Research on Lightweight MVC Framework Based on Spring MVC and Mybatis

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***Abstract*—For the development and operating efficiency of Web applications based on the Model-View-Controller (MVC) framework, and, according to the actual business environment and needs in the project practice, the framework of Web application system is studied in this paper. Through the research of Spring MVC framework and Mybatis framework as well as some related core techniques, combined with JSP and JSTL technology, this paper realizes the design of a lightweight Web application framework based on Spring MVC and Mybatis.**

Keywords-Spring MVC; Mybatis; MVC; Framework

I. INTRODUCTION

In recent years, with the rapid development of Internet technology and the continuous improvement and innovation made by people according to the needs in the reality, multi-tier Web architecture based on Browser/Server (B/S) mode is gradually maturing. Because of overcoming the drawbacks of the traditional Web application development approach, MVC pattern, is widely used now. In the MVC framework, the system is divided into three layers, named Model, View and Controller. These layers are relatively independent, and each has a clear function. On account of these feathers, MVC is beneficial to modularized development and greatly improves the efficiency, maintainability of system development and code reusability, which can adapt to design requirements of the increasingly complex multi-tier application system [1].

The development of Web framework based on MVC is unprecedented prosperity in Java 2 Enterprise Edition (J2EE). Some of them have advantage of development efficiency, some have advantage of operating efficiency, and also some have advantage of security. So we can combine advantages of two or more frameworks to create a relatively efficient and lightweight framework.

Spring MVC separates the roles of controllers, models objects, dispatcher, and handler objects, which makes it easier for them to be customized [2]. In addition, Mybatis is a database persistence layer framework, encapsulating Java Database Connectivity (JDBC) [3] and simplifying the processes of manipulating database, and contrast to Hibernate, the degree of freedom and the accessing efficiency for database has been improved. To Adopt Spring MVC and Mybatis technology and organically combine these two technologies to build a lightweight MVC development framework, which can not only effectively improve the efficiency of system development and reduce the complexity of the development, but also have good improvements in the security, stability and robustness of the system.

This paper is organized as follows. An overview and comparison of Struts2 and Spring MVC, Hibernate and Mybatis is introduced in the second part. The scheme of carrying out a system based on Spring MVC and Mybatis is introduced in the third part. The forth part describes the comparison among these frameworks based on dates and Section5 is the conclusion of this paper.

II. RELATED WORK

A. MVC Framework

MVC, because of ideally separating business logic and view, has become a trend in the development of program design. As people continued to study MVC, MVC framework has been developed continuously. Presently, more mature and stable MVC framework mainly includes Struts, Struts2, Webwork, Spring MVC, etc. The following introduces Struts2 and Spring MVC.

1) Struts2

Struts2 is a new Web-tier application framework on the basis of merging Struts1 and WebWork [4]. It regards WebWork as the core, mainly using Java Server Page (JSP) and Servlet technology, and integrates Servlet, JSP, custom tags and information resources into a unified framework. Developers only need to develop the corresponding Action class, ActionFormBean and JSP components, and develop the project applying Struts framework.

2) Spring MVC

Spring is a lightweight container framework with the properties of inversion of control (IoC) and aspect-oriented programming (AOP) [5], which has seven well-defined modules. Spring MVC, one of seven modules, is a full-featured lightweight realization of MVC to build Web applications. Spring MVC perfectly achieves core concepts and features of MVC, and you can dynamically configure components by simply configuring. Spring MVC works like this: When the client sends an HTTP request, the core controller (DispatcherServlet) receives the request, and lookup HandleMapping according to the URL to dispatch the request to the appropriate Controller. The Controller calls the appropriate business logic to process the request, and returns the view name and ModelAndView object to DispatcherServlet when process is completed, and finally by ViewResolver the returned ModelAndView is rendered to

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the corresponding view. Fig. 1 shows Request-Handling Pipeline of Spring MVC.

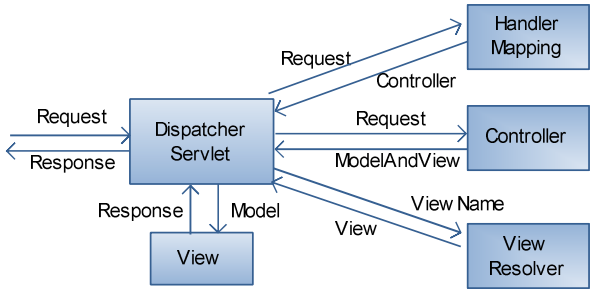

Figure 1. Request-Handling Pipeline of Spring MVC.

3) The comparisons between Struts2 and Spring MVC

a) Operational efficiency: The configuration file amount of Struts2 is bigger than Spring MVC; Spring MVC is more concise when using; the development efficiency of Spring MVC is higher than Struts2.

b) Operational efficiency: The design of Struts2 is based on Class, for the request, it makes class-level interceptors, and the design of Spring MVC is based on the method, it makes method-level interceptor; Struts2 will inject all the attributes of the class which the Action is in, and Spring MVC only injects request data of current Action, so the operating efficiency Spring MVC will be higher than Struts2.Selection: Highlight all author and affiliation lines.

c) Spring MVC achieves complete separation between business logic and view. After processing of business logic, it returns a string, not has any associated flags about display technology of view layer, and then displays the data by the display technology corresponding to the string which is configured in the ViewResolver.

B. Hibernate and Mybatis

Mybatis and Hibernate are database persistence layer frameworks, with varying degrees of encapsulation for JDBC. Comparing with directly using JDBC to access database, development efficiency of them has improved dramatically.

1) Hibernate

Hibernate is an object-relational mapping framework [6] [7], encapsulating JDBC. So, when developing business logic, programmers can adopt object-oriented programming instead of database-oriented which makes it a clearer division of labor and improves development efficiency in the project developing. However, it is not a low threshold to learn Hibernate and is a higher threshold to be proficient. It needs more experience and strong capability for the users on how to design O/R mapping and how to strike a balance between performance and object model.

2) Mybatis

Mybatis is an excellent semi-automated database persistence layer ORM framework which supports common SQL queries, stored procedures and advanced mapping and other operations [8]. Mybatis uses simple XML or annotations to do configuration and original mapping, and maps the interface and Java POJO to records in the database. The workflow of Mybatis is described in Fig. 2:

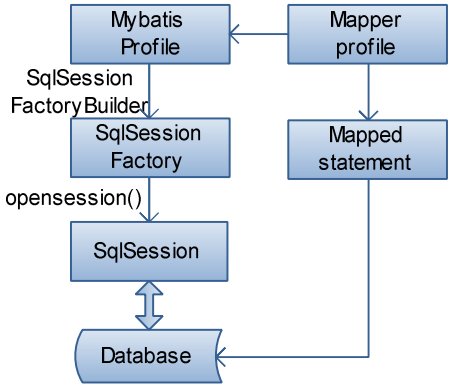

Figure 2. Workflow of Mybatis.

III. Implementation Of MVC Framework Based On Spring MVC And Mybatis

In the implementation of MVC framework based on Spring MVC and Mybatis, it uses Spring MVC framework to gave expression of MVC mode, Mybatis as database persistence framework, Excel, JSP, PDF, jQuery combined with JSTL as View technology, and Logback to deal with a large number of logs while the program is running.

According to the layer idea of MVC, in the implementation of this framework, the Controller layer comprises Core Controller and Business Controllers, the View layer is mainly implemented with JSP and Excel, etc. The Model layer includes Data Access Object (DAO) layer, Service layer, Bean layer, and DAO layer uses Mybatis to access the database. Fig. 3 shows the framework structure.

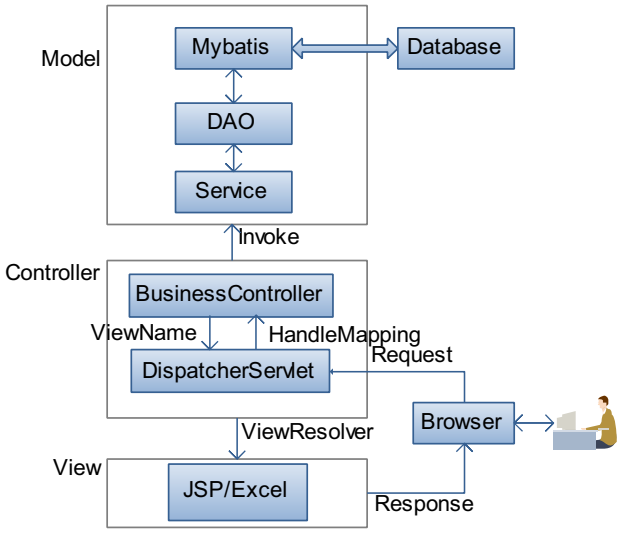

Figure 3. Framework Structure

A. *Configuration*

For Spring MVC, the following configurations need to be done [9]: (1) To configure Core Controller in the deployment descriptor file; (2) To configure ViewResolver in the configuration file of Spring MVC; (3) Because of the use of annotations, it need to start the component scanning and activate the annotation scanning function in the configuration file of Spring MVC; (4) To do HandleMapping configuration.in the Business Controller.

Two types of files need to be configured before using Mybatis to access database. One is the main configuration file which configures database connection information and loads Mapper configuration files of Entities, as well as defines aliases for Entities; Another is Mapper configuration file for Entity which defines the namespace of this file、parameter types、result types、CRUD operations, as well as designates a different id for each operation.

B. *Working process of Mybatis*

After finishing two types of configuration files above, we can use them to do CRUD operations to the database. Take "to insert a user record" for example, the workflow is described as follows:

a) MybatisConnectionFactory.java: Build SqlSessionFactory instance

```
Reader reader = Resources.getResourceAsReader
("mybatis-config.xml");
sqlSessionFactory=new
        SqlSessionFactoryBuilder().build(reader);
```

b) BaseDAO.java: Define the basic operation method in this class. An insert operation is defined as follows:

```
public void insert(String operation,T o) {
    SqlSession session =
sqlSessionFactory.openSession();
      try {
          session.insert(operation, o);
          session.commit();
        } finally {
          session.close();
        }
}
```

c) UserDAO.java: Extends BaseDAO

```
@Repository
Public class UserDAO extends
    BaseDAO<User>{
  Methods needed to be written or added.
  }
```

d) UserServiceImpl.java: Call Method in UserDAO

In implementation class of UserServiceImpl，to insert a user record into the database by calling the method of insert () in UserDAO.

```
public void insertuser(User o) {
      userDAO.insert("User.insert", o);
      }
```

IV. COMAPRSIONS FOR PERFORMANCE OF FRAMEWORKS

For a framework, its performance can be examined from aspects of development efficiency, operational efficiency, system security, maintainability and others. As analyses of part of the performance for frameworks related in this paper have already been described, test and analyses about operational efficiency will be given on MVC framework based on Spring MVC and classic framework SSH[10], as well as Hibernate and Mybatis.

TABLE I. TEST IS DONE IN THE SAME ENVIRONMENT AND ABOUT THE SAME TASK:

CPU	Intel(R) Pentium(R) Dual CPU E2140
Memory	2.0G
Web Container	Tomcat6.0
Operating System	Windows7
Database	Mysql5.5
Request	To query 600 records of User table and display them through JSP page

The same request was executed sixty times using different frameworks to measure the processing time for each request with filter. The execution time of Hibernate and Mybatis to access database was recorded in the DAO layer. Test results are shown in Fig. 5:

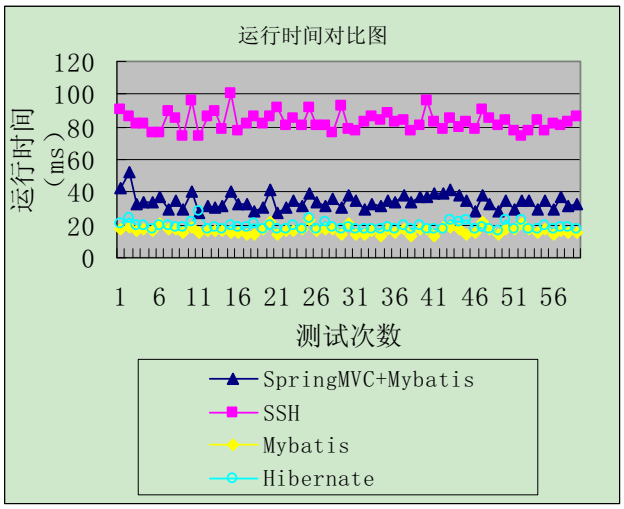

Figure 4. Test Results

TABLE II. AVERAGE RUNNING TIME OF THE REQUEST:

	Spring MVC	SSH	Mybatis	Hibernate
Average Time(ms)	34.339	83.271	16.678	19.407

Figure 5. Average Time

According to the charts above, it is evident that operational efficiency of MVC framework based on Spring MVC and Mybatis is much higher than SSH, increasing almost 58.76 percent. Operating efficiency of Mybatis is 14.06 percent higher than Hibernate. In conclusion, framework based on Spring MVC and Mybatis is a relatively lightweight MVC framework.

V. CONCLISION

This paper realizes the design of lightweight MVC framework based on the Spring MVC and Mybatis. By using Spring annotations, the number of the configuration file and complexity is reduced. Spring MVC does method-level interceptors for requests, and only injects request data of methods, which is beneficial to improve the operating efficiency. In addition, Spring MVC separates business logic and view layer completely. By using Mybatis as the persistence layer framework, it improves development speed and efficiency of accessing the database, and brings more space for improvement in system security, performance, and maintainability.

VI. ACKNOWLEDGEMENT

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