replaced in the future, it probably will not change.

3. CONSTRUCTION SITUATION OF GEOPARK GIS

Geopark in the field of construction information management system is to establish a geological park management network, computer hardware and software as the basis, based on information technology. The network is connected to the external Internet; you can publish all kinds of scientific knowledge, news, etc. Geopark included for individual internal information systems for reporting Geopark, management, operation and maintenance, provide functional support for development planning. In this process, you should refer to the full e-government experience to the field

of information technology, fit to guide the direction of data sharing platform. Under the framework of "Digital Land" framework, integrating geology, tourism, planning and other related aspects of the functional requirements and resources (hardware and software and the data) build Geopark information management and social sharing network system, promote interaction within the industry, the whole of society's data release, sharing.

Geopark information has multiple sources, such as multi-dimensional, multi-class features. Based on GIS, using a combination of global positioning navigation (GPS), remote sensing (RS) and the Internet technology to build information systems Geopark recognized by the industry. Geology and Mineral Point reference source of information systems thinking approach to data should be considered as the core, around the diverse functions of database development system to meet all aspects of the user's business needs, the system of operating the same data to ensure data consistency among the various levels of users.

American is the oldest national geological heritage protection, which is through the establishment of the National Park to protect geological heritage and natural environment. As of 2013 so far, the United States a total of more than 300 national parks, including the volcanic class Geopark (Hawaii), cave class national parks (Mitchel Cave Park), plate tectonics category National Park (Sunset Crater, Great valley) and so on. The establishment and construction of these parks on the information put forward higher requirements. GIS creation and development of a display of these parks are the best tool for information.

National Parks in the United States, the level of GIS applications varies, but also a wide range of scope, mainly used to help educators and administrators of the park. For example, in Hawaii Volcanoes National Park, GIS technology is used to select the rare and endangered plants and invertebrates potential habitat; In the Santa Monica Mountains National Park, the staff using the data obtained by GPS, making precision park road map and monitor the road map, and use it to plan for the future path; In the Minute Man NHP National Park, through the continuous distribution of plants, monuments, roads, landscape correlation analysis to determine priority development area; In PIC NSC National Park, GIS is used to build a three-dimensional model of the cave, find and rescue missing persons assisted action profile superimposed by building maps and historical understanding of the appropriate range of variation, and many other aspects.

It can be seen, GIS has been in the United States in all aspects of the daily management of the National Park has been applied. GIS played a huge role in environmental monitoring national parks, emergency rescue, resource protection and information campaigns, to protect the park's sustainable development have made outstanding contributions. The establishment of US National Program Office, regional technical support center and park GIS institutions, but also for the application of GIS provides a powerful technical support. However, as mentioned earlier, due to the level of management and GIS educators uneven, making the application of GIS also be further developed, especially WebGIS technology in information technology aspects of the national park.

China has a vast variety of climatic characteristics and landscape features created diverse types of geological landscape; which is a lot of geological heritage is rare even in the world, with a high scientific value and aesthetic appeal. Nonetheless, China's propaganda effort in building and park geological information is not enough. So far, China's information construction Geopark also just stays in with a lot of pictures and text in support of attractions, route description etc. Technologies used are basically ASP, HTML, or a combination of both, and not a complete WebGIS system. The Big Lake National Geopark and Yuntaishan Geopark also only stay in the "Digital Park" concept stage [5-8].

And the United States as the representative of the foreign construction and management of GIS Geopark comparison, GIS construction of geopark is still in its infancy: reserve incomplete information, data standards varies greatly, PORTFOLIO less imperfect professional organizations, professionals scarcity and other factors, resulting in "Digital Park" is only in the conceptual stage. This is an urgent need for our geopark construction and development of very suited. In recent years, the planning and construction of geopark more attention, which is information technology Geopark put forward higher requirements [9].

4. ORGANIZATIONAL AND SCHEDULING OF BIG DATA IN REAL TIME

To achieve real-time organization and scheduling massive spatial data, the paper uses the preclude of a spatial database nodes distributed deployment. And implement unified the various nodes of the distributed deployment of spatial data and metadata through the junction global metadata. Use various distributed nodes to achieve organizational and scheduling massive spatial data. To meet the large number of users concurrent access, you need to consider how massive spatial data cache to improve the service side of the concurrent processing capabilities [10, 11].

This article abandons the whole process of the traditional pre-generated tile data. From the data deployment, use mechanism with pre-generated and integration of real-time rendering. At a high level the series, by way of a distributed real-time buffer massive tile data management. We were illustrated by an example of a Chinese Geoparks distributed deployment. Assuming the existing scale of 1: 500, 1: 250,: 50, 1 and each park: 20,1: 5 Chinese Geoparks vector data, need to deploy distributed in the form of tile data show.

We are still using the traditional quadtree algorithm (using the same origin tile, tile display resolution high to low double fold change) to achieve 1: 500, 1: 250,: 50 small-scale data grid network organization. First, the 1: 500, 1: 250, 50 scale grading several pre-generated map. Suppose you need to display the eight pre-generated image tiles, then 1: 500 China Geological Map of the four pre-generated, the series is 1-4; The 1: 250 China Geological Map of pre-generated levels, the series is 5-6; The Chinese geological map 1:50 pre-generated levels, the series is 7-8.

Fig. (**1**) shows the logic diagram for the mass deployment of distributed tile data.

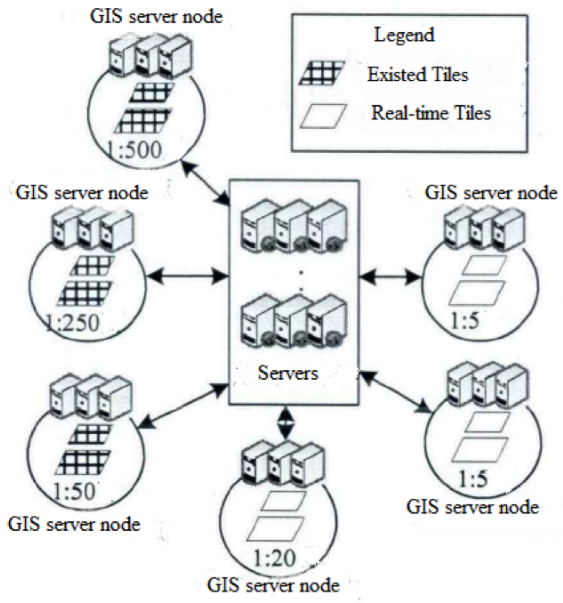


Fig. (1). Massive data distributed deployment logic diagram.

Outsourcing rectangle vector layers in the distribution of elements is $(X_{min}, Y_{min}, X_{max}, Y_{max})$. Since this preclude the use of quad-tree gridding methods, in order to facilitate the grid, we outsource rectangle vector data correction for a square range, as the contents of the vector data grid data range. The correction method is based on the origin (X_{min}, Y_{min}), as a square of side length range, then the coordinates of the upper right square is

$$(X_{min} + \max((X_{max} - X_{min}), (Y_{max} - Y_{min})),$$
$$Y_{min} + \max((X_{max} - X_{min}), (Y_{max} - Y_{min}))) .$$

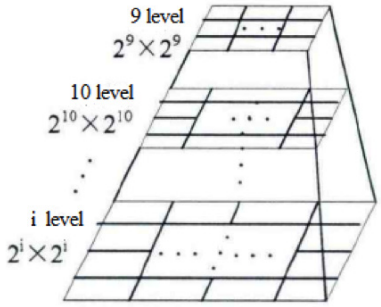


Fig. (2). Blank tiles of real-time preprocessing classification schematic.

To check the number of elements of the vector grid, we must first calculate the range of vector data Fig. (**2**). I-level grid vector data range is:

$$Gx\,\min(i) = X_{min} + d_i * x \quad (1)$$

$$Gy\,\min(i) = Y_{min} + d_i * y \quad (2)$$

$$Gx\,\max(i) = X_{min} + d_i * (x+1) \quad (3)$$

$$Gy\,\max(i) = Y_{min} + d_i * (y+1) \quad (4)$$

According to the grid vector data range, we can query data from a large-scale vector to vector data within the scope of the amount distributed, its vector and grid data range are stored together to end global rating Load Balancer Grid information table in.

5. WEBGIS SERVICE IMPLEMENTATION

WebGIS service will probe deep gravity, magnetic, terrestrial heat flow data such as shown on the map, and provide conditions retrieval, data download and data analysis services. For WebGIS, users can query to the appropriate data set based on latitude and longitude range, keywords, time, data types, and provides download. Dataset contains metadata information, data identification information, data quality information, data distribution information, reference system information; contact the responsible unit of information, data, metadata information and corresponding data volume. In this section, based on the third chapter, first introduced with the rendering process to generate the geological layers display, and then introduced to achieve the relevant geographic information inquiry service.

Realization map service

The steps of Geopark layers generated are as follows:

(1) Import The spatial data file Shapefile to PostGIS database

Use PostgreSQL comes shp2pgsql.exe tool to convert spatial data submitted by the various research units shp format into SQL statements, execute SQL scripts generated in the database, import spatial data into a database that has been created in layers. Fig. (**3**) shows the spatial data magnetotelluric mt_point.shp file into mt_point table layers database, the database information in the table.

(2) Generate the corresponding layers through GeoServer server configuration

Download geoserver.war file from the GeoServer official website, placed into a folder under tomcat / webapp file. After starting the tomcat server, enter in the browser *http://localhost: 8080/geoserver/web/*, they saw geoserver homepage. After the admin username and password to log geoserver, in the left navigation bar, the main configuration of the Data section, including:

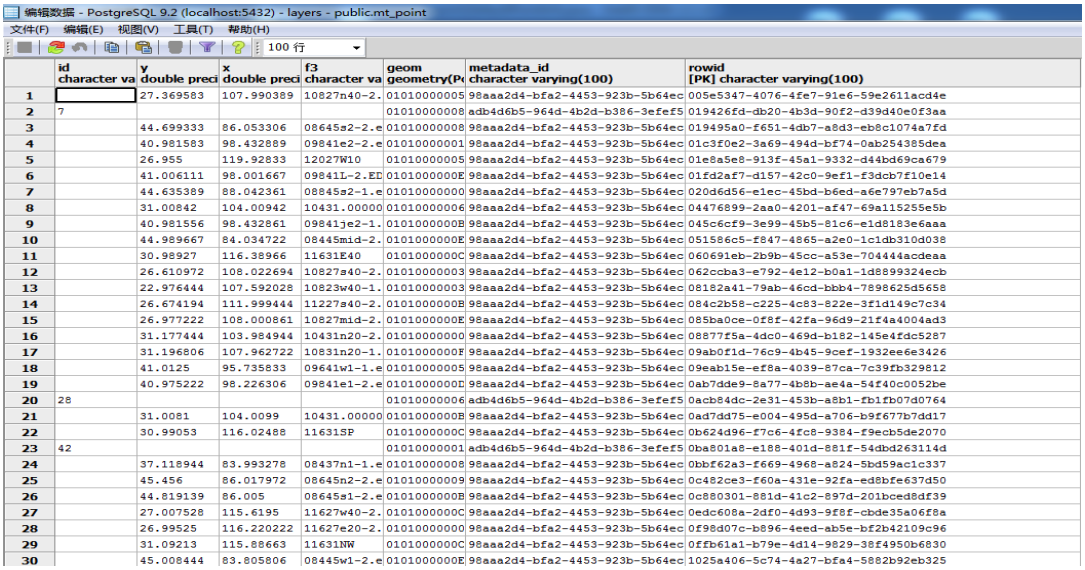
Workspace is a namespace, the layers together some specific functions, equivalent to the concept of the Java programming language package.

Stores data source, connect different data types, spatial database, shp file, also can be images.

Layers are the data Stores data source in the form of layers to show up to see the image in the browser.

Layer Groups are multiple layers of superimposed layers exposed as a foreign merger, usage, and usage of a single layer, the use of caching technology can improve the speed.

Styles are acting on a layer of style sheets, which can control a layer lines, points, surface thickness, color, outline, and filling and other information.



编辑数据 - PostgreSQL 9.2 (localhost:5432) - layers - public.mt_point

文件(F) 编辑(E) 视图(V) 工具(T) 帮助(H)

100 行

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2	7				01010000008	adb4d6b5-964d-4b2d-b386-3efef5	019426fd-db20-4b3d-90f2-d39d40e0f3aa
3		44.699333	86.053306	08645s2-2.e	01010000008	98aaa2d4-bfa2-4453-923b-5b64ec	019495a0-f651-4db7-a8d3-eb8c1074a7fd
4		40.981583	98.432889	09841e2-2.e	01010000001	98aaa2d4-bfa2-4453-923b-5b64ec	01c3f0e2-3a69-494d-bf74-0ab254385dea
5		26.955	119.92833	12027W10	01010000005	98aaa2d4-bfa2-4453-923b-5b64ec	01e8a5e8-913f-45a1-9332-d44bd69ca679
6		41.006111	98.001667	09841L-2.ED	0101000000E	98aaa2d4-bfa2-4453-923b-5b64ec	01fd2af7-d157-42c0-9ef1-f3dcb7f10e14
7		44.635389	88.042361	08845s2-1.e	01010000000	98aaa2d4-bfa2-4453-923b-5b64ec	020d6d56-e1ec-45bd-b6ed-a6e797eb7a5d
8		31.00842	104.00942	10431.00000	01010000006	98aaa2d4-bfa2-4453-923b-5b64ec	04476899-2aa0-4201-af47-69a115255e5b
9		40.981556	98.432861	09841je2-1.	0101000000B	98aaa2d4-bfa2-4453-923b-5b64ec	045c6cf9-3e99-45b5-81c6-e1d8183e6aaa
10		44.989667	84.034722	08445mid-2.	0101000000E	98aaa2d4-bfa2-4453-923b-5b64ec	051586c5-f847-4865-a2e0-1c1db310d038
11		30.98927	116.38966	11631E40	0101000000C	98aaa2d4-bfa2-4453-923b-5b64ec	060691eb-2b9b-45cc-a53e-704444acdeaa
12		26.610972	108.022694	10827s40-2.	01010000003	98aaa2d4-bfa2-4453-923b-5b64ec	062ccba3-e792-4e12-b0a1-1d8899324ecb
13		22.976444	107.592028	10823w40-1.	01010000003	98aaa2d4-bfa2-4453-923b-5b64ec	08182a41-79ab-46cd-bbb4-7898625d5658
14		26.674194	111.999444	11227s40-2.	0101000000B	98aaa2d4-bfa2-4453-923b-5b64ec	084c2b58-c225-4c83-822e-3f1d149c7c34
15		26.977222	108.000861	10827mid-2.	0101000000E	98aaa2d4-bfa2-4453-923b-5b64ec	085ba0ce-0f8f-42fa-96d9-21f4a4004ad3
16		31.177444	103.984944	10431n20-2.	01010000000	98aaa2d4-bfa2-4453-923b-5b64ec	08877f5a-4dc0-469d-b182-145e4fdc5287
17		31.196806	107.962722	10831n20-1.	0101000000F	98aaa2d4-bfa2-4453-923b-5b64ec	09ab0f1d-76c9-4b45-9cef-1932ee6e3426
18		41.0125	95.735833	09641w1-1.e	01010000005	98aaa2d4-bfa2-4453-923b-5b64ec	09eab15e-ef8a-4039-87ca-7c39fb329812
19		40.975222	98.226306	09841e1-2.e	0101000000D	98aaa2d4-bfa2-4453-923b-5b64ec	0ab7dde9-8a77-4b8b-ae4a-54f40c0052be
20	28				01010000006	adb4d6b5-964d-4b2d-b386-3efef5	0acb84dc-2e31-453b-a8b1-fb1fb07d0764
21		31.0081	104.0099	10431.00000	0101000000B	98aaa2d4-bfa2-4453-923b-5b64ec	0ad7dd75-e004-495d-a706-b9f677b7dd17
22		30.99053	116.02488	11631SP	0101000000C	98aaa2d4-bfa2-4453-923b-5b64ec	0b624d96-f7c6-4fc8-9384-f9ecb5de2070
23	42				01010000001	adb4d6b5-964d-4b2d-b386-3efef5	0ba801a8-e188-401d-881f-54dbd263114d
24		37.118944	83.993278	08437n1-1.e	01010000008	98aaa2d4-bfa2-4453-923b-5b64ec	0bbf62a3-f669-4968-a824-5bd59ac1c337
25		45.456	86.017972	08645n2-2.e	01010000009	98aaa2d4-bfa2-4453-923b-5b64ec	0c482ce3-f60a-431e-92fa-ed8bfe637d50
26		44.819139	86.005	08645s1-2.e	0101000000B	98aaa2d4-bfa2-4453-923b-5b64ec	0c880301-881d-41c2-897d-201bced8df39
27		27.007528	115.6195	11627w40-2.	0101000000C	98aaa2d4-bfa2-4453-923b-5b64ec	0edc608a-2df0-4d93-9f8f-cbde35a06f8a
28		26.99525	116.220222	11627e20-2.	01010000000	98aaa2d4-bfa2-4453-923b-5b64ec	0f98d07c-b896-4eed-ab5e-bf2b42109c96
29		31.09213	115.88663	11631NW	0101000000C	98aaa2d4-bfa2-4453-923b-5b64ec	0ffb61a1-b79e-4d14-9829-38f4950b6830
30		45.008444	83.805806	08445w1-2.e	0101000000E	98aaa2d4-bfa2-4453-923b-5b64ec	1025a406-5c74-4a27-bfa4-5882b92eb325

Fig. (3). Data information in the mt_point data table.

When configuring Layer, create a Workspace. After the namespace created, create a data source, data source into vector data and raster data sources are two sources. The system uses the vector data source PostGIS. When configuring, database fill layers; user and passwd are connected postgis database user name and password that postgres and postgres. This database and imported into PostGIS spatial data to establish contact. After the Store addition is complete, the next step is to add a layer. Click Data-> Layers-> Add a new resource, select a data source. List shows sbtc: test this table data source connection to the database. Spatial database each table corresponds to a layer. Click the "publish", will be able to publish the data table into a new layer, and provides WFS, WMS, WCS services for this layer. Which, WMS is a data table showing the data to map out the form with map navigation; WFS is to provide data query capabilities on the layer.

When create a configuration layer, choice EPSG:4326 for SRS. And GeoServer will automatically calculate the latitude and longitude range in the coordinate of EPSG:4326. Over to the next, through the preparation of SLD file, used to render graphics on the map to determine the style of map elements, then map layers successfully posted.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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