Research of Main-functional Zones Management Services Cloud Computing Platform

Guannan Si, Hairong Xiao and Guangyuan Zhang
College of Information Science and Electrical Engineering, Shandong JiaoTong University,
Jinan, 250357, China

Abstract: The issues of functional systemic, regional evolution and distribution business in main-functional zones planning are analyzed. The requirement of core content planning process, key technologies, system functions and important means in main-functional zones management are studied. The main-functional zones management and services cloud platform is designed and implemented combining with the development of GIS technology, software technology and computer technology. It provides theoretical and technical support for planning, dividing and management of the main-functional zones.

Key words: Main-functional zones, cloud computing, GIS, regional planning, service platform

INTRODUCTION

The main functional area is based on the carrying capacity of resources and environment in different regions, the existing development density and development potential. It is coordinated by regional division of labor and development of principles delineated in the main function with a specific spatial positioning unit. The main functional areas based on national spatial planning aims at basic conditions for land development, regional development and urbanization problems. It complies with future urbanization and globalization which solves regional problems through scientific method. Its fundamental purpose is to avoid environmental pollution and to enable economic development of different regions with the same types of resources to match capacity and environmental capacity. And It achieves the best possible regional economic and social development with minimal resource consumption, environmental costs as small as possible.

Current researches have made many achievements in connotation of the main functional areas planning, planning level unit, planning models and planning techniques. But there are still some shortcomings, as follows:

- **Systemic:** Existing researches are more emphasis on division of the main functional areas which is a separate module and using some existing methods for analysis of various indicators based on existing data and calculation. However, in the division of the main functional areas, different indicators can be divided using the appropriate method which is more accurate and objective outcome. So, the system should be integrated with a variety of methods and select the appropriate method based on actual situation on analysis of specific indicators. As a software system, data acquisition, data source processing, interactive, definition of new indicator model analysis update processing functions and calculation modules should be in addition to core main functional areas divide module. It is the only way to form a complete system which provides effective services to relevant departments

- **Evolution:** Classification and management of the main functional areas is a long process. It requires resources and environment carrying capacity from region, existing development density and development potential to be divided. Development status of regional division will impact on the implementation of policy area. And the effect is not a static one-step effect but with persistence, dynamic and gradual change. And development status of each region should be ready to adjust policies based on ensuring healthy development of regions. So, divide management

Corresponding Author: Guannan Si, College of Information Science and Electrical Engineering, Shandong JiaoTong University, Jinan, 250357, China

system should meet the functional zoning functions which also highlight the evolution of divided line, in order to establish long-term monitoring mechanism

- **Distribution:** Divide of the main functional areas should access to relevant documents, maps data from multiple departments and multiple data sources, in order to generate corresponding spatial data and attribute data. Data from different sources will result in non-uniform spatial data projectors and inconsistent statistics scale issues such as property which causes workload data conversion result and conversion very large. In addition, after division of work completed, information dissemination, policy formulation and updating data model also involves collaboration between multiple departments, cooperation, data processing and other tasks. So, original stand-alone zoning system of the main function can't meet needs of multi-sectoral collaborative work. Mechanisms of multi-sectoral Information integration need to be established, in order to process the various departments pooling and disseminate information in real-time which provides support for long-term monitoring mechanism for each functional area

In response to these problems, this study starts from actual demand of the main functional areas planning, combines with the current development of GIS technology, software technology and computer technology and designs a planning and management cloud services platform for the main functional areas. This study is divided into the following sections: Section 1 is the main functional area management systems requirements analysis; Section 2 carries system design and implementation; Section 3 describes related work; Summary is made in the end.

REQUIREMENT ANALYSIS

In zoning main functional areas, index system and divide objects have significant spatial characteristics. They rely on remote sensing and geographic information system technology, spatial and statistical analysis. And complex data models and calculations are complete division of the main functional areas. So, establishing of the main functional area planning support system is very necessary. Construction of the system needs to meet the following requirements:

- Indicators index system based on factors need to divide the main functional areas which combine with actual situation in region. And the corresponding index entries are calculated and evaluated which divide main functional areas into various region. So, establishment of the index system is needed, as well as indicators of division and processing factors
- In planning process of main functional areas, we need to collect, process, analyze and export large amounts of spatial data and form data. They include a large number of basic spatial data and attribute data from natural elements, economic elements and social elements. Additionally, a lot of intermediate data are also generated in process of regionalization, as well as calculation and planning divisions formed resulting data. As the result, we also need a variety of data processing systems
- Main functional areas management system is more than transaction processing systems and management information system. It has not only processing, storage and simple query spatial features and attribute information but also building and mining to extract relevant information which provides scientific planning and the evolution of the main functional areas decision making. So, the system needs to process calculation by hierarchical setting, as well as provide a comparative analysis division of results and program adjustment
- As social and economic development and utilization and protection of land resources, we need to keep abreast of resources dynamic changes. And the changes in a timely manner are even more important to make important decisions. So, the system needs to be able to meet cooperation between various departments to interact and share data, information resources and timely evolution of the system

SYSTEM DESIGN AND IMPLEMENTATION

Design of the system is mainly focused on process of data, acquisition and processing, analysis and calculation index, regional planning division and policy adjustment of the main functional areas, in which information is generated to provide effective support for distributed work. System uses cloud
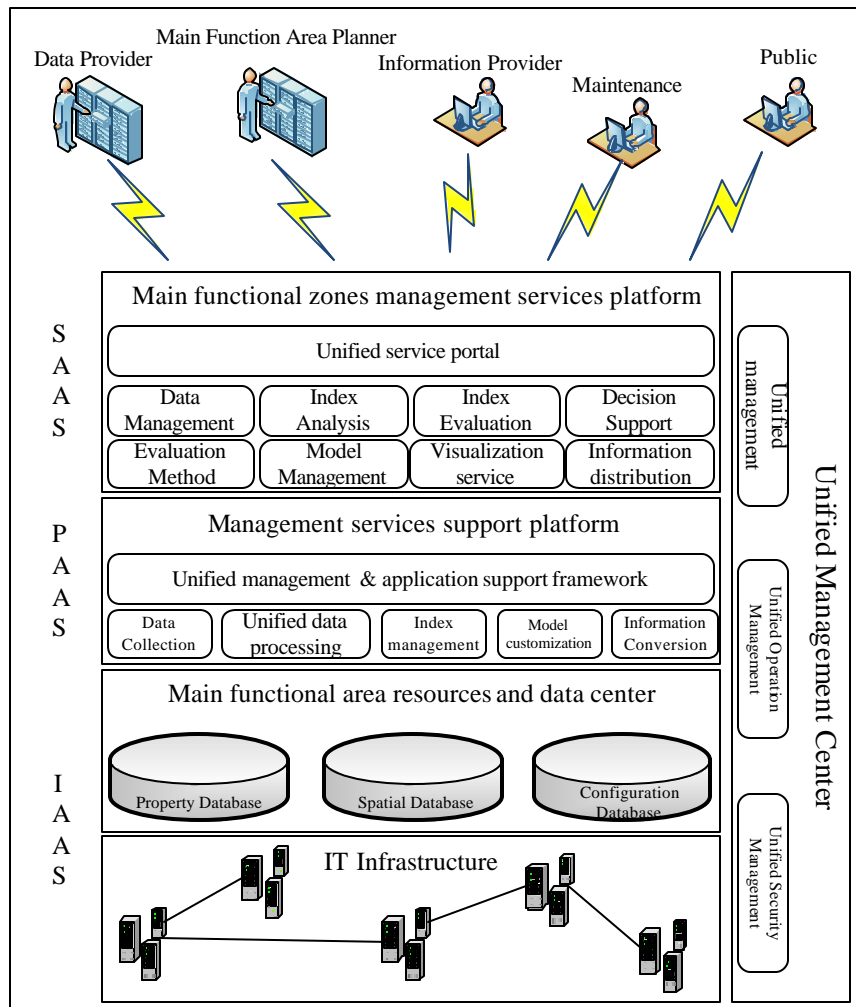
Fig 1: Main functional zones management services platform

computing platform architecture for process of the main functional areas dividing. It involves in software, hardware, platforms and other resources to integrate and provide on-demand services for various departments. The overall system architecture is as Fig. 1.

It infrastructure: It provides infrastructure services as the main functional areas planning and management systems. It uses existing data collection departments, generation, processing system or integrated IT-related public services. It is source IT infrastructure of the main functional areas planning Management system Services which has advantages of business software and hardware resources through virtualization and cloud computing technology.

Main functional area planning resources data center: On the main functional areas management systems services running at different levels to provide data access services resources. It achieves integration of the main functional area planning resources, exchange and sharing. Meanwhile, the use of cloud computing platform resource gathering advantages, resources, data centers can also provide data storage and disaster recovery services for users. Repository is divided into three parts according to different data to be stored.

Property database: Attribute data includes nine categories of data to calculate attributes: Available land resources, available water resources, environmental capacity, fragile ecosystems, ecological importance,

natural disaster risk, concentration of population, level of economic development, transportation accessibility and so on. Property Data sources include Statistics Yearbook and various units, because that data from different departments, data verification and quality inspection are very important. Breakdown of total and total number of statistical data error causes non- inconsistent statistical difference in treatment based on issues, such as the authority, reliability analysis data.

Spatial database: Spatial data includes data administrative divisions, regional topographic map data and traffic diagram data. Spatial data is based on administrative divisions according to their unit. Space is divided into categories of administrative data and non-administrative spatial data. Chief administrative unit are spatial data topology area, non-continuous distribution of data and vector data.

Configuration database: It is used to store data or metadata based information which support common framework service platforms, such as processes data, log data, content management data, billing data management and user management data.

MAIN FUNCTIONAL AREAS MANAGEMENT SERVICES SUPPORT PLATFORM

It provides support to the planning and management of the main functional areas by common and basic platform services. The management system provides flexibility, scalability, sustainability and comprehensive technical support for main functional areas which ensures usability of all types of public users. It's mainly about data acquisition, data centrally, index management, model customization and information conversion. Meanwhile, management services of the main functional areas require online management support platform to provide users with a unified management and application support frameworks by PAAS services. It not only achieves reuse of components within system but also for users to assemble, develop custom workflow reference architecture and development environment.

Data collection: The main functional areas management system collects basic data entry to provide a unified interface for establishment of a unified system. It supports various data sources, such

as maps scanning, image capture and form entries. Its functions include data editing and Digital Elevation Model (DEM) processing.

Data unified treatment: The data are obtained from various departments for processing, such as scanning image correction, vectorization, spatial data projection conversion, text recognition scan data, etc. It achieves integration of basic information.

Indicators management: It includes data processing and main functional areas index management system which manages ecological sensitivity index, environmental stress index, resource potential index and socio-economic potential index. The socio-economic potential index includes 4 level indicators, topography, hydrology and vegetation. And It includes 10 secondary indicators of protected areas, natural disasters, pollution index, landscape degradation index, resources, economy, society, etc. And it also has 36 refined level indicators.

Model customization: According to the actual needs of the regional evaluation, it provides model customization, including ecological assessment model, environmental assessment model, resource evaluation model and other socio-economic evaluation model which provides basis for users in planning and assessing the main functional areas.

Information conversion: Intermediate division data and result generated in process of the main functional areas dividing need to be provided to other departments or utilization of secondary development. So, it provides information transmission, transformation and distribution activities on the basis of support.

Unified management and application support framework: On the basis of the main functional areas management model and framework, the system can provide application support environment to run basic applications which can be regarded as a prototype application system. Main functional areas management support framework provides a standard interface for system assembly and process data exchange to support the application framework, according to individual needs of end users, system customization and rapid development.

MAIN FUNCTIONAL AREAS PLANNING AND MANAGEMENT SERVICES PLATFORM

The main functional areas planning and management service platform is a SAAS service platform for end users to provide the main function zoning, policy development, management and information processing services. The SAAS platform consists of three service levels. It includes gateway services, processes, services and functional services from top to bottom.

Portal services. Main functional areas unified planning and management services portal are for division of the main functional areas, policy making departments, as well as data providing departments. They provide personalized and customizable information management functions and professional information publishing services. Each department can get through this portal provides support for its business services, such as data entry, information conversion, model analysis and decision support.

Process services. It is supported by common processes in dividing the main functional areas, such as data acquisition, data processing, index system, index analysis, evaluation indicators and decision establishment. It divides support functions into various types, such as data management services, analytical services index, index evaluation services and decision support services. It is designed to provide the whole cycle, the integration of services for the main functional areas management to ensure basic information timely and accurate delivery. It also provides strong support for of the decision-making department with accurate and effective decision making activities.

Function service. The main function is to establish a good management mechanism perspective to the service of the main functional areas which offers a range of basic data collection, use and distribution services. It is mainly about an integrated evaluation method, model management services, visualization services and information distribution services.

RELATED WORKS

The main functional areas will have an important impact to equalization of basic public services such as regional development planning and environmental protection. According to the position of different functional areas of the body, we should make more detailed and more targeted regional policy and performance evaluation. It can enhance effectiveness of regional regulation, improve land development and promote coordinated development of the region.

European Spatial Development Perspective (ESDP) proposed guidelines for the development of the European space which provides space to seek holistic development of the overall policy framework and recommends various local departments and extensive cooperation. And the overall requirements of EU development policy should also meet specific regional development policies. Japan in 1998 developed a "national comprehensive development plan" call on the government, residents, volunteers, organizations and businesses to take part in the construction area, to support local government and national coordination. It effectively used existing social capital and protection of the natural environment (Hu, 2005). America does not have a unified national body to manage the development of land use and remediation but have interstate regional planning committee which is composed the city (Gao, 2006).

Domestic academic researches of the main functional areas planning started after the national "Eleventh Five-Year" Plan issued. And now this area has become a hotspot academia. Lu and Lin (2007) developed space development information system (SPIS), to solve the space factor and value assignment types superposition problem. Zhu *et al.* (2007) typed the main functional areas of geographical connotation, characteristics, methodological and theoretical basis and other aspects of space systems. Gu *et al.* (2007) believed that the main functional areas is used to solve regional problems and coordinate regional development. He proposed four zoning steps: A comprehensive economic zoning, control development zoning and development potential zoning. And then he used the map overlay method and geographic features integrated method on the basis of these three divisions to get the final results of a comprehensive main functional areas zoning. Cao *et al.* (2007) used ArcGIS technology and partitioning method proposed policy guidance for different types of functional areas based on economic and social development ladder support, ecological constraints convergence dynamic clustering and classification matrix exclusive combination.

CONCLUSIONS

Main functional areas management is part of the national division of the main functional areas. Research and development of the main functional areas management system provides not only a technology platform for the main functional areas planning but also data base for future planning and implementation of monitoring and evaluation. And it also provides instructive technical support for the main functional areas zoning of other provinces. Main functional area planning requires a combination of quantitative and qualitative analysis. The system provides a quantitative evaluation of the planning and program visualization comparison platform to finalize the planning scheme which provides important technical support to improve the efficiency of the main functional areas division and planning.

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