WEB SERVICE BASED GRID WORKFLOW APPLICATION IN QUANTITATIVE REMOTE SENSING RETRIEVAL

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ABSTRACT

Along with the unprecedented data-collecting capability, the higher algorithm accuracy and real-time application requirements, redundant spatial computing model had been implemented. Traditionally these spatial computing models are stored in different application centers. To avoid waste of resource, Grid workflow provides a powerful tool for sharing both remote sensing data and processing middleware. In order to enhance the interoperability of the heterogeneous quantitative remote sensing retrieval model in the Grid workflow environment, we propose a web service based Grid workflow framework to improve this situation. According to the Open Geospatial Consortium (OGC) and web service standards, we implement a prototype of this framework. Through the experiment, we can find that web service can work well with Grid workflow and provide a management ability of remote sensing model. Also this approach can separate the application logic and process logic, providing the interoperability ability both in application and process layers.

Index Terms**—**Grid workflow, Web service, quantitative remote sensing retrieval

1. INTRODUCTION

Advances in sensor technology are revolutionizing the way remotely sensed data are collected, managed and analyzed[1], which lead to higher requirements for computation and resource sharing[2]. Along with the unprecedented data-collecting capability, the higher algorithm accuracy and real-time application requirements, redundant spatial computing model had been implemented. Traditionally these spatial computing models are stored in different application centers resulting into that other department have to developing the existed model without model sharing [3]. Obviously, vast resource waste exists in this situation. Grid workflow is a powerful tool for sharing both remote sensing data and processing middleware[3],[4]. However，quantitative remote sensing retrieval model are usually have heterogeneity, in order to share data and quantitative remote sensing retrieval model, we need to encapsulate the quantitative remote sensing retrieval model with unified standards, provide a unified model access method. Web service is a kind of feasible solution for this situation to enhance the interoperability of grid workflow[5].

In this paper, we proposed an approach based on web service for Grid workflow application in quantitative remote sensing retrieval. The remainder of the paper is organized as follows. Section 2 presents our research framework. Section 3 discusses our experiments and results. Section 4 concludes our contributions.

2. THE FRAMEWORK OF THE WEB SERVICE BASED GRID WORKFLOW

2.1 Web Service Technology and Standards

The framework requires interoperability of both remote sensing data and model services so that the system can extract and integrate data and model services from providers to complete the users' request. In order to facilitate interoperability, two standards-based interoperability environments are needed: the standard data environment and the standard model service environment.

The standard data environment is a set of standard interfaces for finding and accessing data in data archives of varied data sources. This environment allows geospatial services and value-added applications to access diverse data provided by different providers in a standard way without worrying about the internal handling of data. Currently, the interface standards for the standard data environment are the Open Geospatial Consortium (OGC) Web Data Services Specifications, including Web Coverage Services (WCS)[6], Web Feature Services (WFS)[7], Web Map Services (WMS)[8], and Catalog Services for Web[9]. The OGC technology allows requestors to specify the requirements for the data users want. An OGC-compliant server preprocesses the data on demand

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into requestor-specified form and then returns the data back to the requestor.

The standard service environment is a set of standard interfaces for service declaration, description, discovery, binding, chaining, and execution. This environment allows the system to discover and chain standards-compliant services provided by any service providers dynamically to compose a workflow and generate user-specific results. And this environment is the foundation for this framework. Therefore, the standards (shown as Figure 1) from W3C used in mainstream web service arena are adopted for our workflow systems.

2.2. Research Framework

Remote Sensing Information Service Grid Node (RSSN)[2] is a Grid workflow platform constructed in TeleGeoProcessing research group of Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences. In this work, based on RSSN, we encapsulate the quantitative remote sensing retrieval model with Web service standards, according to the interface specifications proposed by Open Geospatial Consortium (OGC) and provide a uniform access format to the model service. In the framework (Figure 2), according to the SOA architecture and Web service standards, we divide the system into five parts: (1) the user layer - in this layer, we provide an interaction GUI for users to communicate with the system. Also, users can design a workflow by the workflow customization panel; (2) workflow engine - it is a core component for this system. It mainly includes two functions: parsing workflow description file and workflow execution management. After the users compose a workflow from the upper layer and submit it to the system, the workflow engine starts to parse the workflow description file. And then invoke the model service according to the workflow description logic; (3) service register center - it is an interface mainly used for registering model service and finding model service; (4) model service layer - it is a unified interface mainly providing remote sensing model service according to user requesting; (5) database layer - it is the infrastructure of this system including meta database, model database and image database, mainly providing storage service.

2.3. Process Logic

In the prototype framework，the process logic is shown as Figure 3. When the user access system, the model discovery service will offer users functions to search the relevant model service components, and generate the service directory tree. Then through service workflow design tool, users can select models service according to the business logic and compose a correct workflow. The system generates the corresponding workflow description file according to workflow design. And then workflow engine analyzes the submitted description file to carry out the corresponding processing in accordance with the unified model service call interface. During the whole process, users can view workflow execution state and obtain the result at any time.

3. EXPERIMENTS AND DISCUSSION

On the basis of the above framework design, we implement the framework of the prototype (shown as Figure 4). The model service is organized in a directory tree on the left side of the frame. Based on the characteristics of quantitative remote sensing retrieval process, the directory tree is divided into three categories: data input, data processing and data output. The design interface of workflow is on the right side. Users can drag and drop a model service from the left side of the model directory into the workflow design interface, and users can connect the model service to a desired workflow according to the process logic in aerosol quantitative remote sensing retrieval (Figure 5). The Users can also manage models through the registration and management services at the same time, shown as Figure 6.

4. CONCLUSION

In this paper, we proposed an approach based on web service for Grid workflow application in quantitative remote sensing retrieval. Based on OGC and web service standards, the prototype of the framework is implemented. In this framework, a user friendly client GUI is designed and can be used to compose a remote sensing application workflow. In the process of workflow design, model service can be consulted and binded through the service register center freely. After the workflow executes completely, the results will be produced for users to receive. Through the experiment, it demonstrates that web service can work well with Grid workflow. And this approach can separate the application logic and process logic, providing some interoperability ability both in application and process layers, having a certain reference value.

ACKNOWLEDGMENTS

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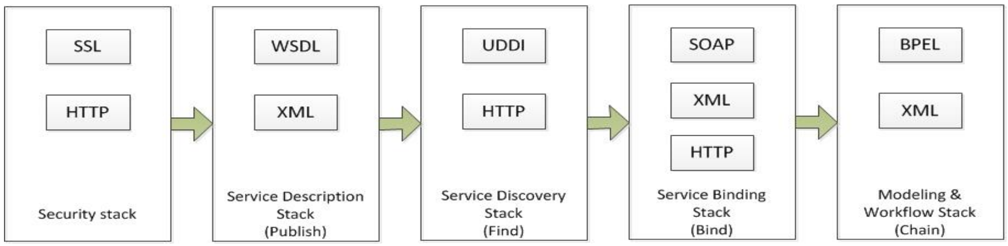

Figure 1. Web service standards of standard service environment

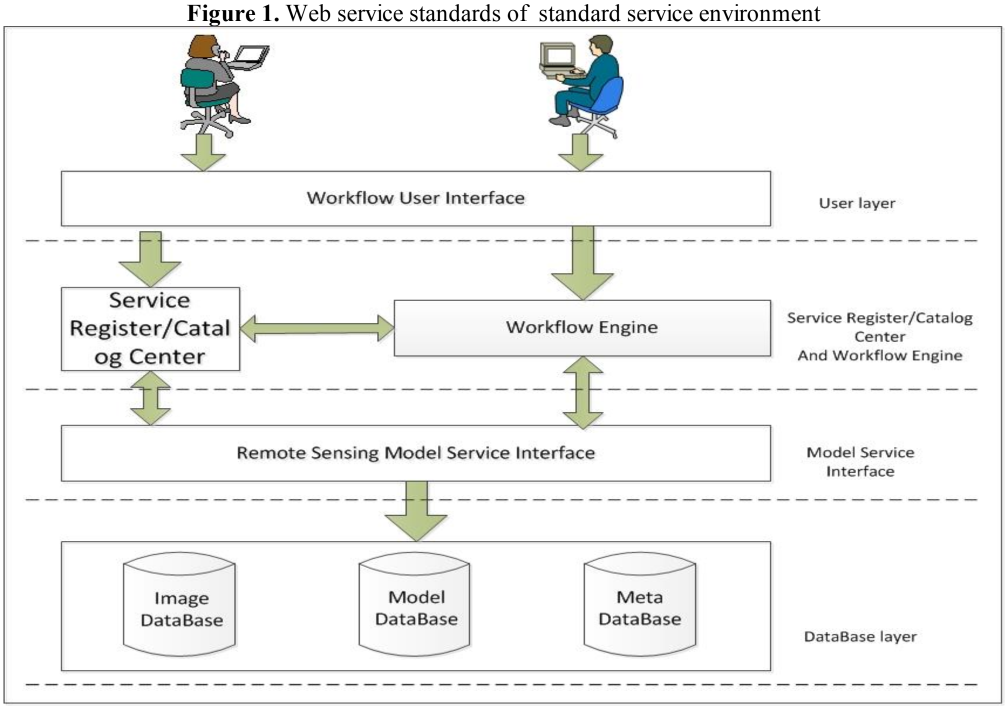

Figure 2. The architecture of the framework (including five parts)

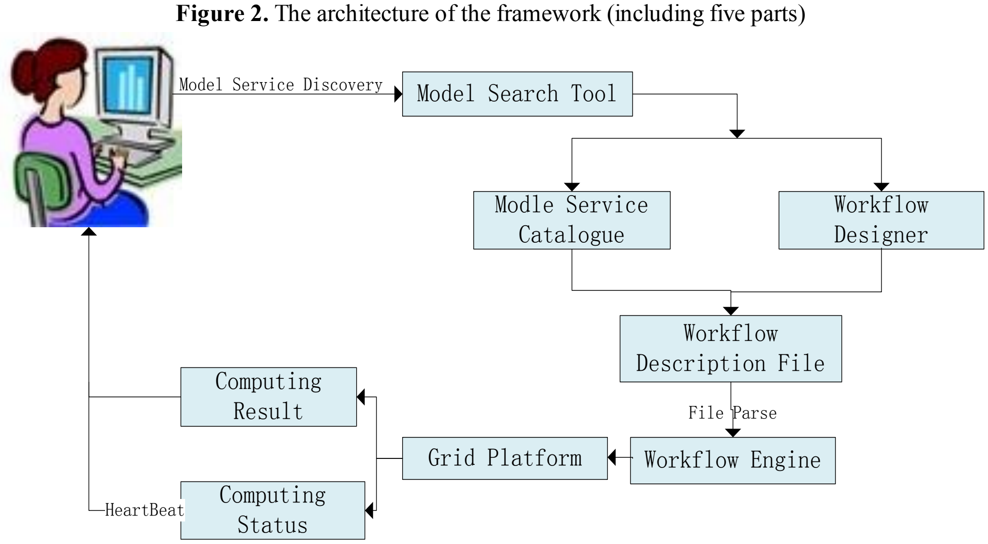

Figure 3. The bussness process logic of the framework

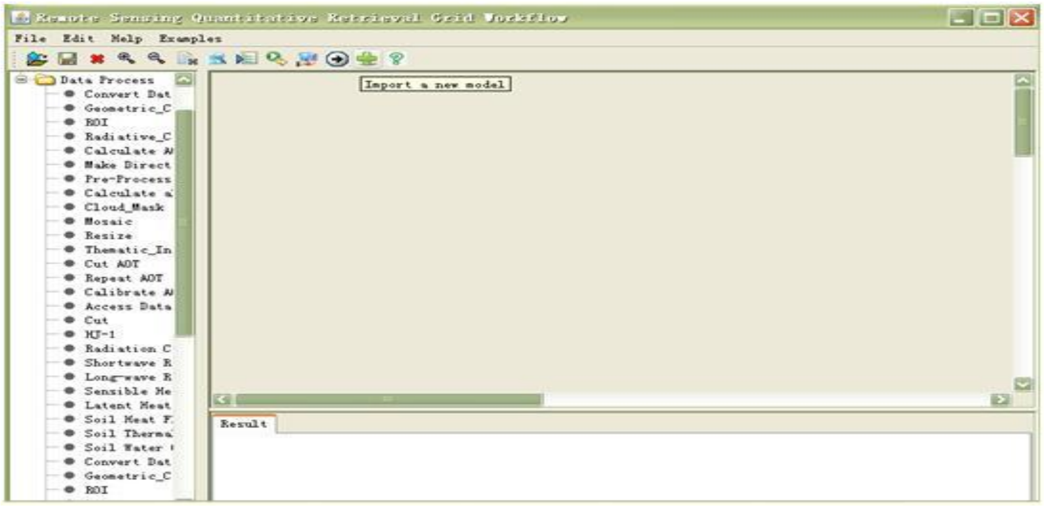

Figure 4. The prototype of the framework

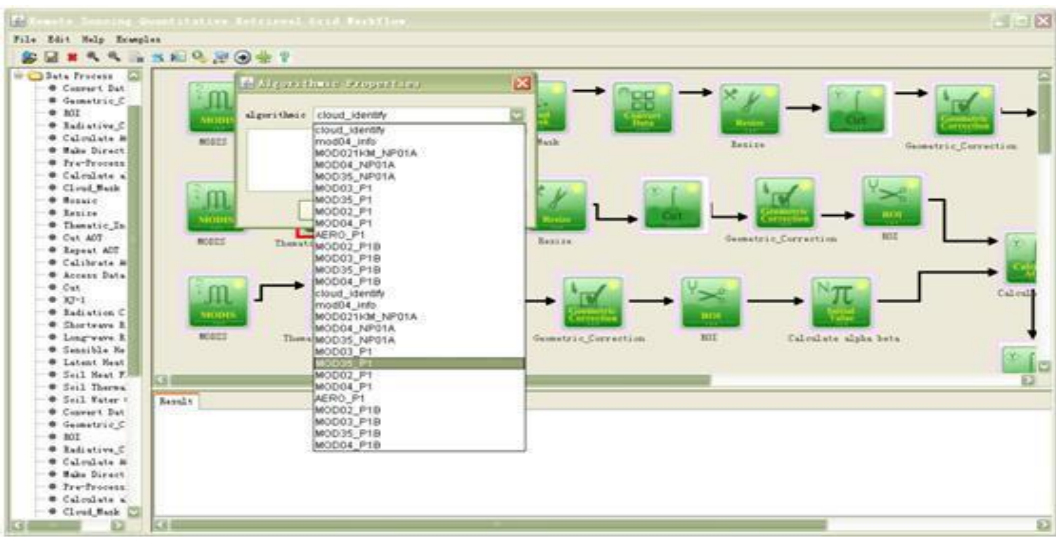

Figure 5. Workflow composing and model service properties selecting

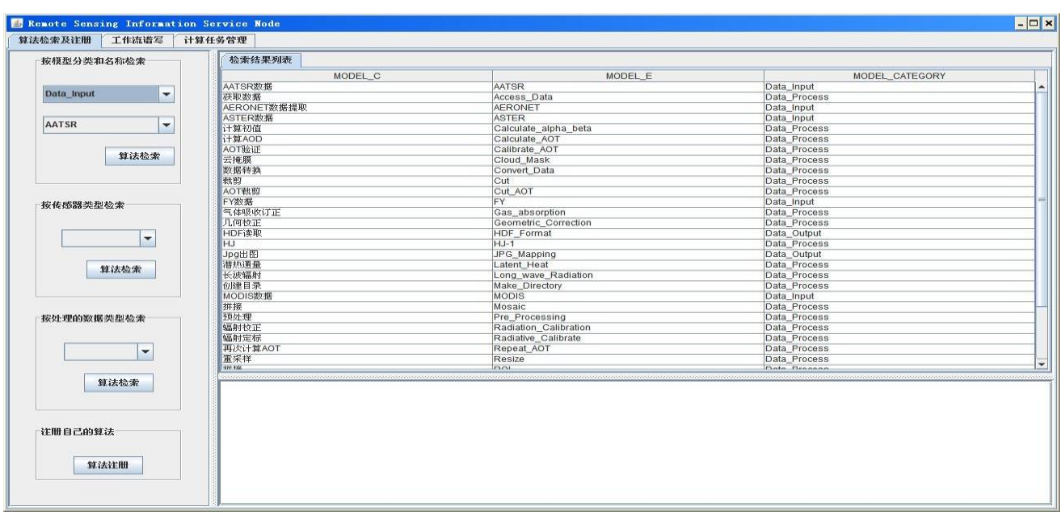

Figure 6. Model registration and management service