# The LIS with the Kernel of the Process Management

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**Abstract** Based on the design of the LIS of GuangZhou and BeiJing, this paper discusses the resolution of the LIS with the kernel of process management. It applies the idea of workflow in the management supporting stratum, applies the process-oriented mechanism in the definition, coordination, supervision and control of the management process. The scheme has the character of information-media-oriented, work process dynamic changing supported, application system extended and restructure supported and is independent of the running environment of specific work.. Due to the previous character, the LIS is flexible, useable, elastic and able to support the dynamic application.

**Keywords** : GIS System, LIS System, Process Management

## 1. Introduction

Land is the base of the development and survival of human being. The development of the current economic requires the scientific management and scientific decision of land, the automatic management process, socialized information service and the concern of the influence of the land management in the sustainable economic development[1]. With the application of the modern information technology, the land information system(LIS) with the character of digital and network is founded. This is the main ways of the moderation of land management. The ministries of land resources requires that “We must give priority to the development of land resources information. We must give a impetus to the development of management, investigation and evaluation and social service of land resources. We must realize the striding development of land resources.” All above new objectives of land management make still greater demands on the development of land information system.

The current LIS are in three categories: the comprehensive management of graphic and document based on OA or GIS, the comprehensive management integrates GIS functions and work process through workflow system. The essence of previous two are the static system and is difficult to satisfied with the requirement of the variation of the mode of the land management and the work process. The third mode realizes the dynamic adjustment of work process in the process of system, enhances the elasticity of system and has a promising prospect. However, due to the fact that every process of land management has its own special application support environment, and it is difficult to integrate the current product of workflow with the specific system, the main support technology of workflow in the land department application system does not work well in the practice. On the other hand, there are many problems in the aspect of system technology, software architecture, the fusion and cooperation of multi-source data, the management of data pooling and distributing.

Based on the design of the land information management system of GuangZhou and BeiJing, The paper puts forward the resolution of the land information system with the kernel of process management which can resolve the problems above. Instead of applying the idea of workflow in the development of application, the paper applies the idea of workflow in the management supporting stratum, applies the process-oriented mechanism in the definition, coordination, supervision and control of the management process. As the basic component of land information

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system, the control system of management process is independent of other application system, supplies the functions of synchronic coordination, information circulation and process control based on the process example. The scheme has the character of information-media-oriented, work process dynamic changing supported, application system extended and restructure supported and is independent of the running environment of specific work. Due to the previous character, the land information system is flexible, useable, elastic and able to support the dynamic application.

## 2. The LIS with the kernel of process management

### 2.1 Organization, resource, process model

Organization model is used in the description of the organization form of land management ministry. In normal, an organization model is composed of five entities: "personnel", "role", "duty", "ministry" and "workgroup" with the corresponding activity participants in the process of operation. The relationships among these five entities are: composition, responsibility, qualification, setting. The structure of organization model is shown in Figure 1[2].

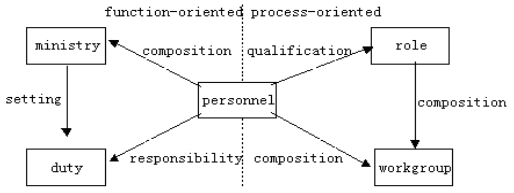


Fig. 1. The Structure of Organization Model

The LIS is a tool to assistant the management and decision of land. The system is concern of the process of the graphic and word information and pays no attention to the detail process of production and manufacture. The concept of resources is in allusion to the entity and object of the information process. The entities of information process are some application programs with individual functions which compose the system, like the edition of graphic, statistic and analysis, the transformation of the form, etc. The objects of information process are aggregation of information domain in the different phase of real data operation. All kinds of documents, forms and graphics are the expression of the object of information process. In order to be called by the process control system conveniently, the application program should be embedded and supplies the interface. The object of information process should register the type of loading media in the process control system.

A logical step of handling of a category of information object is defined as activity. For example, the process of the confirmation of the land ownership can be defined as "the activity of land ownership confirmation". There are some logical relationship among the activities to confirm the process time and the process personnel. The process means the aggregation of activities which are related to some operation and joined in proper sequence. The process model is the formal description of operation process. It can be expressed as a graphic with direction: (A, F), where A is the aggregation of the nodes composed of all activities, F is the aggregation of the relationships among the activities, which are the arcs join the happen sequences of the activities with direction. The process model is executed and explained by the process control system.

### 2.2 The management process control system

In the group of processes which are defined for the realization of the operation object, that section which loses contact with detail operation and involve information-flow and control-flow only is called management process. The process model is the formal description of the management process and controls among the process. It is used to support the operation process modeling and the automatic operation process. A system which can define, create and control management process is called management process control system.. The structure of management process control system is shown in Figure 2.

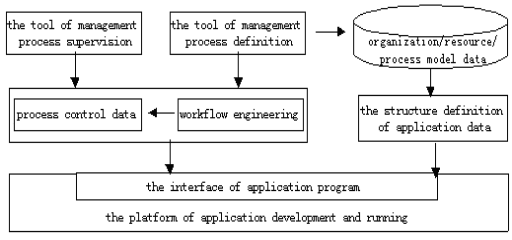


Fig. 2. The Structure of Management Process Control System

The tool of management process definition is used to build the definition information of process model. The definition information include activity, resource

category, operate personnel and the restrict condition of all process, the operation limit, process time limit, warning time limit, etc.

The tool of management process supervision enables the administrator to supervise the process on time, correct the errors and recover the system. For example, the shadow of the process, the handling under abnormal condition, the temporary authority, etc. The workflow engineering is the kernel of the process control machine which explains and control the operation, record the status of process execution. The application program interface is the only channel through which the applications such as GIS function components and management control system communicate with each other in the phase of process executing. It transfer the control information such as process example number, the activity number, the operation personnel and process time, etc to the application program. The application program feed back the information of the process such as operation result, abnormal, early warning/warning etc.

## 2.3 Two issues involved with the process control

### 2.3.1 The circulation and prolongation of the information process object.

In the operation process, the information process object has the life-circulation of emerging, altering, and decreasing. The activity causes the alteration of status. There are two form of status alteration: circulation and prolongation. Circulation means that the object is transmitted (read or edited by different operators) in the activity, but the essence is unchanged. For example, in the operation of the report and approval of the construction land, there are many examinations for the document of "Report of construction land pre-examination". The prolongation means the join of different categories information content among activities, and abstract information in the old information object to produce new category object. For example, the table of land category alteration balance is created according to the current land-use graphic of last year and the alteration record of land pieces.

The essence of circulation is the join of the activity of the same information process object. It is realized through the different access authority of form of graphic layer. The essence of prolongation is the join of the activity of the different process information object. There are two ways to realized it: the static continue and the dynamic continue. The former determines the precursor of prolongation and the coming-up information, is realized through program automatically. Due to the uncertainty of the process information, the latter defines the mechanism of human-intervene under certain condition. As for the form and graphic, the category and structure of information are pre-defined by system naturally.

### 2.3.2. The design of the client application program interface.

The client application program is used by the personnel to accomplish the mission assigned by the management system. The association of the workflow management define a group of application program interface(WAPI) which can start the ordinary application and those application based on

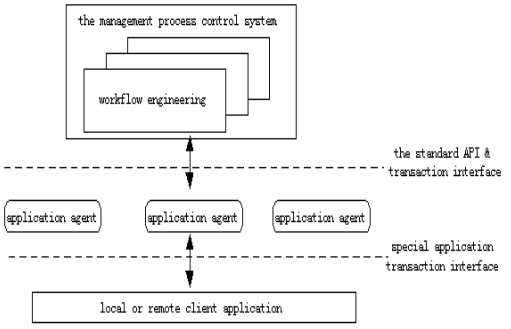


Fig. 3. The Client Application Interface

WEB such as word process, mail system etc. In general, the WAPI is relevant to the platform[3]. The application system of enterprise is distributed and in different structure. The majority of application is distributed in the different hardware environment and developed under different platform and running environment. The fact that these applications are the product of different software company is even more important. Since there are great difference among the interface parameters, data structure and communication mechanism of these applications, the WAPI could not provide the direct support for all these applications.

The application of Agent technology could solve the previous problems. Agent is a kind of computer entity of application, which could sense the environment under special environment and accomplish the mission automatically as planned. In fact, it is a kind of the object which is object-oriented, self-intelligent and self-reaction. Starting the client application through application agent is a flexible way, which could integrate the application system in the land in-

formation system conveniently. The data transaction and information transaction between the application agent and management process control system is accomplished through standard API and data format. The data transaction and information transaction between the application agent and client application is accomplished through the definition and the development of special integration-oriented interface. The client application interface based on agent is shown in Figure 3.

## 3. The realization technology of LIS

### 3.1 The technology routine of system development

In order to keep the system advance, robust and reliable , the most advanced technology, method, software, hardware and network platform should be adopted in the construction of the land information system. In order to fit the alteration of the future technology development and requirement, the system should be sustainable as well as overall situation-fitted.

The technology of Object-Oriented(OO) and Component Based Development(CBD) is robust nowadays. The Unified Modeling Language(UML) has it's own standard and is industrialized. The development of land information system can adopt the CBD-Based software development technology driven by information model. According to the complexity of the client application, the system can integrate the C/S and B/S, realize the application system requirement, analysis and design to satisfy the system requirement in general and overall situation.

### 3.2 The Data management of LIS

The management of vast amount spatial data is used in the land management operation. In the management of spatial data, the principal development of GIS is the adoption of relation database or object relation database such as ArcSDE of ESRI, Oracle Spatial of Oracle, Spatial Database of Informix, ADO engineering of SuperMap. The data management function of RDBMS such as data storage and management, operation transaction record-fixed, synchronize-control, data warehouse etc. can be used fully to realize the management of vast amount spatial data. The extend SQL language can be used to operate the spatial and non-spatial data, realize the management of long-operation and version conveniently. Since the spatial data is seamless, the usage of relation database can avoid the problem that the spatial object is cut apart, which is always caused by the traditional file system management. The spatial data can be visited in the Internet more conveniently. The adoption of the object-oriented spatial data model is of critical importance in the application of spatial database management. It embedded the attributes and operation of spatial and non-spatial, define the relationship and rules among the spatial objects, spatial object and non-spatial conveniently, and can model the real world better. The cadastral database based on the object-oriented spatial data model can resolve the problem of the recall of the land history data, the shared land and the mixed land [4].

On the other hand, the merging and integration of multi-meta different-structure spatial data is important to the land information system. The multi-resolution seamless image database should be established for the vast amount of airline and satellite remote sensing data. For example, the MrSID (Multiple Resolution Seamless Image Database) technology of Lizardtech company can compress the image in the rate of 1:20~50. It can recover the images in different resolution; pick up the current land application data to update the database of land through the overlay of the vector data and image data. The share of data between the system and the external system can be realized through the definition of data transaction format with the XML technology. XML provide the mechanism of the description of the file format of data, the model of the description of the data structure and the explanation of HTML. The GIS software of ESRI also support the XML, ESRI define the ArcXML based XML to describe the GIS data and meta data.

### 3.3 The realization of LIS

3.3.1. The model of land operation management.

The model of operation management has two phrases. In the first phrase, the analysis model and design model is established with the process-modeling tool such as Rational Rose under the ordinary system design and analysis method. In the two phrase, according to the requirement of the operation management standard, the control-flow is abstracted out based on these model and define the role, information process object, the process authority of activity, and compose the description of activity. The operation process model is accomplished through the confirmation of the precursor and the coming-up condition of the activity.

3.3.2. The definition of organization/resource model.

The definition of the organization/resource model comes from the design model of land information system mainly. The definition of organization is depended on the security control mechanism of the application system. The quality or grade of the operator is abstract out from the mechanism and used as the definition of the organization/role. The management process is depended on the operation, management and control of the role. The definition of the data object category comes from the data storage related to the management process control in the design model of the application system.

3.3.3. The Execution of the System.

After loading the organization, resource and process model in the management process control system, the land management operation can be controlled automatically according to the pre-defined process as a process example is started. The management process control system accomplishes the special mission when the application agent activates the client application program and record the traces of all the operation process.

## 4. Practice and Conclusion

There are many geographic information systems use workflow management technology all these years. The workflow management software Super Workflow developed by BeiJIng SuperMap Company is used successfully in many GIS systems such as HanZhou Land Information System, LiuZhou Digital Land System and NingBo Digital Land System. The GuangZhou Land Management System require the office automatic based on the workflow and emphasize the integration of the application system centralized on process. The system is designed under the above-mentioned idea and is in the process of development now.

The scheme issued in this paper has the character of information-media-oriented, work process dynamic changing supported, application system extended and restructure supported and is independent of the running environment of specific work. The paper applies the process-oriented mechanism in the definition, coordination, supervision and control of the management process. As the basic component of land information system, the control system of management process is independent of other application system, supplies the functions of synchronic coordination, information circulation and process control based on the process example. Due to the previous character, the land information system is flexible, usable, elastic, and able to support the dynamic application.

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