

# The Development and Implementation of Teaching Quality Management System based on Hadoop

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## Abstract

The method of traditional teaching quality management records the basic information of various aspects by handwork or a single computer. This method is not convenient for the management and evaluation these information. To solve this problem, a teaching quality management and evaluation system based on Hadoop is designed and implemented. HDFS(Hadoop Distributed File System) used in this system ensures the security and fault tolerance for data. This system is developed by the MVC (Model View Controller) pattern and implemented by SSM (Spring + Spring MVC + Mybatis) framework. The SSM framework not only improves the development efficiency, but also reduces the later maintenance cost.

## Keywords

Teaching Quality Management; Hadoop; HDFS; Module View Controlle.

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## 1. Introduction

The innovation action and development plan for national higher vocational education (2015-2018) is published in 2015. This plan clearly stated that higher vocational colleges should run through the guiding principle of demand-oriented, self-assurance, multi-diagnosis and emphasis on improvement [1]. This plan guided to fulfill the responsibility of the main body of quality assurance of personnel training and established a normalized internal environment. In the same year, the Education Ministry issued the 2015-168 document . This document mainly guided colleges to improve their own teaching quality assurance system and internal diagnostic mechanism. This document put forward the spirit of the state council decision on accelerating the development of modern vocational education as a guide, in order to improve the quality standards and systems.

The method of traditional teaching quality management only records the basic information by hand or a single computer. This method is not very convenient for the management and evaluation of teaching quality information. With the development of the new generation of information technology, it brings new opportunities and challenges to the development and evolution of wisdom campus. The traditional management method is not adapted to current management method, and the teaching quality management system is proposed. Compared the traditional method, this system is WEB-based. By the distributed B/S mode, it simplifies the development, maintenance and use of the system.

From the different angle of different user, this system is constructed. These users include manager, teacher, student and other users. Java EE technology is used to development the teaching quality management and diagnosis platform. The system uses the MVC (Model View Controller) model and is based on the SSM (Spring+Spring MVC+Mybatis) framework. Based on the SSM framework, not

only the development efficiency can be improved, but also the maintenance cost can be reduced. To fully utilize the reliability and scalability of the cloud computer, the platform is deployed a docker cluster. It is effectively reduces development, deployment and operation and maintenance costs.

## 2. Hadoop HDFS

Hadoop distributed file system is a core sub-project of the Hadoop project. It is the basis for data storage management in distributed computing [3-4]. It is developed based on the need to access and process very large files in streaming data mode and can run on inexpensive commercial servers. Its high fault tolerance, high reliability, high scalability, high availability, high throughput rate and other features provide a fearless storage for massive data, bringing application processing for large data sets. A lot of convenience is for the application of big data.

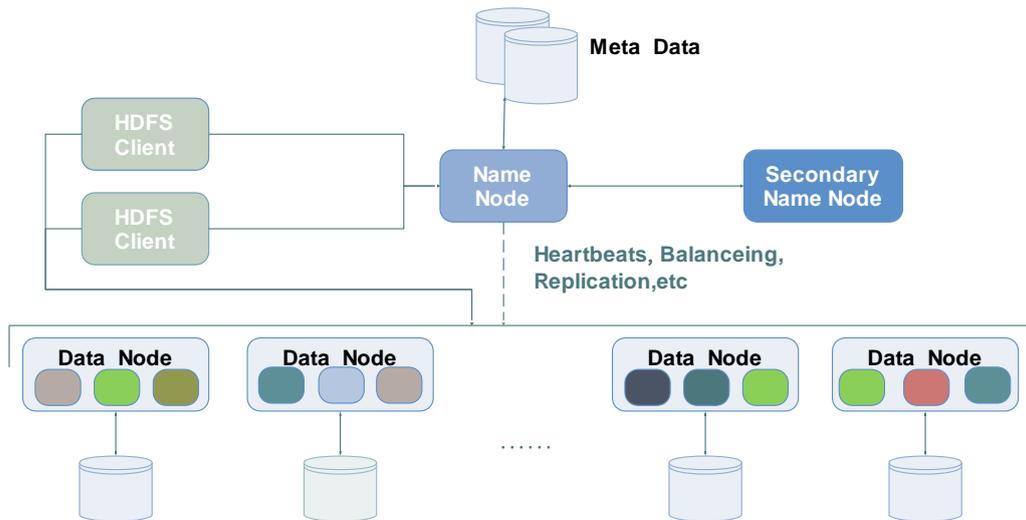


Fig. 1 HDFS Architecture

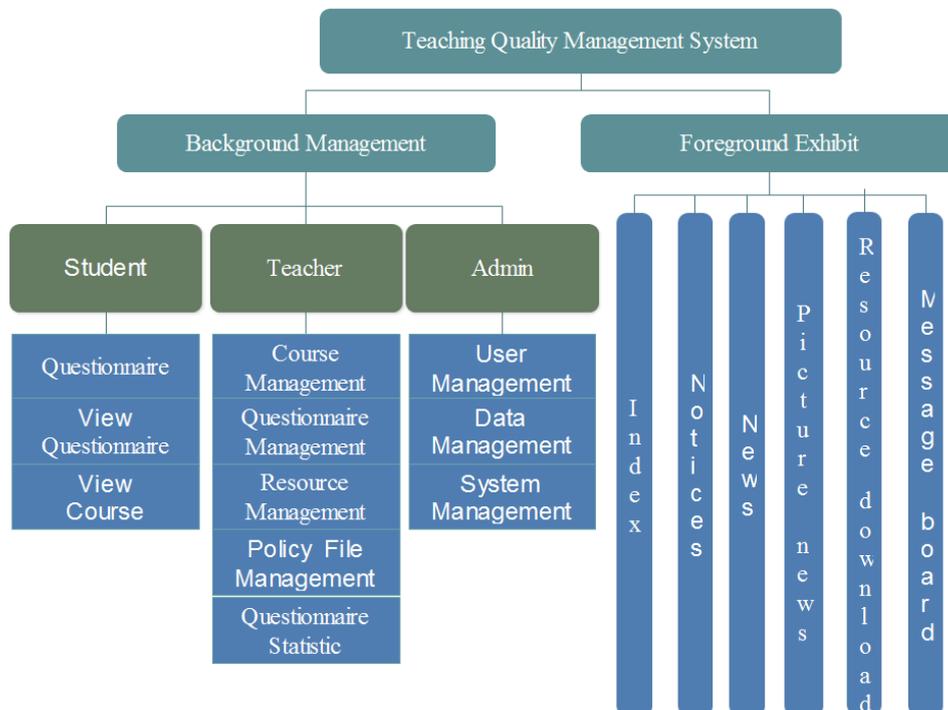


Fig. 2 Functional diagram

### 3. Development and implementation

#### 3.1 Development Architecture

This teaching quality management system consists of foreground exhibit and background management. Background management includes three type users. The first type user is student, and these usres can do questionnaire, view questionnaire and view course. The second type user is teacher, and these users can manage coures, questionnaire, resource, policy file and do questionnaire statistic. The third type user is administrator, and these users can manage user, data and system. The foreground exhibit includes the index, notices,news, picture news, resouce download and message board. The structure of this platform is shown in Fig.2.

#### 3.2 Implementation

Combining Hadoop cloud platform technology and HDFS distributed file system, the teaching quality management system is constructed, as shown in Figure 3.

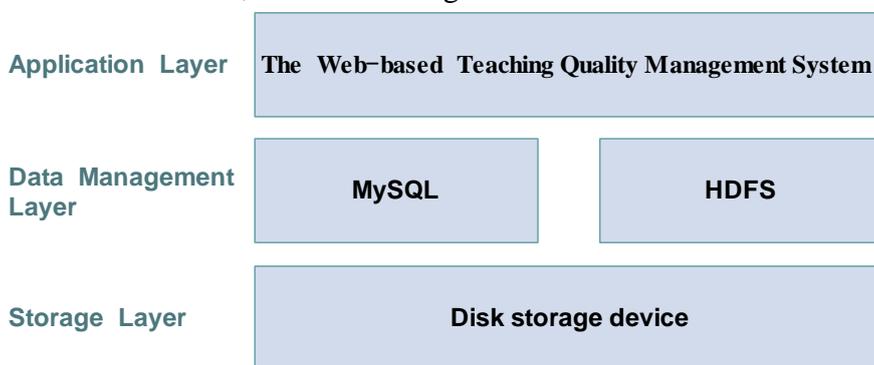


Fig. 3 Architecture diagram

The application layer provides web application. This layer is implements by SSM framework. It calls API interface of HDFS, and realizing various operations such as reading and writing files. Data management layer provides data services by a HDFS cluster. The actual storage of the data is placed on the storage layer. The storage devices consist of the disk in the HDFS cluster.

The application layer is implemented by the MVC (Model View Controller) model and based on the SSM (Spring, Spring MVC, Mybatis) framework. The platform architecture is shown in Fig. 4.

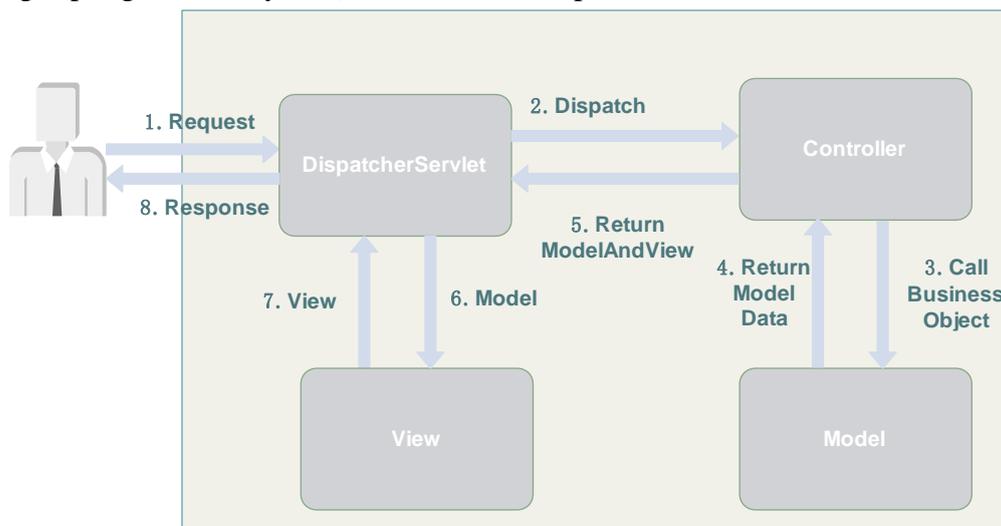


Fig. 4 SSM framework

In SSM framework, Spring DispatcherServlet and controller classes which are defined by developers form the controller layer [5-6]. Spring Web MVC is the original web framework built on the Servlet API and has been included in the Spring Framework from the very beginning. The model layer

consists of business classes and persistence classes [7]. Business classes realize business logic and business verification. Persistence class implements the operation to the database [8].

### 3.3 Deployment

Based on a docker cluster, this system can take advantage of cloud computing technology, flexible, and scalable services to effectively reduce the cost of operation and maintenance [9]. The system architecture consists of load balance, monitor, elastic controller, docker image repository and web server based on docker container. The platform deployment architecture is shown in Fig. 5.

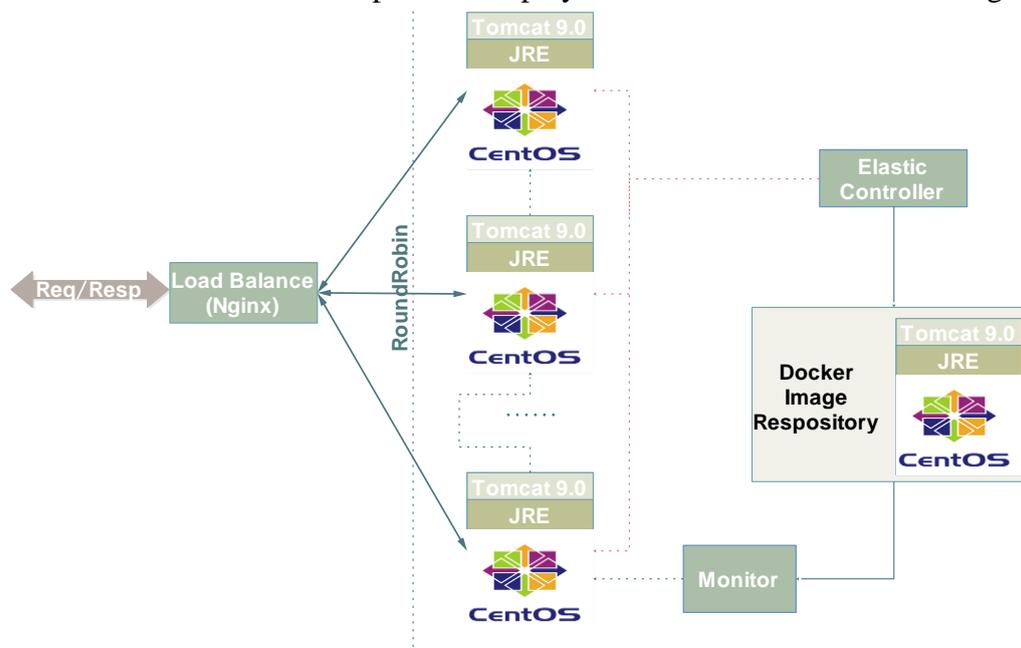


Fig. 5 Platform deployment diagram

Load balance is responsible for distributing traffic requests and completing route switching when the number of nodes changes. In this platform, Nginx as a load balancer implementation is used to support multiple traffic distribution algorithms [10]. This platform uses a simple polling (Round Robin) mode. Load monitor is responsible for monitoring the current load request amount and determining the next action according to the set threshold. In this platform, it is implemented by Java, and the current traffic status reported by the web server in real time determines whether to dynamically apply for resources and implement Scale-Out. Elastic controller encapsulates the operation API of docker and completes the operation of adding or deleting service nodes according to the instructions of the monitor. Each web server is deployed a docker container. Docker image repository stores the web app for container. This container provides built-in Docker images on centos with support for specific versions, such as Java 8.0 and Tomcat 9.0. Web App for Containers uses the Docker container technology to host both built-in images and custom images as a platform as a service [11].

### 4. Conclusion

Through investigation and detailed requirement analysis, a web-based teaching quality management system is designed and developed. By the distributed storage of Hadoop HDFS, this system improves the utilization ratio of resource. The system adopts the current popular SSM framework and deployed on docker cluster. It improves development efficiency, reduces operation and maintenance costs, and ensures stable and reliable system operation.

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