Research on Resource Sharing Talent Training Scheme System of Nginx Load Balancing under Big Data Technology

Kanghua Peng[1], Jincheng Shi[2,*]

[1] School of Information Engineering, Guangdong Engineering Polytechnic, Guangzhou 510520, China
[2] Science and Technology Research Office, Jinan University, Guangzhou 510632, China
[*] Corresponding author: Jincheng Shi

Abstract: Under big data, it is of great significance in digital campus with cloud computing virtualization of resource Co-Construction and sharing. In order to adapt the problems of insufficient bearing stability and waste of resource energy consumption of higher vocational talent training scheme, this paper designs a cloud solution of talent training management system based on LAAS. The talent training scheme system is developed by using java language and IntelliJ IDEA integrated development environment, and improves concurrency performance based on Nginx load balancing technology. The functions of the system are designed around the entity model of talent training scheme, database establishment, resource sharing management and other functions, so as to meet the needs of all levels and multiple functions of the talent training system under the expansion of Higher Vocational enrollment, so as to serve the talent training of Higher Vocational enrollment expansion and improve the quality of talent training.

Keywords: big data technology; cloud computing; resource sharing; higher vocational education enrollment expansion; talent training program

1. Introduction

Under the big data technology, there is a great demand for digital resources and data processing in Colleges and universities, and the talent training scheme system has been gradually popularized in Colleges and universities. It is of great significance to strengthen educational informatization and develop digital, systematic and resource sharing talent training management and application in higher vocational colleges. In particular, since the three-year expansion of Higher Vocational enrollment by the Ministry of education, the types and number of enrollment have continued to increase, diversified groups have begun to appear, and the amount of information on talent training has increased rapidly. In order to solve the problems of insufficient bearing stability and waste of energy consumption of talent training system under the high concurrency of teaching plan entry by academic administrators and course selection by students under the expansion of higher vocational education, the virtual machine consolidation rate calculation method is adopted to redeploy the server software and hardware architecture, configure virtual machines in the cloud computing environment, deploy host pools and clusters, implement network and storage virtualization, and optimize and restructure the CPU and RAM of virtual machines, A cloud solution of talent training management system based on LAAS is designed [1,2].

Under the joint construction and sharing of resources and advanced software design, the talent training management of Higher Vocational enrollment expansion will be more systematic, scientific and standardized, which is conducive to the full realization of college credit bank.

2. System Architecture and Technology

2.1. System Architecture

The talent training system of Higher Vocational expansion adopts B / S system architecture and is based on MVC three-tier architecture, as shown in Figure 1.

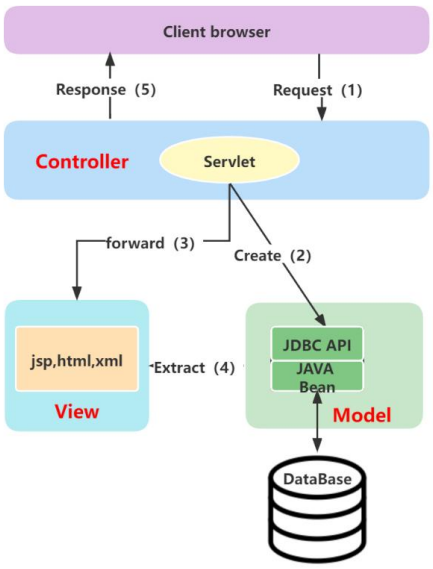

Figure 1. Three tier architecture based on MVC

The view layer is mainly the interaction of the user

interface, which is generally based on JSP and realized through the browser. The instructions of the control layer come from the request of the view layer. After message processing, they are finally transmitted to the model layer and realized by servlet. The model layer mainly realizes the addition, deletion, modification and query of the database, and uses JavaBean to reflect the business logic. MVC structure greatly improves the maintainability of the talent training scheme system for higher vocational expansion [3,4].

2.2. Load Balancing Technology

Due to the high concurrency requirements of the talent training scheme system for the expansion of higher vocational education, the Nginx high-performance web server with reverse agent function is a good solution. At the same time, the consumption of resources is also low. However, it can obtain higher CPU efficiency. The existing talent training system in some colleges and universities is generally Apache Web server, but for high concurrency application scenarios, Nginx web server is more suitable for the current scenario under the background of Higher Vocational enrollment expansion. Nginx can realize more than 50000 concurrent connection requests [5,6], which can better solve the existing concurrency problem.

3. Cloud Computing Talent Training System Deployment and Digital Resource Sharing

3.1. Deployment Framework and Scheme Design of Virtualization Platform

In order to further realize the co construction and sharing of resources, further optimize and integrate the allocation of resources based on the current situation of the system demand of Higher Vocational enrollment expansion talent training program, which is divided into three aspects.

The first is to integrate the client server of Higher Vocational enrollment expansion talent training scheme system. Its main user object is teaching managers, which is used for the processing of daily affairs. It usually has relatively low requirements for CPU and RAM, but when students choose courses, high concurrency is often prone to downtime [7,8].

The second is to integrate the database server, which is dedicated to the talent training program system of Higher Vocational enrollment expansion. The daily CPU and RAM requirements are not high, but the demand for high concurrency can not be met when evaluating teaching and selecting courses at the end of the initial period [9].

The third is the integration of blade servers. The existing low-performance blade servers are relatively old, including old web servers, client servers, database servers, etc., which are prone to failure [10].

According to the analysis of the above three aspects, the virtualization of the system platform of the talent training scheme for higher vocational expansion includes three parts: server virtualization, network virtualization and storage virtualization. The scheme architecture of cloud computing virtualization higher vocational enrollment expansion talent training scheme system platform is shown in Figure 2.

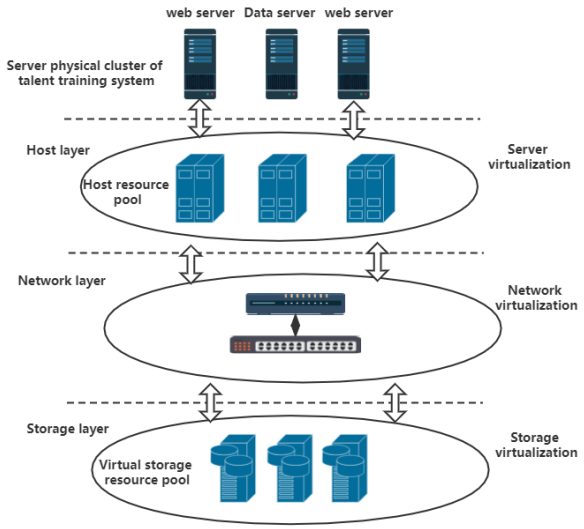

Figure 2. Scheme architecture of cloud computing virtualization higher vocational enrollment expansion talent training scheme system platform

The web server, data server and other resources of the higher vocational expansion talent training scheme system are integrated through the resource pool of the host layer. The other two parts of virtualization, such as network virtualization and storage virtualization, can be configured by adding some new equipment to the existing hardware to form a virtual storage resource pool [11,12].

3.2. Server Virtualization and Sharing

Based on the original hardware resources, the talent training scheme system of Higher Vocational expansion carries out resource integration and virtualization to share resources. The host supports the intel-t series original educational administration system and deploys three special servers. In order to meet the high demand of students' course selection, two blade servers are added. After resource integration and sharing, run the new educational administration management system client, web service, database service and other applications respectively, optimize the sharing configuration through virtualized resources, and reasonably migrate the network application services with low resource occupancy and high requirements for course selection concurrency to the cloud computing platform and merge them into the shared host pool [13,14].

A series of hosts on the same network layer are deployed in the host pool to realize cluster management, so that under the condition of high concurrency and high load, the system of talent training scheme for higher vocational expansion can ensure stability. The cloud computing talent training system platform of this design scheme integrates 3 high-performance servers and 15 virtual CPUs through virtualization technology, to meet the high load demand of students in course selection and teaching evaluation [15,16].

4. Design of Talent Training Management System under the Background of College Enrollment Expansion

4.1. Entity Model

4.1.1. Student module

Student entity module model is divided into student information, curriculum information, student management, achievement management, etc. each sub module contains multiple attribute information, such as student ID number, name, ID card number, Department, specialty, grade, etc.

4.1.2. Teacher (Mentor) module

The physical module model of teachers (tutors) is divided into personal information, professional title information, teaching, assessment and salary records of teachers in schools, teaching points and enterprise tutors. Teachers or tutors can modify personal information, query personal assessment and salary, and have the functions of reviewing students' homework, performance and comments.

4.1.3. Administrator module

The administrator entity module model includes the above students, teachers (tutors) and course information management, including the analysis and statistics of various data. And can modify the above information and issue notices and announcements.

4.2. Realization of Main Functions

4.2.1. Formulation of higher vocational enrollment expansion training plan

According to the general requirements of Higher Vocational enrollment expansion of the Ministry of education and the guidance on the talent training plan for higher vocational enrollment expansion, the school needs to further formulate the corresponding talent training plan for higher vocational enrollment expansion. The plan stipulates the type, objectives, years, specifications, credit requirements, teaching plan arrangement, etc. of talent training. The data dictionary should include secondary colleges, majors, grades, courses, credits, class hours, practical teaching plans, etc, It can also add, delete, modify and check, analyze and count the courses, and add, submit, review and approve the teaching plan. The higher vocational enrollment expansion training program is available for users such as leaders in charge, academic administrators, teachers (tutors), various students of Higher Vocational enrollment expansion, etc.

4.2.2. Operation of higher vocational enrollment expansion training program

After the higher vocational enrollment expansion training plan is formulated, the system automatically generates semester data according to the teaching schedule in the plan, which is the actual operation track of the three-year enrollment expansion of higher vocational education. The talent training is implemented according to the operation plan, including the practical teaching plan. If there is any change during the operation, you can also fine tune the teaching plan.

4.2.3. Curriculum management of higher vocational enrollment expansion training program

The higher vocational enrollment expansion training program system includes a course library, which can jointly build and share the courses inside and outside the school, including online excellent courses (MOOC) and on-campus courses (SPOC), and leave interfaces with different permissions. Administrators and secondary colleges can manage the coding, teaching plan, course overview and other contents of various courses.

4.2.4. Application and management of higher vocational enrollment expansion training program system

The application module of Higher Vocational enrollment expansion training scheme system mainly has all management permissions for the module data such as secondary college information, professional information, student information, teacher (tutor) information and course information. It can also set the user permissions of each functional module to increase the security of data access. The system application management permissions of stakeholders and zero level data flow chart are shown in the Figure 3.

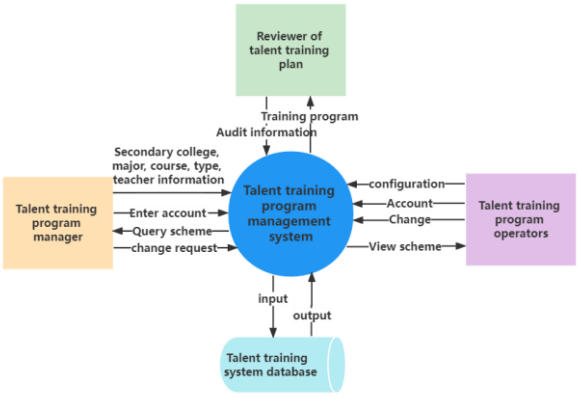

Figure 3. Zero level data flow chart of talent training scheme for higher vocational expansion

4.3. Configure the Culture System Nginx Reverse Agent

The content of Nginx server configuration information of Higher Vocational enrollment expansion and training program system is arranged in Nginx.conf configuration file. The HTTP module mainly includes the configuration related to reverse proxy and load balancing functions, as shown in the following program section.

```
server{
#The listening server port number is 8080
listen 8080;
#Server virtual machine name address is local host
server_name localhost;
location / {
#Filter the list of siteJK proxy servers
   proxy_passhttp”//site/;
}}
#Define the list of siteJK proxy servers
```

```
upstream site{
ip_hash;
#IP address of 6 siteJK servers
server 192.168.13.68;
keepalive 400;
}
```

The server module and the upstream module are configured in the HTTP module, the //site server list is defined in the upstream module, and the sever module defines a virtual server, the proxy_passhttp parameter determines which server list to select.

5. Optimization Design of Performance Load Balance of Higher Vocational Enrollment Expansion Training System

In order to realize the high concurrency and high stability of user access of Higher Vocational enrollment expansion and training system, this paper implements the optimal configuration design of Higher Vocational enrollment expansion and training system, mainly the distributed Nginx reverse agent and load balancing method, as the solution of optimal configuration. Through the load balancing algorithm, the user concurrent request task of the higher vocational expansion training system is reasonably distributed to the idle available server to realize load balancing.

5.1. Weighted Polling Method

The working mode of polling method is to distribute concurrent user request tasks to each server in turn without considering the actual connection number and system load of each server node. This method has the advantage of convenient deployment. Based on the polling method, considering that different server system configurations and actual loads in concurrent user request tasks are treated differently, that is, the weight parameter is added, and the corresponding weight is allocated according to the server configuration and actual load, which is more in line with the practical needs and can deal with the load balancing problem between servers more effectively.

5.2. Weighted Minimum Connection Algorithm

The minimum connection algorithm is a dynamic scheduling algorithm, which is characterized by adding a scheduler to record the number of requested tasks of each server, and dynamically selecting the server with the least tasks to call according to the number of requested tasks. Add 1 to the number of server connections for each call; On the contrary, if the task ends or is cancelled, the number of server connections is subtracted by 1 to make each server achieve load balancing. Based on the minimum connection algorithm, different weights are set considering the differences of server performance and real-time request tasks. When receiving the request task initiated by the user, first judge the real-time task connection number of each server and compare it with its weight. The smaller the value is, the smaller the load is, then the user request task can be assigned to the server for processing.

5.3. Server Deployment Design

In the operation of Higher Vocational enrollment expansion and training system, the price of physical server is relatively expensive. In order to reduce the cost, this design adopts the virtual server cluster mode. According to the performance of each physical server, build one or more virtual servers on it. CentOS system is installed on each virtual server, its resources are configured, and weighted polling method or weighted minimum connection algorithm is adopted to realize load balancing [4].

5.4. Implementation Scheme Design

When secondary colleges and other users initiate concurrent request tasks, the reverse proxy server Nginx assigns work tasks to each web server in the virtual server cluster according to the order of request tasks, as shown in Figure 4.

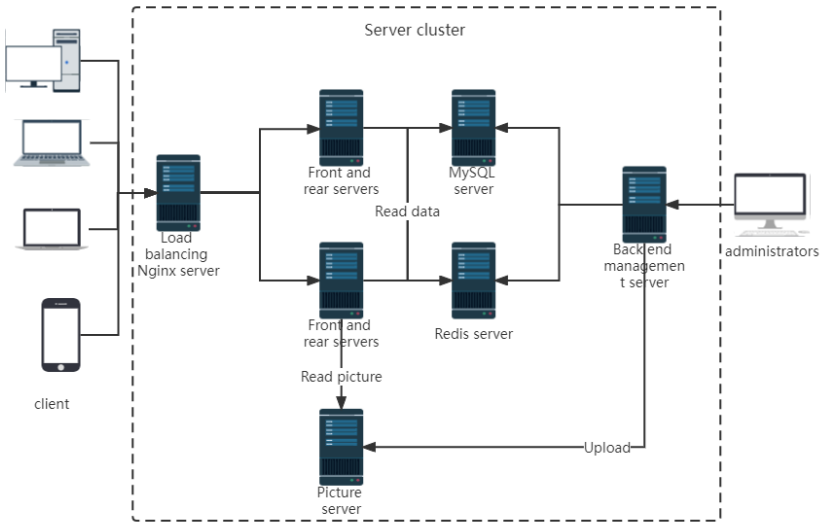

Figure 4. Training scheme load balancing Nginx server topology

In this design scheme, six web virtual servers are set, s = [S1, S2, S3, S4, S5, S6]. The load balancing polling algorithm assigns the user request task to the web virtual server from S1 to S6 in turn, and then re submits the user request task from S1 to S6.

Once an unexpected event occurs, such as the unexpected shutdown of a web server, the load balanced Nginx will automatically remove the failed web server from the cluster. Therefore, the user request task will be handed over to other servers with good performance to ensure the normal access of users to the talent training system.

In this design, the load balancing Nginx server distinguishes different web servers through port number and domain name. In the configuration file, by establishing multiple server modules, each server module can specify a web virtual server. In the port number difference mode, different web servers are distinguished by assigning different port numbers to the listen attribute in the server module; In the domain name difference mode, the server module in server_name attribute assigns different domain names to distinguish different web virtual servers. Finally, configure the upstream module to realize the load balancing of web virtual server. Represented by the port number difference mode, the code snippet of upstream module configuration mode is as follows:

```
Upstream name{
Server web server IP: Port 8001;
Server web server IP: Port 8002;
Server web server IP: Port 8003;
Server web server IP: Port 8004;
}
```

6. Performance Test of Higher Vocational Enrollment Expansion Training System Platform

6.1. Server Load Performance Test under Simulated Environment

In order to test whether the deployment of Nginx server in the higher vocational expansion and training system platform under the cloud computing platform can achieve the expected effect of high parallelism and high availability, in the early stage of the higher vocational expansion and training system platform being put into use, the load runner professional test software is used to simulate the high concurrency environment to test the bearing upper limit of the higher vocational expansion and training system platform, as shown in Figure 5.

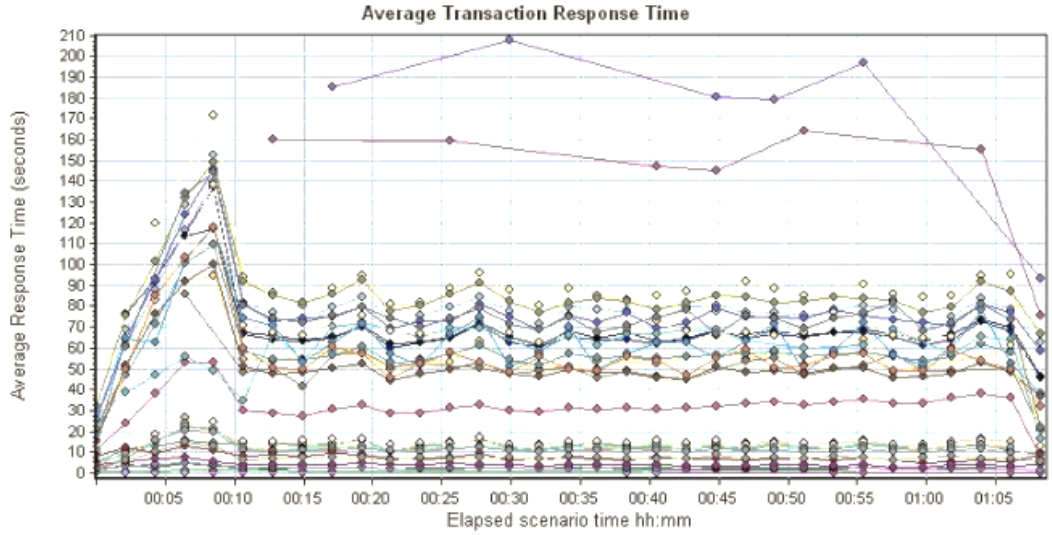

Figure 5. Bearing test of Higher Vocational enrollment expansion training system platform

In Figure 5, for the task requests of the top two curves, the execution of other user requested tasks is slow at the initial stage of the test. With the completion of user login, the average response time of various user requested tasks is stable at the corresponding value and maintained within 85 seconds.

In the load runner software simulation load test, six virtual machines are configured according to the actual use process of each secondary college. In the test environment, it is concluded that the maximum concurrent number of Higher Vocational enrollment expansion and training system platform is 21556. According to the enrollment expansion of higher vocational colleges, there are about 13568 people in two grades in each course selection or teaching evaluation. It is predicted that there are about 12000 concurrent tasks in real-time course selection or teaching evaluation, so the test results can meet the needs of course selection or teaching evaluation in peak hours.

6.2. System Platform Performance Test during Actual Course Selection and Teaching Evaluation

During the period of course selection and teaching evaluation of students in higher vocational education, the CPU and RAM utilization of six virtual servers deployed for the higher vocational education enrollment expansion and training system are monitored by the cloud computing platform in real time. At the initial stage of course selection and teaching evaluation, the CPU and RAM utilization of some virtual servers are close to the peak. Through Nginx load balancing, the task availability of user requests gradually tends to be stable, and the whole

process of user login and course selection and teaching evaluation requests is smooth, Downtime did not occur. In the course management module interface of the educational administration system, data analysis and statistics are carried out on the number of students who choose courses and evaluate teaching. Some popular courses are filled with 120 people within the first minute, which shows that the observed concurrency is very high. Therefore, the talent training system of Higher Vocational expansion not only ensures the concurrency, but also has high stability.

7. Conclusion

The higher vocational enrollment expansion talent training system based on Nginx load balancing runs stably without downtime. This design scheme combines cloud computing and virtualization technology. On the original educational administration management system architecture, through appropriate expansion of software and hardware resources for co construction and sharing, deployment and optimization of virtual machine pool, sharing CPU, RAM, network and other resources, it successfully solves the problems of unreasonable utilization of software and hardware resources of talent training management system platform in higher vocational colleges. When the talent training program system for higher vocational expansion is applied to the author's unit, 11 enrollment types need to be formulated every year, involving more than 500 talent training program documents. Through the use of the system, the work intensity of relevant stakeholders is greatly reduced, and the time for formulation and fine-tuning is reduced by 50%, making the talent training program formulation and curriculum management more systematic, comprehensive, efficient and convenient. It also realizes the system dynamic tracking and intelligent statistics, improves the concurrent load performance of user requests, reduces user waiting time and energy consumption, saves the cost of digital information construction, and achieves the expected goal of this project.

Acknowledgments

This work was supported by the Higher Vocational Education Reform Research and Practice Project in 2020 under Grant number: jggzkz2020018; Guangdong Higher Vocational Education Quality Engineering Project, Boutique open Courses, Database technology and application (database technology and sqlserver); Guangdong education and Teaching Achievement Award (Higher Education) cultivation project (serial number: 1001); Natural platforms and projects of universities in Guangdong Province: Key field (Rural Revitalization) project of colleges and universities in Guangdong Province (Number: 2020ZDZX1084)

Reference

[1] Zhu L.X. Web system security deployment scheme based on Nginx technology , Information and computer (theoretical Edition), 2019; Volume 31, no 17, pp. 172-173 + 176

[2] Luo Y.J.; Li X.L.; Sun R.X. Overview of load balancing algorithms, Science and technology information development and economy, 2008; no 23, pp. 134-136

[3] Chen L.P. Research and deployment of performance optimization of talent training management system based on cluster, Modernization of education, 2019; Volume 6, no 20, pp. 116-117.

[4] Peng K.H. Blockchain Equity System Transaction Method and System Research Based on Machine Learning and Big Data Algorithm. WIRELESS COMMUNICATIONS & MOBILE COMPUTING 2021. (2021). doi:10.1155/2021/3457967.

[5] Huang R.Y. Design and application of library personalized service system based on reading big data. Office business, 2021; no 09, pp. 164-165.

[6] Zhu Y.R.; Zhong H.F.; Huang D.C.; Shi R.B.; Wen Y.H. Design of intelligent cold chain temperature control system under big data and blockchain application scenario. China storage and Transportation Corporation, 2021; no 05, pp. 188-190.

[7] GUI H.X.; Xue J.; Wang Q.Q. Research on employability evaluation and cultivation of information management and Information System Specialty under big data. Journal of Xichang University (NATURAL SCIENCE EDITION), 2021; Volume 35, no 01, pp. 116-119+128.

[8] Peng K.H. Research and Application of Equity System Development of Rural Joint Stock Cooperative Economic Association Oriented to Big Data Technology (Blockchain Technology). Cyber Security Intelligence and Analytics: 2021 International Conference on Cyber Security Intelligence and Analytics (CSIA2021), Volume 1. Springer International Publishing, 2021.

[9] Peng K.H.; Shi J.C. "Design and Application of Digital Resource Sharing Talent Training program System for Big Data Technology." 2021 IEEE Conference on Telecommunications, Optics and Computer Science (TOCS), Volume 1. IEEE Press, 2021.

[10] Deng Q.Z.; Wang W.Q.; Wang B. Design and implementation of report application system for first-line stations based on real-time database data. China informatization, 2021; no 01, pp. 60-62.

[11] Chen H.Y.; Zhang D.W.; Wan Junwei, Qi Hongwei. Design and application of space target monitoring data management system based on big data. Aerospace electronic countermeasures, 2020; Volume 36, no 04, pp. 11-14.

[12] Peng K.H. Research and application of equity information system of economic association based on cloud technology. Information system engineering, 2020; no 09, pp. 101-102+104.

[13] Shen Y. Application performance monitoring system. Dalian press:, 202005.147.

[14] Zhang J.J.; Zhang P.C.; Liu X.X. Design and application value of intelligent measurement management information system. National defense science and technology, 2020; Volume 41, no 01, pp. 24-29.

[15] Peng K.H..; Shi J.C. Analysis and Design of Equity System for Rural Joint Stock Economic Association Oriented to Big Data Technology Platform. Journal of Network Computing and Applications, 2021 6.1. doi:10.23977/JNCA.2021;060104.

[16] Chen S.H.; Cao L.; Li X.L. Design and analysis of university scientific research management system in the era of big data. Wireless Internet technology, 2020; Volume 17, no 03, pp. 82-83+88.