

Research and Application of J2EE and AJAX Technologies in Industry Report

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Abstract—The traditional system of industry report is highly influenced by the speed of Internet and has low efficiency on report. In order to solve these problems, this paper studies J2EE and AJAX technologies, combine them and propose an industry report system which based on J2EE and AJAX technologies. The system which makes full advantages of both technologies, has solved the problems such as easily impacted by the bandwidth, reported in low efficiency, also increased the server's load capacity. It obtains a good result in the practical application.

Index Terms—Industry Report, J2EE, AJAX

I. INTRODUCTION

With the deepening of China's economic reform, various economic types and operational forms of companies are emerging, number and size of enterprises are constantly expanding, and the traditional way of industry report encountered a series of problems and faced a serious challenge in practice.

In this case, it is imperative to establish an online industry report system using computer and network technology. Enterprises could connect to data networks of management institutions and submit the industry reports directly through the Internet. The realization of online industry report system which has changed industrial data acquisition, is an inevitable reform trend of report method, also speeds up the construction of statistical information and achieves paperless report. The introduction of network-based work, brings a huge impact in industry report, and has greatly improved the capacity of data collection, analysis and aggregate while upgrading data quality and work efficiency.

At present, despite that the online report system has got a certain application, most of them have many problems, such as slow access, system instability, report on low efficiency, poor server load capacity and so on. In view of these problems, after making detailed studies in J2EE and AJAX technologies, we apply them to the development of industry report system and achieve good results; both of them fully play respective advantages. For

example, J2EE technology holds high scalability and steady availability; and AJAX technology owns strong response capability between the client and server.

II. THEORIES OF J2EE AND AJAX

A. The Theory of J2EE

J2EE [1] is a system structure which uses Java 2 platform standard edition as the core to simplify the development of enterprise solutions and deploy and manage some complex issues. It not only consolidates the advantages of the standard such as "write once, run anywhere", to facilitate database access JDBC API, CORBA technology, security model of protecting data in Internet applications and so on, but also provides full support of EJB, Java Servlets API, JSP and XML technology. J2EE has many technical advantages, as follows:

a) Supporting heterogeneous environment: J2EE could develop transplantable program which deployed in heterogeneous environment, and the program that developed once can be deployed to a variety of platforms.

b) Scalability: Applications based on J2EE platform could be deployed to a variety of operating system. The provider of J2EE field offers a wide range of load balancing strategies, allows integrated deployment of multiple servers, and achieves highly scalable system.

c) Steady availability: A server-side platform must be able to run uninterrupted. J2EE supports long-term availability while being deployed to a reliable operating system.

J2EE uses multi-tier distributed application model. Application logic is divided into components in light of the function. And all application components locate in different machines according to their location in different tiers. Now J2EE multi-tier enterprise applications divide different levels of two-tier model into many tiers. A multi-tiered application can provide an independent tier for each different service. The following is a typical four-tier structure of J2EE [2] (Shown in Fig. 1):

a) Client tier components running on the client machine.

b) Web tier components running on J2EE server.

Project supported by the National Natural Science Foundation of China (No. 60773043).

- c) Business logic tier components running on J2EE server.
- d) Enterprise information system tier components running on EIS server.

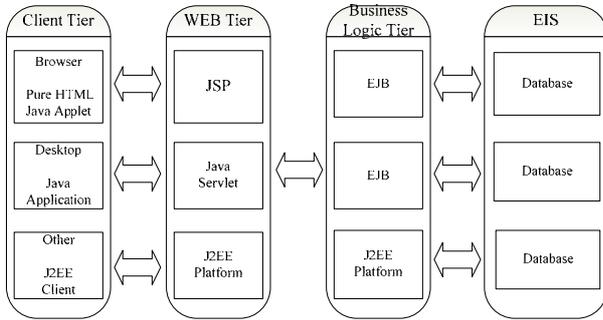


Figure 1. Four-layer Structure Diagram.

B. The Theory of AJAX

AJAX [3] works is to use the XMLHttpRequest object to transfer requests and responses asynchronously between the client and server. Fig. 2 shows the process flow of communication between client and server. XMLHttpRequest object is the core of AJAX and has become the actual standard of asynchronous transfer for XML data via HTTP. Asynchronous interaction means that the browser could continue processing the events page while sending request. Data is transferred in the background, and automatically loaded to the page without refreshing. Using AJAX technology has the following advantages:

- a) No page refreshing, communicating with server within the page, and providing a good user experience.
- b) Communicating with server using asynchronous mode without interrupting the user’s operation, and holding a more rapid response capability.
- c) Passing some of the burden work from server to the client, using the client’s ability to deal with, reducing the burden on server and bandwidth, saving space and bandwidth rental costs. And AJAX reduces the burden on the principles of “on-demand access of data”, shows the greatest degree of reduction of redundant request and response on the server.
- d) Based on a standardized and widely supported technology, no need to download plug-ins or applets.

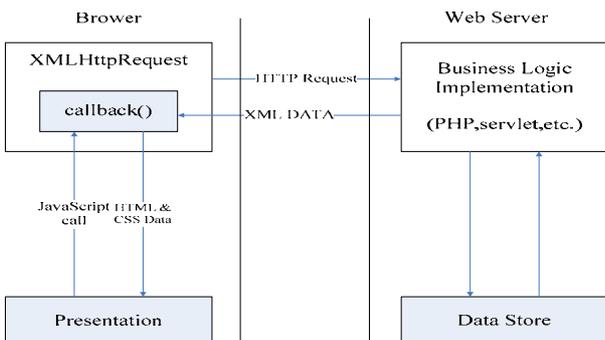


Figure 2. The Process Flow Diagram of Communication between Client and Server

C. The Relation of J2EE and AJAX

J2EE and AJAX are two technologies of Java, or two frameworks. They can not communicate with each other and both have their own advantages. On J2EE, all tasks are on the server, because, on the one hand, the client is relatively simple and does not need to do complex logic; on the other hand, data processing on the server is securer than the client. However, if the server capacity is limited, to improve data bandwidth and processing capabilities are also limited, many customers can not bear the burden. On AJAX, almost all services are placed on the client and processing speed is fast, but the client would be so complex that leading to poor compatibility. In general, all operations are focusing on the client and server. In response, we combine the two technologies and give full play to both of superiority. The core part of the implementation will use J2EE on server, while a relatively minor operation will be implemented with AJAX on the client.

III. SYSTEM DESIGN

A. The Analysis of System

The principle system design is to ensure stability, high reliability, security and scalability of the data, implement unified interface for data interchange, exchange standards and authentication. Industry report system accomplishes the task of data collection. In order to facilitate on-line industry data report and ensure the access to the Internet effectively, we need to create a unified plan of report platform and data centre, specify normative organizational structure and data exchange standards while providing data interface to other systems.

Since the work of special report, industry report system uses three-tier B/S architecture. This structure fully accounts the special report, not only provides users with a simple operating environment, but also ensures a quick and easy transfer report effectively. Enterprises connect to higher authorities via the Internet; they are linked into a seamless system by WEB technology and database. During industry report system B/S structure, enterprise users and the authorities have always been at the client. Enterprise users could transmit the data to authorities through the IE browser. The authorities can also carry out audit, management, statistics and summary on real-time data reported and print out reports (Shown in Fig. 3). The client is responsible for user authentication, input, report and audit of the data; and server is responsible for data reception and management.

B. The Architecture of System

System architecture is three-layer structure achieved by Struts [4][5] framework (shown in Fig. 4). It includes three parts: Model layer, View layer and Control layer. Compared with four-layer structure of J2EE, the view layer corresponds to the client tier components and the WEB tier components; model layer corresponds to business logic tier.

- a) Model Layer

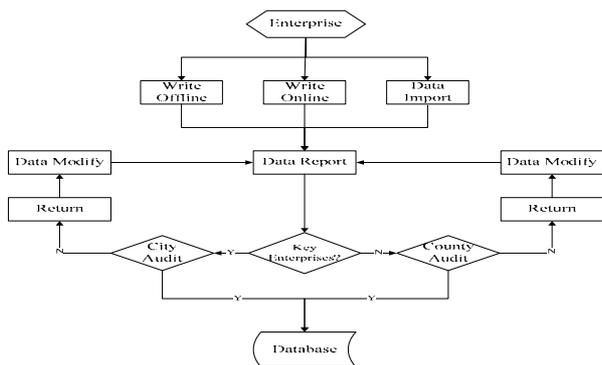


Figure 3. Flow Chart of Industry Report

Model Layer is the main part of the system architecture. In the Struts framework, model layer is composed of ActionForm and JavaBean. ActionForm will encapsulate the user's parameters ActionForm object, the object is forwarded to the Action by ActionServlet, and Action process client requests according to the request parameter in the ActionForm. JavaBean then encapsulates the underlying business logic like database access etc. The system uses DAO to access operations on database and protect the security of database.

b) View Layer

View layer which composed by the JSP page is the interactive interface and achieves development and design of the main page of each functional module. It could check operational status to model, synchronize and update the user interface. Struts framework provides a rich tag library which could reduce the use of scripts; custom tag library can achieve an effective interaction with the model layer.

c) Control Layer

Control layer is the core of system architecture. Struts uses built-in Servlet—ActionServlet—as a controller, which receives a request from the client, enables event scheduling mechanism, selects the model of the corresponding business logic layer upon request, and then sends the results of the response to the client. While there are more concurrent operations in the client, use data scheduling to reduce pressure on the client by load balancing access technology.

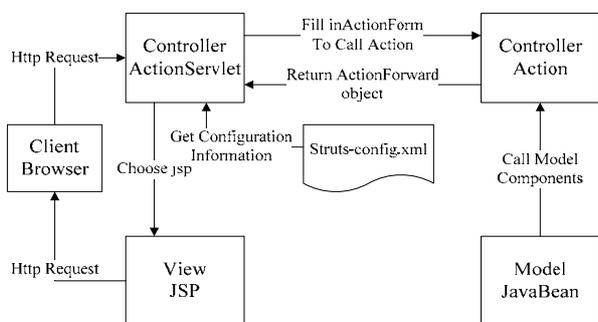


Figure 4. Framework Diagram of Struts MVC.

C. The Design of Module

On the base of the demand, we finalize the system modules, namely, enterprise information, enterprise data reporting, enterprise data auditing, statistical summary, query analysis and system management, a total of six modules. In accordance with the functional requirements, each module contains several corresponding sub-module (Shown in Fig. 5).

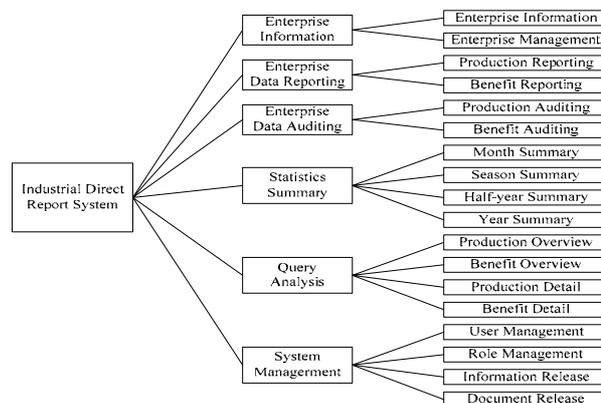


Figure 5. Diagram of System Module

D. The Design of Database

In the database design [6], using Power Designer [7] for the design of logical model and physical model, and automatically generate the SQL script of SQL Server 2008. According to the system design and function modules, design database tables as follows:

- a) Enterprise basic information table: used to store basic information of enterprises.
- b) User table and permissions group table: used to store user names and distribution of user rights.
- c) Production table and benefit table: used to store the data of production and benefit which reported by enterprise.
- d) Summary table: used to store the summary results of the data of production and benefit.

IV. SYSTEM IMPLEMENTATION

A. Development Environment

Based on J2EE platform, B/S structure is applied to achieve system's cross-platform deployment and operation. And MS SQL Server 2008 is chosen as background database, Tomcat 5.5 as publishing tools, and Eclipse 3.1 as programming tools.

B. Implementation of Persistence with DAO

During the development of J2EE-based system, in order to take full advantage of object-oriented features of Java, developers often design the required Java classes to manipulate business data. Now databases used commonly are relational database rather than object database. Therefore, the data to add, delete, change and other operations in the Java class can not be directly persistent to the relationship table of database. In this paper we propose JDBC and DAO pattern to solve the problem using JDBC to establish a connection to the database and

DAO [8] to abstract and encapsulate all access on data sources. And DAO is also responsible for connection management and data sources to obtain and store the data. Figure 6 shows the principle diagram of DAO.

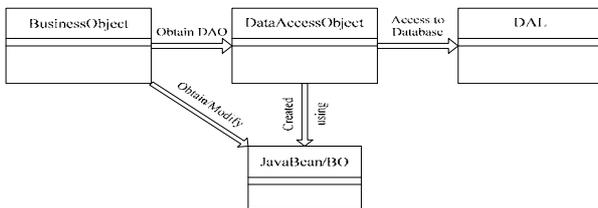


Figure 6. Principle Diagram of DAO

C. Implementation of J2EE and AJAX Technology

Struts framework can achieve MVC model of J2EE easily, a clear division of application makes the application logic and display logic independent of each other. However, users need to interact with server while the server is running. In this process users need to fill a large number of forms, and these operations directly affect the response speed of user interface. To solve the problem, DWR [9] which is a kind of AJAX technology is introduced in this paper. Its biggest advantage is safeguarding data without updating the page, combination of asynchronous nature of AJAX and synchronous nature of normal Java method calls. In asynchronous mode, the resulting data could be accessed asynchronously after the call has been executed for a long time.

DWR which is an open source library contains two main parts: First, JavaScript could get data from a Servlet which is in the WEB server and follows the principle of AJAX; second, a JavaScript library could help WEB developers to use the obtained data and change the content of page dynamically. In addition, DWR has adopted a new method which is similar to AJAX to dynamically generate JavaScript code which based on Java class, so the WEB developers could use the Java code in JavaScript. However, the Java code runs on server and is free to visit the WEB server resources. Finally, considering to the security, WEB developers must properly configure the Java class which can be used outside safely.

V. EXAMPLES OF J2EE AND AJAX

In this paper, we introduce the application of J2EE and AJAX technologies with the example: monthly report of economic benefits.

A. The Implementation of J2EE Technology

Struts framework is mainly used to implement the MVC pattern of J2EE technology. It provides the controller which is inherited HttpServlet class and intercepts all HTTP requests, then calls the model layer to complete the request upon the HTTP requests and passes the final result to the client. To achieve the functionality, we need configure the struts-config.xml file as follows:

```

<struts-config>
  <action-mappings>

```

```

    <action path="/jjzbybb"
      type="com.jjyx.jjzbybb.JjzbybbAction">
      <forward name="success"
        path="/jjyx/jjzbybb/jjzbybbMain.jsp"/>
      <forward name="failure"
        path="/common/errmsg.jsp"/>
    </action>
    <action path="" type="">
      .....
    </action>
  </action-mappings>
</struts-config>

```

And then implement the subclass which inherited the corresponding Action class.

B. The Implementation of AJAX Technology

The response of user interface is too slow while system is running. In order to solve the problem, this paper successfully introduced DWR which is a kind of AJAX technology. DWR allows passing a callback function which used to process the Java function call asynchronously.

a) Configure dwr.xml file as follows:

```

<dwr>
  <allow>
    <create creator="new"
      javascript="JjzbybbManager">
      <param name="class"
        value="com.jjyx.jjzbybb.JjzbybbDao"/>
    </create>
    <convert converter="bean"
      match="com.jjyx.jjzbybb.Jjzbybb"/>
    .....
  </allow>
</dwr>

```

b) Javascript Calls

```

<script
  src="/dwr/interface/JjzbybbManager.js"></script>
<script src="/dwr/engine.js"></script>
<script src="/dwr/util.js"></script>
<script language="javascript">
  Function dosubmit(){
    .....
    JjzbybbManager.submitJjzbybb();
    .....
  }
</script>

```

Then it enables the client to call the function in class JjzbybbDao to complete the operations of economic reports.

VI. CONCLUSIONS

Based on B/S architecture and relational database, in this paper we design and implement industry report system based on J2EE and AJAX technologies. During the implementation, we achieve the MVC pattern of J2EE with Struts framework, design the logical and physical models with Power Designer tool, and implement the development of data persistence with DAO technology. Also, with the combination of J2EE and AJAX, the

system has good scalability and security, fully embodies the design advantages of MVC pattern, and receives the desired results in practical application.

ACKNOWLEDGMENT

The authors would like to thank the guest editors reviewer for their valuable comments and insightful suggestions. This research was supported by the National Natural Science Foundation of China (No. 60773043).

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