Research on Web Business-Client Construction based on Spatial Information

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Abstract—With the deepen application of GIS, it is hot in research to improve system development speed and business flexibility. In order to adapt to business logic more flexibly, this paper approve a form model oriented on spatial information service, and implements an integrated user-defined form system based on this form model. The form model based on spatial information service is made up of five components, that is, form engine, form designer, form application server, spatial information service, and WebGIS components. It has been applied successfully in the new generation GIS platform—Mapgis 7.0. The practice shows that we can implement business-client real-timely with this user-defined which introduces a new way to develop application based on GIS.

Keywords-component; Service Oriented Architecture; form designer; business client construction; Spatial Information

I. INTRODUCTION

With the rapid development of information technology, enterprises require more on spatial information systems. SOA(Service Oriented Architecture) is satisfying such requirements. SaaS (Software as a Service)[1] is currently quite an appealing way to provide application service. Customers are charged by the time of usage under the SaaS-based application. Service oriented architecture has a great advantage on satisfying the varied business demand. With the growing of SOA, the extremely flexible and agile architecture makes such a sales way more feasible and more attractive to customers. The paper [2] presents our key geoportal projects that help to define distributed GIS, and illustrate the challenges to be met in order to achieve the goal of wider GIS usage. The paper[3] offers a method to build SOA service with ArcGIS. The paper[4] investigates the service-oriented architecture for constructing a distributed and Web service enabled geographical information platform. The paper [5] introduces a dynamic architecture for distributing GIS services.

This universal client is the web browser and the various standards that allow browsers to run on almost any computing device. In particular, HTML standard is a cornerstone of web. This march towards dynamic web content has improved the web’s utility and the experience of web users, but it has also led to more complexity in programming web applications. How to build web client rapidly becomes a hot issue. The paper [6] defines a simplified programming model for form-based web applications and we use XForms and a subset of J2EE as enabling technologies. The paper [7] provides improvements on Xforms model including data and event model, gives a new method with use case for automatic form-building and the transformations from use case models to form user interfaces. The paper[8] presents an approach to model ontologies as populated conceptual schemas and to implement them using XML and relational databases. The paper [9] provides WWW-based input forms implemented as Java applets for updating a WWW-accessible database. But all these methods discussed above can’t be applied fully in complicated GIS system. Large scaled coding is still dominating current GIS development.

Therefore, this paper tries to research on form based on spatial information service with method of building business client.

II. SYSTEM MODEL

As figure 1 shown, the form model based on spatial information service is made up of five components, that is, form engine, form designer, form application server, spatial information service, and WebGIS components. It can be depicted as a five-tuple, that is, {Form Engine, Form Designer, Form Application Server, Spatial Information Service, WebGIS}. It builds the web business components depending on spatial data engine, and offers services such as spatial data management and display in the web server.

![System model](image)

Figure 1. System model
A. Spatial information service

Spatial information service is web service provided GIS function to upper level through spatial data engine. It accords to web services criterion[10], and can be self-contained and self-described, as well as be released, searched, and called by web.

B. WebGIS component

WebGIS components implement graphics display, query or statistic data from graphics, or position graphics depending on data.

C. Form designer

Form designer is a visible form editor which can represent spatial data function components in the form as a visible interface so that users can simply click and drag them to edit form, bind data and function, and write plug-ins. It separates data definition from form style so that when form style modified, user only need to update form in the form designer without modifying the business logic.

D. Form application server

Form application server mainly provides all the business data needed by form. It accesses spatial information service model to manipulate spatial data, complete GIS operation and maintain active session. This layer can run on local computer or remote computer; the running PC environment can be similar or different; it can be run in same process or in different process, as well as a single module called by other systems; it can use same basic geodatabase or use different thematic database. It’s a running service which can be called through .NET Remoting or Web Service.

E. Form Engine

Form engine is the kernel part to run forms which contributes to translate form style and form right, fill and display data, analyze graphics form to XML format and contrarily. The analyzed form can run in Web Server or become a part of the web application.

III. FORM ENGINE MODEL

The execution process of form engine is to analyze form, and then to execute GIS function through form application server to display spatial data in multiple styles. The detailed process is as follows:

A. Load configuration file

Configuration file is a XML file created by form designer during the form designing process automatically which records the related information of the current form such as data source, map parameters, event management, and related info about user plug-ins, and so on.

B. Manage system plug-ins

It means to load user plug-ins, register user event, and dispose related plug-ins according to the plug-in info and execution time.

C. Initiate context environment

After loading configuration file, form engine can initiate the context environment to get more environment info such as the description of data, GIS service and WebGIS data.

D. Manage spatial info service

Execute the corresponding services in this spatial info service layer according to the GIS service description, and return result. For the GIS visible interface, it call the related WebGIS function to generate Web interface.

E. Manage user event

When the appointed event occurs, the form application server will call related event processing program according to the registered user event position.

F. Generate dynamic web page

Lastly, the form application server generates the visible Web interface to user so that users can describe his demand directly. It also provides method to translate user “programming result” to service combination to get the whole service-oriented application.

IV. CASE STUDY

We develop a Visual Form Designer system through .Net technology on MapGIS according to the above model. The system integrates page creation, form creation, data access, data storage, data display, data verification, form maintenance, spatial info operation, function plug-ins management and plug-ins development in a single visual environment.

A. Form designer

Form designer is a visual editor as Fig 2 shown. Users can create or edit the forms through this editor by setting the attribute format and event of the spatial info service as well as bind plug-ins through the attribute board to build the basic frame of a form.

Figure 2. Form designer
The configuration file describes the related information of the current form such as data source, map parameters, event management, and related info about user plug-ins, and so on. An example xml file is as follows.

```xml
<?xml version="1.0" encoding="utf-8"?>
<WebFormConfig>
	<Caption></Caption>
	<PageLoadFunctionList />
	<PageParamaterList />
	<MySelect />
	<MyEdit />
	<MyDelete />
	<MyReadCustomControl />
	<MyUpdateCustomControl />
	<SingleControlList>
		<Control>
			<ControlType>TextBox</ControlType>
			<ID>IDD61F36B49C57</ID>
			<ReadField></ReadField>
			<EditField></EditField>
			<ClientControlType></ClientControlType>
			<ReadCtrl></ReadCtrl>
			<UpdateCtrl></UpdateCtrl>
		</Control>
	</SingleControlList>
	<EventButtonList>
		<EventButton>
			<ID>ID6679BEF7C9084</ID>
			<ButtonType>Button</ButtonType>
			<FunctionList />
			<AllowClientCheck>true</AllowClientCheck>
			<DataOperList />
			<CustomDataOper>False</CustomDataOper>
		</EventButton>
		<EventButton>
			<ID>IDD61F36B49</ID>
			<ButtonType>TextBox</ButtonType>
			<FunctionList />
			<AllowClientCheck>true</AllowClientCheck>
			<DataOperList />
		</EventButton>
	</EventButtonList>
</WebFormConfig>
```

B. Form application server

We build the form application server with .NET technology, and use Remoting method to implement remote communication. An example configuration file is as follows.

```xml
<?xml version="1.0" encoding="utf-8" ?>
<VFDWebServerConfig>
	<ServiceList>
		<Service>
			{Name>Mapgis</Name>
			<Address>tcp://127.0.0.1:8888</Address>
		</Service>
		<Service>
			{Name>ArcGis</Name>
			<Address>tcp://127.0.0.1:8881</Address>
		</Service>
	</ServiceList>
	<ClientReportAllowMe>TRUE</ClientReportAllowMe>
	<ClientReportType>0</ClientReportType>
	<ClientReportColor>Red</ClientReportColor>
	<ShowDetailErrorInfo>true</ShowDetailErrorInfo>
	<SystemLoad>
		<dll>WorkFlowInit.dll</dll>
	</SystemLoad>
	<SystemBegin>
		<dll>VFDWebServerSystemBegin1.dll</dll>
		<dll>LoadGisView.dll</dll>
	</SystemBegin>
	<SystemEnd>
		<dll>CloseGisView.dll</dll>
	</SystemEnd>
	<SystemDispose>
		<dll>WorkFlowDispose.dll</dll>
	</SystemDispose>
</VFDWebServerConfig>
```
C. Form Engine

Form engine runs on Web Server as a component. As figure 3 shown, form engine holds up access through ISAPI controller firstly, and then generates files suffixed by aspx, html, rdlc, and xml, and so on. Thirdly, it executes business logic and other related functions defined in XML file. Finally, it sends the result to web explorer by HTTP. The presentation before end user is generated by HTML and JavaScript, and the data transformation is completed by XML HTTP (that is Asynchronous JavaScript and XML, AJAX). With AJAX, user can update pages dynamically when operating components by JavaScript and DHTML, and send asynchronous request to server so as to execute corresponding business logic in the form application server. When the AJAX request returns, it updates the page with JavaScript and CSS (Cascading Style Sheets), then one interaction completes.

D. Spatial info service and WebGIS

It’s implemented by MAPGIS-IMS, and it won’t be discussed here.

V. DISCUSSION

The SOA architecture has its advantages in terms of compatibility. However, how to extend form system and combine it to application system more flexibly is the emphases issue. We’ll discuss it from the workflow supporting, system integration and extension method, and spatial data engine separately.

A. Workflow supporting

Workflow automation is one of the kernel technologies to implement info system. It provides a way to work together between several departments with integrating experts’ knowledge to working process and application system so as to improve working efficiency and overall collaboration.

The form mainly solved the design issue of small granularity in single page. The environment between pages needs workflow for further support. And each form page can be taken as a task of workflow node to achieve.

B. System integration and extension method

User-defined form engine can serve as a server component to embed into GIS application system for integration.

Form page can communicate with other systems through server plug-ins. Web client end also can operate pages through embedded script.

C. Spatial data engine

Spatial data engine has been a system which can run and dispose independently similar to database. It provides functional supports for spatial info service and WebGIS. At the same time, it also provides basic management of GIS components, that is offering basic operating flow, modeling methods and tools to users, such as creating, updating, querying and deleting component, as well as running-time management for components. It also must provides performance analyze function of application based on components depot and average running time analyze function of components so as to be improved by developers on time.

VI. CONCLUSION

This paper introduces a spatial service-oriented form method to build business clent quickly during spatial info application development. This method can avoid repeated development effectively as well as fasten the system developing speed. It has been applied successfully in MAPGIS. Certainly, there are still more work to complete, such as functional operation of spatial info and the mutual operation in small granule.

REFERENCES