

SOUTH GIS STRUCTURE AND ITS APPLICATION CONCERNING GOVERNMENT AFFAIRS BASED ON COMPONENT TECHNOLOGYS

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ABSTRACT:

E-government GIS, which is an application of GIS in the government departments, has attracted increasingly attention. A novel E-government software structure was proposed according to the solutions refining from the development process in many real projects and the basal theory of GIS and E-government. This structure is divided into different GIS components according to the different functions which components can be integrated by software development tool. Compared to the traditional GIS structure, this structure may bring forward great benefits, such as lower development and maintenance cost, more scalable and reliable system. This structure as the ultimate GIS application system applied in many projects.

1. INTRODUCTION

Governments around the world are implementing Electronic government (e-government). In every part of the world from industrialized countries to developing ones governments are putting information online to provide better services for citizens (Chircu, Lee, 2005). E-government is always regarded as more than just making some public information and specific citizen services available to people via website (Curtin et al., 2003). E-government promises accurate, agile, transactions and delivery of services and information to businesses, citizens and governments agencies. More, e-government plays a part towards the enhancement of democracy. E-government, as a bran-new mode of administrative management, brings great opportunities and challenges to our government reform in the 21century. It will improve government's efficiency, transparency and low the cost. Therefore, all the governments in the world, including developing and developed countries, actively take measures to develop their E-government.

With the continuous development on the E-government, Government service delivery units are heavily dependent on Geographic Information System (GIS) technology. E-government GIS, which is an application of GIS in the government departments, has attracted increasingly attention (Zhang and Liu, 2003). At present, the major problems of the application of E-government GIS mainly associate with the improvement of industrialization; for example, how to develop series of GIS software products that have their own copyright and how to produce the GIS application system with following desirable characteristics: interoperable system, modular system, multidimensional system, intelligent system, network platform system, and community-facing system. All these problems are harmful to the GIS industrialization progress. If suitable solutions can not be find out, the GIS industrialization progress will stagnate so as to affect the "Digital Earth" development (Xie, 2004). An efficient E-government GIS with rational function design greatly benefits the enterprises and institutions

on both economic and social affairs; moreover, it can also save a large amount of human and material resources for the companies to develop the E-government GIS application system.

2. COMPONENT GIS

There are four types of system integrations based on GIS: Import/Export, Embedding, COM and API. With the rapid development of COM, the component-based technology becomes quite mature (Pan, 1999). It is composed of a group of GIS components which conform to the "technical criterion" of COM (Component Object Model) and is based on the platform of component objects and may be applied to all programming languages, furthermore all various computers (Song and Zhong, 1998). One GIS component may communicate with another through the standard communication interfaces. At present, Component GIS (ComGIS) , which is a new generation GIS system, has become a mainstream in GIS technology, especially in E-government.

COM technology becomes so mature that many manufacturers have the support it; moreover many GIS software manufacturers have introduced COM in open GIS Software. ESRI Inc., the Famous GIS manufacturers, has released the new object library of ArcGIS Engine9.1 which based on COM technology. It provides unprecedented flexibility for GIS developers. Therefore, it breaks the monopoly of the GIS software by few manufacturers and opens up the new way for professional GIS components to enter the new market.

3. SOUTH E-GOVERNMENT GIS ARCHITECTURE

A GIS system has some basic functions such as data input, data storage, data edition, data calculation and operation, data query and retrieve, analysis of data application, data and graphic display, results export, etc. These characteristics have little relation with business. Therefore, they can be extracted into

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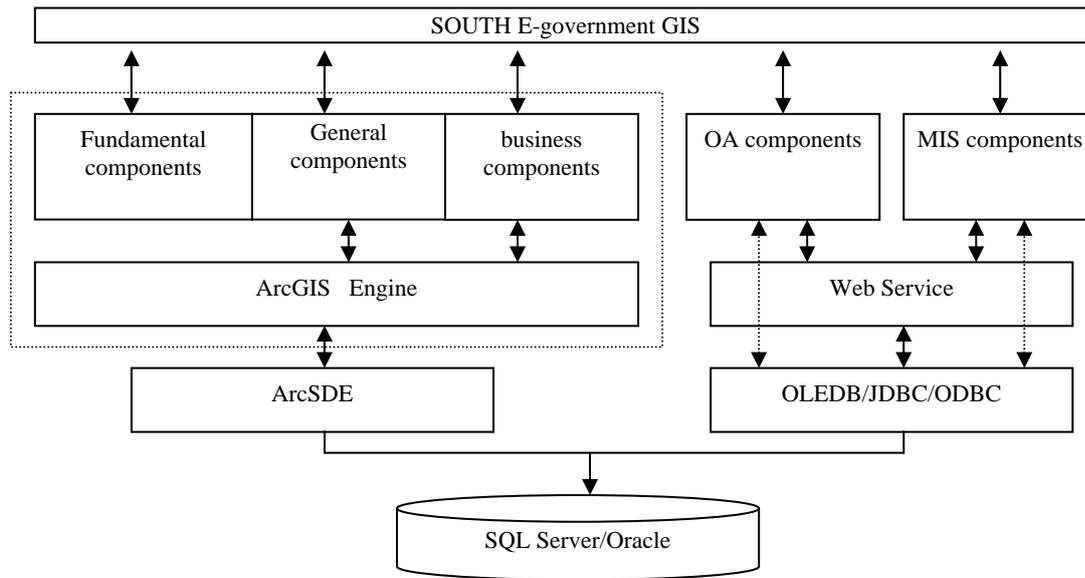


Figure 1 Software architecture of SOUTH E-government GIS

independent modules as GIS application system was developed. Then, those independent modules can be shared with other GIS software system in the future, and save the repeated building process. A whole GIS system includes spatial attributes, social attributes and natural attributes. Both of the latter are associated with the spatial attributes in a GIS system. These attributes may have different definitions when they apply to different business; however the basic functions of GIS rarely correlate with them.

A good GIS structure can be considered as a big bookshelf and the different functions that need to realize can be considered as books (components) of different industries. Thus, when different books as the different industry type are placed in the bookshelf, the basic structure of bookshelf as the basic function of GIS system may not to be rebuilt. With the extension and expansion of the GIS application field, there are more and more books in the bookshelf and more and more function in structure. If the industry changes, only the business related to this industry need to be updated without disturbing other parts of the basic functions. When books in the bookshelf are placed in different order, GIS software in different industry would be developed. It is considered that all the industries concerning GIS have some common characteristics, such as transportation, natural resources management, urban management, electricity, telecommunication, country land resource management, real estate resources, underground pipeline, mineral resources, etc. The common characteristics among these different industries are the invariable space attributes of graphics and the operations based on these graphics, which are always processed on the point, line and the surface. The variances of these industries mainly concentrate on the different business processes, as well as the different additional characteristics of graphics. Based on these considerations, the GIS system can be designed more general if disregarding those variances.

Based on these points and the characters of E-government GIS and component technology, SOUTH E-government GIS structure was proposed as a novel E-government software structure according to the solutions refining from the development process in many real projects. ArcGIS Engine has so powerful and scalable characters that SOUTH E-government

GIS structure was developed based on it. Figure 1 shows the SOUTH E-government GIS structure. In this structure, GIS components are divided into four layers and every component rebuilds according to the functions. The bottom layer has nothing to do with the business which functions have been accomplished by GIS platform. The first layer is fundamental component which has completed the general operations such as metadata operation, data import, data export, and other parameter settings. It has nothing to do

with the business too. The second layer is general component which has accomplished basic functions of GIS such as zoom out, zoom in, pan, previous view, next view, eagle view, add layer, delete layer, browse, identify, find, edit, etc.. To some extent, this layer looks like the familiar computer software on operating system. It still has nothing to do with the business. The third layer is business components which has relation with business. It has different GIS functions according to different business such as land, house property, pipeline, mine resource, traffic, archaeology, power, sail, and forestry and so on to accomplish GIS functions. In many information systems, the function to realize graphics and work flow together is the most tedious step. Different business has different demand as well as different place has different vision. So this layer was put on the top. In order to achieve standardization of components and interoperability between components, all e-government GIS components must follow OpenGIS technical standardization that OGC set. E-government GIS which based on components can realize Interoperability for different business data and resource, moreover it can share business spatial data.

4. IMPLEMENTATION OF TECHNOLOGY IN SOUTH E-GOVERNMENT GIS

South E-government GIS structure is technically realized on the basis of the component-middleware technique, adopting certain inter-ports to enable all the function modules, using the Fundamental Geography Space Database as the basic data as well as the objects for the space information service, by appropriate processing of some data format which is popular at

current, to meet the requirements of interoperable system; based on the principle to partition the component-middleware by the function classes, dividing the GIS application system into modules, starting by the research of those fundamental components, followed by the expansion of the common components, then the professional extension on the business components, OA components and MIS components particular for different industries, to achieve a ideal module system; using the component technique and the web distributing technique as the base, using the network and mobile communication technique as the method, to establish the network platform of distributing space information service; using the digital signature technique to ensure the safety and security of the application system; using search technique for huge space information to improve the system reaction speed; using the work flow technique to drive the GIS system of different industries, which can result in a intelligent business process; using the resource file technique to manage the requirements of system version of different language. These techniques provide the GIS application system in exploitation those desirable characteristics: an interoperable system, a modular system, a multidimensional system, an intelligent system, a network platform system, and a community-facing system

South E-government GIS structure was divided into different GIS components according to the function and was formed as the ultimate GIS application system, which components can be integrated by software development tool. Various components, like a pile of various kinds of "books", were to realize different functions. If the components are business components, they would achieve their different business functions. According to need to put the books which realize the various functions into the corresponding shelves, the GIS application systems in different business were developed. Various components have the general standard interface, including properties, methods and events. For example, ArcGIS Engine includes the ICommand interface, ITool interface, IMapControl2 interface, MapControl control, and so on. Component GIS is interactive with the programs of client and user which is mainly through the properties, methods and events (Zhong, etc., 1997). We developed the Guangxi Wuzhou land management information system, Hunan Lixian land information management system, Anhui Huainan Mining Management System based on South E-government GIS structure, which have got very good results according to functions to divide different component and to achieve code.

To take Hunan Lixian land information management system as an example, we take South E-government GIS framework to divide it into 17 sub systems, including cadastral management, land use and planning, land use and detailed investigation, land-use management, construction land, cultivated land protection, real estate management, planning and management of mineral resources, geological environment, mapping management, land and natural resources monitoring, file management, and so on. This system is currently achieved the business office automation and openness in government affairs, and uses digital signature in all handling business to prevent data changes

5. CONCLUSION

Through a lots of practice test, South E-government GIS structure has proved that its functions become increasingly perfect with the development of more and more application systems. Compared to the traditional GIS development, South E-government GIS structure may bring forward great benefits, such as lower development and maintenance cost, more scalable and reliable system. Moreover, it has won the user's appreciation. To develop and apply information technology and to accelerate the process of information and to promote the development of the new economy with information and globalization become strategic high ground of the country's future development and strategic choice in country's fierce competition. ComGIS and WebGIS have become a very important development trend of GIS. To study and follow these new technologies, the development of China's Chief GIS industry is of great significance.

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