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Jun Xu

Zhejiang University of Technology, xujun@zjut.edu.cn

Gang Xiao

Zhejiang University of Technology, xg@zjut.edu.cn

Jiawei Lu

Zhejiang University of Technology, viivan@zjut.edu.cn

Qianhui Liang

Singapore Management University, althealiang@smu.edu.sg

Jun Shen

University of Wollongong, jshen@uow.edu.au

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Abstract

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Customizable Data Exchange based on Web Service

Jun Xu, Gang Xiao, JiaWei Lu
College of Computer Science and
Technology
Zhejiang University of Technology
Hangzhou, China
{xujun, xg, viivan}@zjut.edu.cn

Qianhui Liang
School of Information Systems
Singapore Management University
Singapore
althealiang@smu.edu.sg

Jun Shen
School of Information Systems and
Technology
University of Wollongong
Australia
jshen@uow.edu.au

Abstract - In this paper, we propose a method of customizable data exchange based on the service-oriented application environment. We highlight the data exchange model of this method, analyze the components and specific functions of the exchange platform and data exchange node in the model, and finally expound the operation principle and specific implementation of customizable data exchange. We demonstrate this is an efficient way to overcome the shortcomings of the original, single and fixed data exchange mode.

Keywords - Data exchange; Web service; XML; Data exchange platform

I. INTRODUCTION

With the rapid growth of information technology, digital offices become popular. Governmental departments and corporations have built up application systems with different functions. The independence, heterogeneity and isolation of the most of systems, however, lead to many problems: firstly, plenty of information stored by application systems of departments can not be shared; secondly, the difficulty in information exchange between systems causes the failure of business alternation; thirdly, the information resources for public service and construction of application systems can not be developed.

In order to solve the problem of information isolation, research centers, such as IBM, Microsoft, Sybase, have conducted the research on data exchanges. The present solutions for data exchange mainly focus on star exchange pattern. Star exchange pattern mainly finds application in some specific field. If internal data is converted to the standard data exchange in an application field established by XML, then the data exchange between many systems can be implemented [1].

In [12], a technique of data migration, carried out by data integration intermediary between different databases, is reported. The choice for data migration is implemented through configuration files. A local data model and the conception of global model are presented in [7], through which the mapping for heterogeneous data source in global network is implemented. Some researchers have also carried out inquiry dissociation and transfer between XML files and database in many data sources in other papers.

II. WEB SERVICE DATA EXCHANGE TECHNOLOGY

A. Web Service Structure

Web Service is a software system passing the URI (Universal Resource Identifier) symbol, with the purpose of alternation between procedures, providing the information exchange ability in scalable, loosely-coupled and unspecified platforms [2].

Web service architecture [3-4] is integrated technical framework for web services, providing a standard method for interoperability between software systems on many platforms. Through the Web service architecture, various services of software systems under dispersed circumstances can be integrated by Internet to a resource system with the feature of high interoperability, real-time integration and good encapsulation [5]. Therefore, web service can hide the system and technical discrepancy in different application systems, so that cross-platform data operation can be carried out in distributed circumstances, providing practicable solution for exchange and sharing of heterogeneous data.

B. Web Service Data Exchange Principle

Under the present data exchange system, the implementation of data exchange is based on fixed format beforehand. That is to say, data provider provides data based on a fixed format, and data requester analyzes it according to the data format beforehand. This mode is applicable for the fixed business procedure and data model. However, the procedure needs to be modified to be adaptable to new data exchange in case of changes of business procedure and data model. We, therefore, have designed a customizable data exchange mode, establishing a unified exchange platform under Web service structure, through which data provider and data requester may customize the data exchange, so that the application to business changes of data exchange can be strengthened.

System heterogeneity, data model heterogeneity and logic heterogeneity cause data heterogeneity [6][13][14]. Consequently, exchange should occur before converting the local data to universal and mutually understandable XML model. XML is an universal language standardization with strong extension and framework [7-10]. The heterogeneous system carries out the exchange with Web service mode through exchange platform after converting data to XML.

Figure 1. Whole framework of data exchange platform

III. CUSTOMIZABLE DATA EXCHANGE MODEL

Customizable data exchange framework model is composed of a unified public data exchange platform and many data exchange nodes. One exchange node is related to a Heterogeneous System, database in the system and Web service. Web service is composed of Data Transceiver, Data Adapter and Data Register, while data exchange platform is composed of data dictionary and data exchange engine. Framework model of data exchange is shown in figure 1.

A. Customizable Data Exchange Platform

The core function of the data exchange platform is to establish unified exchange strategy, maintain unified exchange standard, manage exchanging node and implement the transfer between exchange nodes.

1) *Data Dictionary*: Data Dictionary is for global mapping on the exchange platform of all distributed heterogeneous database engaged in exchange, including UUID(Universal Unique Identifier), database address, database type, access drive, database name, sheet name, field name, field type. Because Heterogeneous Database stores a great deal of homonymic database names, sheet names, field names, field types, etc, mapping of Data Dictionary should be employed so as to convert the local view of Heterogeneous Database to global view. In fact, XML self-description provides simple, fast and efficient method for describing database's global view [11].

The figure 2 is the XML structure of global data view:

Figure 2. The XML structure of global data view

2) *Data Exchange Engine*: Data exchange engine is the core of the whole data conversion platform, composed of registration management module, data transport module and data supervision module.

a) Registration management module is responsible for registration of data exchange service of exchanging node, real-time supervision of service response of client-side, registration of data engaged in exchanging in data dictionary, and if Web service provides data, in order to make public the exchanging data range for exchange platform;

b) Data transport module assumes the sending and reception of XML document sequence and message sequence. Through data transport module, the platform interacts with data transceiver of exchanging node. The function of route of data transport module records the address of legitimate subsystem carrying out the data exchange through the platform, so that the correct data packet sources and data transport direction can be ensured. When exchanging node sends request to platform, data transport module records the requesting address and activate the exchanging engine for the implementation of data exchange;

c) Data supervision module takes the responsibility of control, management, search and statistics collection, etc of data exchange flow and data document exchange condition, meanwhile, on the premise of providing CA (Certificate Authority) identity authentication, guarding against data request from illegitimate users, ensuring the safety and integration of data exchange process, providing the record and management of data exchange log. UML drawing of data exchange engine is shown by figure 3 (on next page).

B. Data Exchange Node

This node is composed of heterogeneous system, heterogeneous database of the system and Web service, while Web service is composed of data transceiver, data adapter and data register.

1) *Data Transceiver*: Data transceiver is the external interface provided by exchange node. Through data transceiver, conversion platform can implement the data and message transfer.

2) *Data Register*: Data register is in charge of the registration on exchange platform of exchanging data of heterogeneous database, so that platform can implement the exchange within the appointed data range. Meanwhile, in case of changes of heterogeneous database, it can also conveniently re-register through data register. Therefore, platform can be automatically adaptable to the changes of heterogeneous database.

3) *Data Adapter*: Data adapter's main function is to carry out the data exchange through the operation of heterogeneous data interface, converting the data of the database to XML document according to platform

Heterogeneous Database changes to a global view after the view was processed and added to Data Dictionary.

B. Customizable Data Exchanging Process

Once the data exchange node is registered successfully, users can search and use the data exchange service of the node on exchange platform:

1) *Step 1:* Users search appointed data exchange service on the platform, and send usage request to platform. Platform returns the data view of the node and shows it in a visual Web mode.

2) *Step 2*: Users customize the data to be exchanged through selection or other alternative modes. Platform converts the customization of users to data exchange order, based on XML format carrying user names, passwords and SQL operation sentences of target data and sending them to exchange node interface.

3) *Step 3*: Target exchange node verifies the correctness of the XML, analyzes and extracts the fields in it, then generates a SQL query. An Exchange node searches appointed data set according to the query, converts them to standard data in XML format on platform and sends back them to the platform. The following is an analysis of process flow in JAVA:

```

{
    SQLParseManager    manager    =    new
SQLParseManager();
    manager.setRequestXML(request_document);
    if    (manager.docIsValid()!=true)    return
xmlmessage("invalid document");
    manager.parsing(request_document);
    if(manager.userIsValid()!=true)return
xmlmessage("invalid user information");
    if(manager.operationIsValid()!=true)return
xmlmessage("invalid operation");
    Document result=manager.operationSQL();
    Return result;
}

```

```
<Database>
  <Intro>This is a table structure</Info>
  <SelectTable>Select      table      structure      form
SysObjects</SelectTable >
```

<results>

```

classDiagram
    class DataService {
        AcceptService
        SendService
    }
    class Web
    class DataQueryAdapter {
        DataQueryAdapter
    }
    class DataMonitoring
    class DataRegist
    class XMLDataManager {
        XMLDataAggregator
        ProjectXMLFilter
        SelectXMLFilter
        CompositeXMLFilter
        XMLFilter
        XMLComposer
        JoinXMLComposer
        UnionXMLComposer
    }
    class Rule {
        SQLRule
        resultFields:List
        conditions:List
    }
    class SQLManager {
        SQLGenerator
    }
    class Dictionary {
        DatabaseDictionary
    }
    class Java_io
    class Java_util
    class Java_lang

    DataService --> Web
    DataService --> DataQueryAdapter
    Web --> DataQueryAdapter
    DataQueryAdapter --> DataMonitoring
    DataQueryAdapter --> DataRegist
    DataRegist --> Dictionary
    XMLDataManager --> DataQueryAdapter
    XMLDataManager --> DataMonitoring
    DataMonitoring --> Rule
    DataMonitoring --> SQLManager
    DataMonitoring --> Dictionary
    Rule --> Java_io
    Rule --> Java_util
    Rule --> Java_lang
    SQLManager --> Java_util
    Dictionary --> Java_lang
    XMLDataAggregator --> XMLFilter
    XMLDataAggregator --> XMLComposer
    ProjectXMLFilter --|> XMLFilter
    SelectXMLFilter --|> XMLFilter
    CompositeXMLFilter --|> XMLFilter
    JoinXMLComposer --|> XMLComposer
    UnionXMLComposer --|> XMLComposer

```

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```

<row>
  <id>203</id>
  <name>John</name>
  <age>35</age>
  <sex>man</sex>
  <email>john@data.com</email>
</row>

```

```

...
</results>

```

4) *Step 4*: Platform directly analyzes the standard data and shows them in Web format, or directly sends the XML document back to the requester for further processing.

Besides, through the design of data dictionary for global view of heterogeneous database, exchange platform can precisely locate the data field from different data resources, so that compound search on many heterogeneous databases can be implemented. Furthermore, owing to the adoption of designing form of data exchange platform, business operations, such as periodic and directed data exchange, can be customized.

V. APPLICATION EXAMPLE

The research of this project is applied preliminarily in an administrative approval center. The Administrative Approval Center gathers many governmental departments together, so as to allow the public to deal with the administrative approval procedure of all kinds of business. In order to improve the governmental service level, the center decided to develop the on-line approval business, aiming to satisfy the public's requirement of one-stop procedure and inquiry of all kinds of business for approval through website. Owing to the separate approval systems of the departments, the best way to realize the data exchange between heterogeneous systems is to establish an exchange platform based on Web service. The following figure 4 is the data exchange platform structure of the Administrative Approval Center.

Through the on-line approval center, the user can deal with on-line procedure and inquiry of many kinds of administrative approval business. Meantime, owing to the customizable data exchange method, the only requirement is to re-register the data when its own business data of some department is changed, so that the independence and stability of the on-line approval center operation can be ensured.

Figure 4. Data exchange platform structure of the administrative approval center

VI. CONCLUSIONS

In this paper, with the background of data exchange research, we approach the data exchange problem with the under Web service technology. We proposed a method of customizable data exchange based on XML under Web service architecture, introduced the data exchange model and its components, and finally expounded the operation process and specific implementation of the customization, which is a new solution for information transfer and sharing between heterogeneous systems.

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