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ITJ

ISSN 1812-5638

INFORMATION TECHNOLOGY JOURNAL

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Information Technology Journal 12 (16): 3729-3734, 2013
ISSN 1812-5638 / DOI: 10.3923/itj.2013.3729.3734
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Research on Framework of Spatial Data Integration in Beibu Bay

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Abstract: Study and formulate the data classification system and data standard, forming the Beibu Bay resources a standardized and environmental data system. Develop data acquisition and processing, database building and sharing technology standard, realizes data acquisition, conversion, processing, inspection, analysis, display the process sequence and sharing. According to the technical regulation, standard and integrated arrangement of Beibu Bay based data, thematic data resources environment, social and economic data and other data and information and combined with the network information technology, integrated "Guangxi Beibu Bay Economic Zone Based on the major projects" the implementation process of the acquisition, the formation of scientific data, analysis results and literature data, to establish a network of federal database, data network based on the intersection of environment, realize the network data integration; functional requirements through the analysis from the distributed environment, heterogeneous data processing, data integration and management, uncertainty, automation and intelligent and pointed out that the spatial data seamless integration is a systems engineering, need to meet the demanding requirements of in many aspects, Presents the design principle of system resources and environment in Beibu Bay seamless data integration system. A detailed analysis of the Beibu Bay resources and Environmental data system of spatial data center architecture and the general pattern, put forward the feasibility of seamless integration framework of spatial data center based on model. Research and design of system architecture for seamless integration of Beibu Bay of space data, focusing on design key components of seamless integration framework, global directory system, a multi-layer intelligent middleware etc.

Key words: Beibu bay, spatial data, architecture, framework, integration

INTRODUCTION

At present, all kinds of information in the Beibu Bay Economic Zone, including resources, ecology, environment and disaster, the lack of a reliable system information integration platform. Acquisition, storage, processing and analysis of the service object data, limited to a single data units and departments, lack of unified, systematic management and brought great difficulties to the data integration and sharing. No spatial analysis technology, to meet the comprehensive analysis and evaluation requirements, need to carry on systematic research to data sharing, the establishment of scientific data sharing platform. To realize real-time monitoring of resource and environment spatial information of the Beibu Bay, distribution and dynamic change, to the scientific research and management of the Beibu Bay Economic Zone to provide important basic data and decision analysis.

Develop data acquisition, processing, database building and sharing of technical regulations, unified data acquisition, storage, can be for the construction of sharing database group to provide security. Comprehensive application of Remote Sensing (RS), Geographic Information System (GIS), Global Navigation Satellite System (GNSS), modern high-tech distributed model and virtual simulation, through the construction of broadband multimedia information network, on the Beibu Bay ecological environment, natural resources, natural disasters, population, social economic status and other information to digital signal, transmission, storage, management and dynamic processing, integrated dynamic information and the corresponding model, method and knowledge (Buyya *et al*., 2001; Barkaoui and Benamara, 2003). Aiming at the main problems faced and interleaved with the corresponding application system, the establishment of professional and comprehensive application system, realize the whole area in all kinds of

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high resolution dynamic information support multidimensional virtual reproduction, as government departments at all levels to provide for the coastal zone information and decision of professional and comprehensive application support services (Young, 1989).

DISTRIBUTION OF THE SPATIAL DATA IN THE BEIBU BAY

Establishment of Beibu Bay resources and environment data system is an important basis for the construction of Beibu Bay of scientific data sharing platform, the system combined with the actual situation is divided into basic geographic data, background data, other data, on the basis of a series of derived thematic data such as ecological environment, environmental pollution, natural disasters, water and soil resources, species resources and social economy, there is a detailed record of metadata data background, content, quality, condition and other files. Long as no unified standard and planning, making the region cannot share the data fusion is very good. For example, the SQL Server engine access storage of spatial data in SQL Server. Oracle can access the Oracle Spatial database engine. The SDE engine access database, ESRI SDE support. The SDB engine access Super Map SDB etc.

And the lack of unified description method of spatial objects, different formats used to describe the spatial data model is not the same, so that the data format conversion will lead to loss of information more or less. DXF focuses on the description of spatial object graph expression (such as: color, shape), while ignoring the topological relation between attribute data and spatial object; E00 is focused on describing the relationship between spatial objects (such as topological relation), while ignoring its graphical expression ability. Therefore, the CAD data output E00 format will lose color, line type and other information; and the Arc/Info data output to the DXF will be valuable information loss of topological relationship and attribute data.

As mentioned above, the spatial data of Beibu Bay of dispersion, the overall integration degree is not high, not to play its due role in the region.

EXISTING OF BEIBU BAY OF SPATIAL DATA TYPES, STRUCTURE

The basic geographic data: Fundamental geographic database is space background data construction of public data platform, in the construction of public platform of spatial database is divided into 1:50, 1:25, 1:5, 1:2.5 and 1:1 million, multiple levels, from the data format can be divided into vector data and raster image database of two categories.

1:25 or 1:5 million vector database: Elevation, drainage, transportation, residential, administrative center, boundary line.

Raster image database: The construction of raster databases including DOM, DRG, DEM data: 1:25, 1:5 million, 1:1 million regional or even higher; satellite, aerial image number.

Basic background data: Background database is relevant background data except the basic geographic data, is an important supplement to the basic geographic data. Mainly includes: biological resources, climate resources data, geological information, hydrological information data set.

Thematic data: In addition to the above data, the other is related with the Beibu Bay information stored in the database. For example, government reports, news, images, files and so on.

Metadata: Metadata is the smallest unit of data. In the spatial data, metadata is the background information that data content, quality, condition and other related characteristics, can be used for including the establishment of data files, data distribution, data browsing, data conversion. According to the features of application of geographic information system, database construction should according to the data of spatial information infrastructure basic data platform contains detailed data, establish the background, content, quality, condition and other files and data, metadata and dynamic maintenance and dynamic basic data maintenance to maintain synchronization. Database construction content includes three aspects of content, metadata definition of metadata dynamic maintenance mechanism, metadata publishing rules.

Beibu Bay data is divided into basic geographic data, background data, thematic data (ecological environment, environmental pollution, natural disasters, water resources, social economy and species resources), other data, metadata and so.

INTEGRATION OF MULTI-SOURCE SPATIAL DATA MODEL

Principle of SIMS Technology: Seamless integration of multi-source spatial data (Seamless Integration of

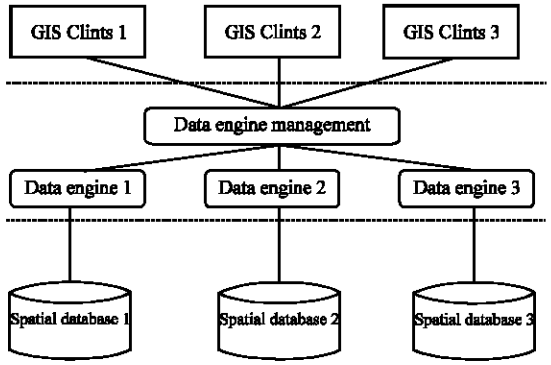

Fig. 1: SIMS Technology.

Multisource Spatial data, SIMS) is a multi-source spatial data in the GIS software of a built-in integrated technology, does not need the data format conversion, through virtual spatial data engine operation, to achieve direct access between multi-source data. SIMS system has the following structure of three layers; each layer has a clear division of labor (Fig. 1).

Seamless integration of multi-source spatial data: SIMS system is a kind of compact structure of three layers, including: data consumer (Customer), the data agency (Agency) and the data provider (Provider). Each of the layers has a clear division of labor: data provider to directly access the data file or database and through the data agency provided to other modules use; data consumption and use of data module, usually responsible for analysis, all kinds of data processing and performance; data link between agents is maintaining data consumer and data provider, the data from the provider through the agency of the intermediate transfer to consumers, to complete a data access (or data consumption), the act of a data consumer may generate new data (such as: the new layer superposition analysis, buffer analysis of the buffer polygons), these new data is transferred to the provider through a proxy, by the provider to complete disk movement.

Seamless integration of multi-source spatial data (SIMS) technology has direct access to multiple data format, Format independent data integration, Position independent data integration, complex multi-source data analysis etc, to effectively solve the comprehensive utilization of different format data resources problem. SIMS technology to develop GIS software data integration capabilities, provides a variety of data storage scheme, enhanced the application range of single GIS software.

Integration of multi-source spatial data model platform choice: Data providers can directly access the data file or database module, the module to acquire data and provide to consumers through the use of agents and send back data to a file or database.

SIMS provides the ability to access data in multiple formats, access to each kind of data format, finally through the spatial data engine (Spatial data Engine) implementation. The data provider is composed of a set of spatial data engine; each engine is responsible for accessing a data format. For the convenience of engine management and scheduling, each engine with the uniform interface is encapsulated into a dynamic link library (Dynamic Linking Library). Similar to some software plug-in (Plug-in or Add-in) mechanism, engine DLL stored in a specific directory, automatic search for the directory when the program starts, dynamic scheduling and register.

Generally speaking, spatial data engine provides only the storage, retrieval, reading, data management and data processing functions, is not responsible for spatial analysis and complex processing. But based on the third API (such as: Oracle Spatial and ESRISDE) development engine can provide more features.

INTEGRATION OF MULTI-SOURCE SPATIAL DATA

Construction of database: The construction of spatial database must first do research, demand analysis, construction of comprehensive database is the core content; shared database design is good, for the efficient operation of the system and maintain a great help. In the data center frame, we mainly introduce the necessary to establish the database. Because a lot of application system will use these basic geographic data, Construction of the database will be launched step by step, in the construction process, improve data standard, running software function and establishes the data storage and updating mechanism, constructing the whole database. Beibu Bay spatial data frame in Fig. 2.

Exchange of information resources sharing system: Resource sharing is a key construction center frame. Establish database for data sharing. Sharing and exchange system provides the technical support for data sharing. Sharing and exchange system includes the internal data sharing and exchange and internal data and external data sharing exchange. The core internal data sharing and exchange is addressed within various application systems of data sharing and exchange. .All kinds of application system must follow the unified data standards and access interface, in order to realize the data sharing and exchange

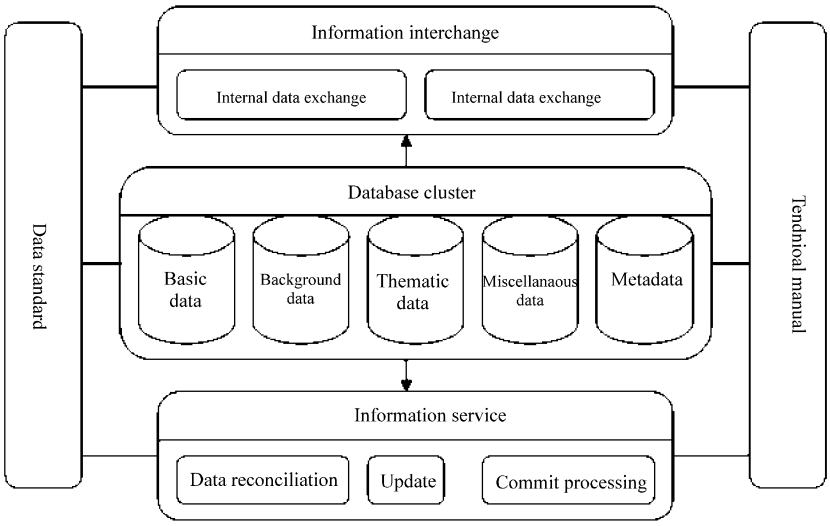

Fig. 2: Beibu Bay spatial data framework.

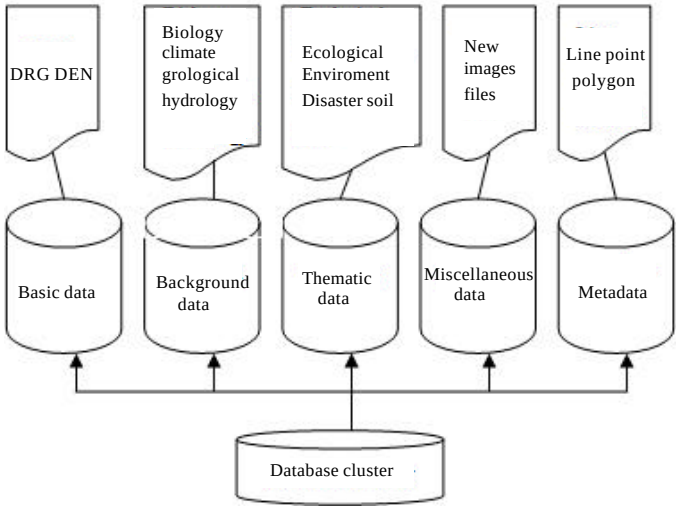

Fig. 3: Beibu Bay spatial data structure

between each other. Through the establishment of an effective information access, sharing and exchange system, ensure the updating of the data, the integrity and consistency.

External data sharing and exchange, is the foundation of information sharing in different libraries. External data exchange and sharing mechanism based on the data exchange network can be realized by private network, the network conditions do not permit, can be used in optical disc medium and intermediate data media realizes data exchange. The establishment of external data sharing and exchange mechanism still need soft environment, the soft environment includes the basic guarantee of information resources co-construction and sharing, data standards, policies, regulations, such as: the geographical elements classification system and coding standard, standard data format, spatial data by standard etc.

The realization of information exchange and sharing by using Service Oriented Architecture (SOA) technology, the unified information exchange platform, to adapt to different heterogeneous system of data sharing and exchange. Information exchange platform by the logical architecture of data exchange nodes and intermediate exchange protocol packet of two parts.

According to the application demand, establishment of spatial database management system, mainly based on

the geospatial database of original system and create a new geographic database, the prototype system of data input function, unified cataloging in the meta-database, data center through global catalog, unified management of these distributed heterogeneous spatial data resources. In the management of the core vector database, the main function of the database management system is: to provide continuous seamless integrated management of Basic data, Background Data, Thematic data, miscellaneous data, metadata and other auxiliary data set, the query, extraction, analysis, visualization, roaming, editing and other basic functions.

Combined with actual requirement of basic geographic information manage, the server in Geographic Information Center uses Oracle database as the background database. Different GIS vendors. Using ArcGIS, MapGIS, SuperMap, Geostar, GIS database platform respectively, collaborative work. In the database structure design, system uses the database integration technology and use Oracle's Real Application Cluster clusters. In order to improve the database processing speed, we use RAID and other disk file segmentation solutions, distributed data storage, symmetric multiprocessor system, transaction processing load balance method and increase the redundancy of software, hardware and communication line is necessary, in order to improve the availability of the database.

In database management system, DLG, GN data type is a vector format; DRG, DEM, LC, CP data type for the grid format (LC containing the vector data; CP containing text information,); DOM?TM,DOM?SPOT,DOM?AP data type is a video format; MD is the database, the data type to contain text information, fast visual image and the sample vector data.

Create a different database; data are stored in Coverage, Shape File, Mapgis, SuperMap, Geostar, GIS data model and format. Through the application, based on the field of geographic information can be seen, the prototype system to fully support TB, distributed, heterogeneous spatial data seamless integration management, can provide good support for the application of related industries. The function module seamlessly integrated in the prototype system provides important technical support for the realization of the application system.

At present, the project data interoperability has the support of ArcGIS Shapefile, Coverage, Access, Arcsde and relational database Oracle and SQLServer data source, but also supports Oracle Spatial, MAPINFO, AUTOCAD, MAPGIS and other heterogeneous spatial data source.

CONCLUSION

This study uses multi-source spatial data seamless integration (SIMS) technology, effectively solves the problem of consolidation the different formats of data resources in Beibu Bay area. SIMS technology develops GIS software data integration capabilities, provides a variety of data storage scheme, enhanced the application range of resources and environment data in the Beibu Bay.

According to the characteristics of current research status and application integration project, we believe that the Beibu Bay resources and environment data integration has the following work to do:

- Strengthening the construction of network. The distributed features of the data, the needs of the project data diversity, make the integrated content is more and more complex, requiring fast using the physical distribution in each node of the data, the construction of various types of network provides the conditions for the integration of multi-source spatial data
- Detailed standards. SIMS provides the possibility for the integration of multi-source spatial data integration, the real implementation and multi-source spatial data characteristics inseparable. In particular, Multi-source spatial data organization, abstract, expression, have not formed an effective method. Integrated mechanism, integration rules and standards, universal integration methods will be the focus of future work
- Efforts in several directions on the integration of expert system based on knowledge and make a breakthrough in the one or two direction

ACKNOWLEDGMENTS

The authors appreciate the support of the Projects from the major infrastructure projects of Beibu Bay in Guangxi " Economic Zone Science Data Sharing Platform and decision support system of Beibu Bay" (NO.2011GXNSFE018003), The key Laboratory project environmental evolution and resource utilization from Ministry of Education in Beibu Bay " The research on integrated spatial data infrastructure in Beibu Bay " (NO.BBG1102) and the Department of Education in Zhuang Autonomous Region of Guangxi "The visualization system of oil spill accident in Beibu Bay based on the GE(NO.201106LX529) and the youth fund

project from Qinzhou University " The definition of spatial data model for oil spill emergency in Qinzhou Bay based on KML (NO. 2011XJKYQN-04).

REFERENCES

Barkaoui, K. and R. Benamara, 2003. On concurrency control in multidatabase systems with an extended transaction model. J. Supercomput., 24: 193-202.

Buyya, R., T. Cortes and H. Jin, 2001. Single system image. Int. J. High Perfor. Comp. Applicat., 15: 124-135.

Young, M., 1989. The Technical Writer's Handbook. University Science, Mill Valley, CA., USA.