

## System Implementation of a Service for Data Resources Integration and Sharing for Ecological Environment Applications

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**Abstract** — The ecological data sharing service system is developed for the purpose of effectively integrating ecological data resources. Using GIS, database and modern communication technologies, the research has solved some key issues in current technologies, such as mechanisms of spatial data sharing service and database access mode. This system has realized the overall integration, presentation, real-time sharing and dynamic service capabilities of multi source ecological data, thus providing the necessary supports for deep and wide applications of ecological data for the management of environment protection and improvement initiatives.

**Keywords** - ecological environment; data sharing; system implementation

### I. INTRODUCTION

Affected by global climate changes and human activities, the environment problems are increasingly prominent. Small scale research on the environment is not enough to explain complex phenomenon. With the application of 3s and spatial database technology, ecological dynamic monitoring system of river basin scale, evolution trend and driving force research have gradually been in a hot research. These methods will deal with the massive data storage of environment and management technology which are still restricted in the field of research[1].

### II. MASSIVE ECOLOGICAL DATABASE DESIGNS

#### A. Data Types

The system not only covers the data types referred to the general information of management system on the data storage, but also includes the unstructured data such as text and image, and spatial data such as geographic information data, etc. So the data types are summarized on the design method firstly, according to different data types for diversified designs, in order to ensure the integrity, accuracy and extensiveness of the database platform in the end. The System from the data type is mainly divided into two categories of structured and unstructured. Geographic information data is a more specific type in structured data, which is adapted to the independent design method.

The content of massive ecological environment system integrated data can be divided into the general database, secondary database, spatial database and file database and business database.

TABLE I DATA CONTENT OF DATA SHARE SYSTEM

The database	Instructions
General database system	Including users, access control, log data, system configuration, etc.
Business secondary database	Including the ground survey data, environmental monitoring statistics, social and economic statistical data, data analysis and evaluation model, etc.
Spatial database	Including the basic geographic data, special spatial data and satellite remote sensing data, project outcome data, intermediate results, etc
File database	Including the ground investigation to collect pictures, special reports, such as different types of document data, part of spatial data
Business database	Massive ecological environment (resource directory, distribute data)

#### B. The Overall Framework of Data Architecture

Data architecture framework identifies the data flow of the massive ecological system, which is separated from the data storage and management and practical use (Figure 1).

Data architecture framework consists of three levels, such as data collection and processing, storage and management and application. The specific content is as follows:

1) The data collection and processing describes that data are respectively passed through different sources in the internal and external network, by receiving external system

data exchange, entering the corresponding internal and external network database system;

2) The data storage and management describes that the located data are stored separately in the internal and external network, regularly or irregularly manual between system, automatic batch data synchronization;

3) Data application describes that the ecological remote sensing investigation results shared services portal, and the multi-scale realization, multiform results published based on the permission management, realizes fast distribution and services of survey data and the results. Services include data distribution, retrieval and download, etc.

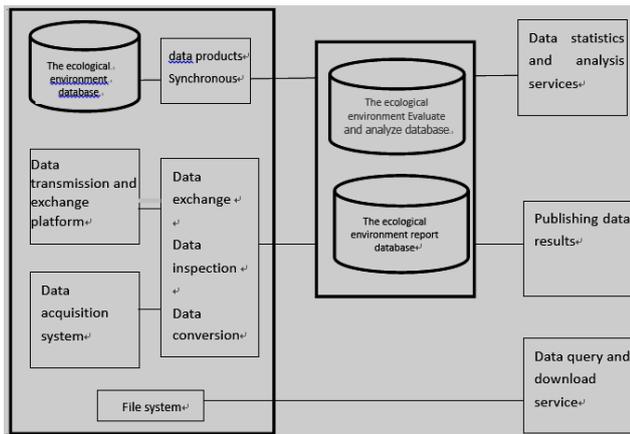


Figure 1. Data architecture diagram of data share system

download of results data. Main functions include web portal, data results show, data results distribution and data exchange.

1) *Portal*

Portal is acted as a total interface and a general window of system Web service, which is authenticated through the users' single sign-on, achieving all kinds of ecological environment survey assessing results data and other business information integration and integration, to achieve the full range of information resources sharing. The main functions include interface integration, user management, single sign-on, personalized services, integrated development environment, the predefined style appearance, and Portlet templates, etc.

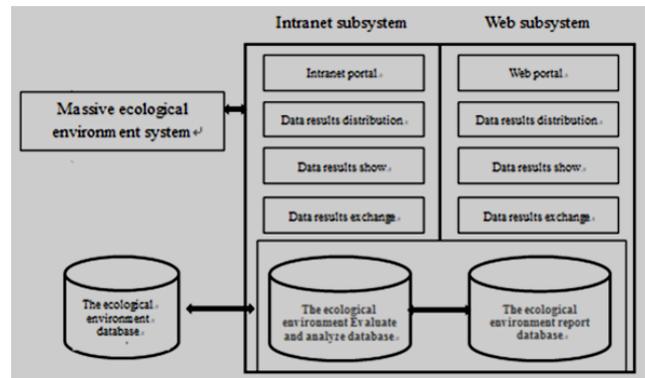


Figure 2. Architecture of data share system

III. THE STRUCTURE AND FUNCTION OF MASSIVE ECOLOGICAL SYSTEM

A. *Overall System Architecture*

Massive ecological system from the entire structure can be divided into two subsystems, internal and external network. From the data source, system design should fully consider results' centralized transformation and future data's update report. Considering system construction from the data of application service, we must give full consideration to the data exchange interface with other applications and information service interface. Survey assessment result data can be intersected in accordance with the requirements of other application service, and can provide other related department with fast, diverse data services, at the same time to consider using data provided by other applications [2]. Massive ecological environment system architecture is shown in Figure 2.

B. *System Function*

Massive ecological environment system based on permission management, realizes the multi-scale, multiform results published, offers a variety of huge amounts of ecological environment, and achieves the distribution and

2) *Data results show*

We could inquire and browse the maps, data sets, achievement reports in the formal database via portal web, and also need to present some results data and the results of data analysis' statistical tables and charts, thematic map by using a variety of comprehensive approaches. Ecological environment in the different projects, different period data can be compared and analyzed from different forms, and support for vertical comparison, overlay window parallel comparison, historical, shutter, flicker, and set the transparency comparing a variety of ways, such as view, support the integration of two and three dimensional browsing, and could show the statistical data of environmental monitoring, documents data, photographs and data association.

3) *Distributed data results*

The data results of massive ecological environment has been realized by the means of web, including query, browse, application, review, download (or offline distribution), user access, permission control, etc. System needs to use logging users, page view, and data distribution and data service content, object, time and amount of data, etc. The data service can be inquired, browsed, statistical summarized and output. Huge amounts of ecological environment system overall function structure is shown in Figure 3.

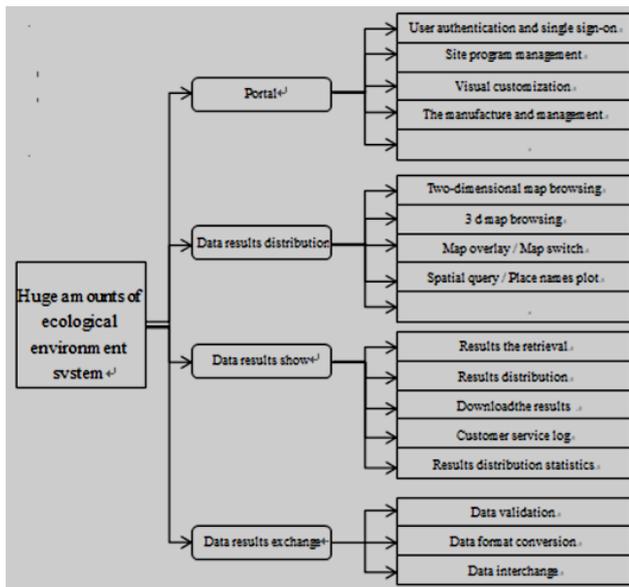


Figure 3. Functional common of data share system

#### IV. KEY TECHNOLOGY RESEARCHES

##### A. Organization and Management Technology

Massive ecological environment system involves the integrated display of environmental remote sensing data. Environmental remote sensing data have some features such as multiple levels, multiple projects, multi-scale, and polymorphic. It includes the basic geographic information data, data source such as a variety of data types and business application projects. In the terms of system construction, we must give full consideration to the diversity and complexity of the data source, and the flexibility of the spatial data model. At the same time, we must improve the data storage, data retrieval, data loading, and the efficiency of data browsing through a variety of optimization to realize the multilevel, more features, multi-scale, polymeric the efficient organization and management of [3] of geographic space information, the specific measures include:

(1) On the data management, the system adopts the GeoDatabase data model, for all kinds of data storage, management and access. In storage, database server, database, middleware, application system and so on several aspects of optimization design to ensure that the system of storage, management and access could be efficiency.

(2) To cross with data, vectors are all united to the latitude and longitude coordinates, and images can be hierarchically managed according to belt region and scale.

(3) Vector data adopted the management of the means of factor set. Raster data adopted the management a wide range of continuous images by using Raster Dataset, according to the different data application form. Points image can be managed using Raster Catalog. Whatever the form used, the

vector and image can be visited on the client side through a unified interface.

(4) Spatial index technique was adopted to realize quick retrieval and analysis of spatial data. This technology includes two levels, the space between and grid index. should according to different data characteristics, the design of optimal spatial index is between small and index level.

(5) On the system design, adopted by the means of logical and physical object separation. Through careful overall planning, the hierarchical structure, the relevant properties from all kinds of data, physical objects, such as coding system abstract inductive logic model of data organization and expression, which can be expanded in the future of the data type and dynamic extensions.

(6) System application layer software coding will focus on the logic of system data organization model, rather than directly manipulate physical objects; These data expressing model can be dynamically edit and expansion; Through the system maintenance tool, the user can visually dynamic adjustment system with the information, and transform the data organization model of the system, to adapt to the different needs.

(7) Through the design and application of logical data organization model, even if the change data organization, system code without making any changes, also make the whole system can have open, easy extension, easy maintenance, tools, etc.

In a word, through reasonable comprehensive application of the above a variety of means is a good way to realize multi-level and more features, multi-scale, form the efficient organization and management of geographic space information [4].

##### B. The CPU and the Use of Parallel Query Method

(1) Try to use multiple CPU processor to execute the transaction and query. A database access work can use multiple CPUs in parallel technology to cooperate to complete each other, and distributed computing applications has been quite common, should separate database server and application CPU requests, at the same time using the CPU requests from one server to another server. For multiple CPU system adopts parallel query method for database operation as far as possible, improve the efficiency of database access [5].

(2) Using the parallel query way to query the data. Not only can use parallel between multiple CPU allocation request processing of SQL statements, when the data query in the state of different disk, individual process can also be at the same time to read the data.

(3) Using a good tool for large amount of data loading. Using the method for data loading, program to create formatting data block write data file directly, does not require the database is the kernel of other I/O [6].

### C. Use Data Background Processing Scheme to Reduce Network Traffic

(1) Reasonable create a temporary table or view. According to their needs on the basis of the database to create a new table or view, after more than for a table to query information can be a new table, can create a view for single table query, which can make full use of the database of large capacity, strong scalability, etc, all of the conditions, the numerical statistics, are available on the database server backstage after unified handling appended to the temporary table, the forming process of the data available database of the procedure or function [7].

(2) Make full use of the database package technology. Database is used to describe the procedure or function of language writing database, and then their procedure or function into package, running in the background database unity.

(3) The use of data replication, a snapshot, view and remote procedure call (RPC) technology. Data replication, the one-time data is copied to the local, you use the local data query, data but only for those who haven't changed much. Using the snapshot is also available in dynamic replication data between distributed database, define the snapshot refresh automatically or manually refresh time, to ensure the reference referential integrity of the data. Call remote procedure will be greatly reduced due to the frequent SQL statement calls the network congestion.

(4) the raster data is sorted by rows and columns of network units, with different gray level or color array data, most of its file format by pixel sets consisting of image files., according to the need of layered precision of image pixels are grouped, and based on the pixel group to slice of data, without any increase in the data of the total cases, achieve the goal of data segmentation. An orderly superposition, the data section can obtain all levels of grid layer data, so as to realize the data layer. As a result of the data layer is based on the slicing of superposition, server group simply sends data slices in each layer to the client, study the browser can these slices are pixels overlay, and through certain interpolation processing to obtain the required service data. Raster data layering method based on pixel grouping section, under the precondition of no increase in the amount of data to achieve

the raster data layer, and the data stack on geological browser, not only shortens the users download the waiting time, and take full advantage of the growing user computer performance.

## V. CONCLUSIONS

The ecological data system integrate large amounts of ecological survey data, assessment data and other reference data very well. It provides integrated management and sharing service capability for multiple source data, category data and multiple scale data. It can provide all round data supports for national level of ecological management, science research and planning. It further promotes a foundation platform of environment protection data sharing service.

## ACKNOWLEDGMENT

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

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