A Novel Construction and Design of Network Learning Platform in Cloud Computing Environment

Huanyu Li[1(✉)], Jing Wang[2], and Hua Shen[1]

[1] Air Force Engineering University, Xi'an, Shanxi, China
{lihuanyul984, king448705776}@163.com
[2] Xi'an Aerospace Middle School, Xi'an, Shanxi, China
Wangjing63363@163.com

Abstract. With the rapid development of computer technology, educational information technology plays a more and more important role in modern education. The development of cloud computing technology has brought great influence and change to the construction of network learning platform. Aiming at the problem of design and implementation under the environment of network learning platform for cloud computing, through in-depth analysis of the current network learning under cloud computing environment, learning theory, learning object and system function, system construction is given a practical significance of the cloud computing network learning platform and system design method, provides the theoretical basis and reference for promoting the application of cloud computing technology in modern education.

1 Introduction

With the rapid development of information technology, cloud computing has been widely used in the field of education for its advantage and characteristics. However, the application of cloud computing in higher education is still in its early stage in China [1–3]. As the organization of knowledge and the resource center of education information, colleges and universities need to provide information services through modern information technology today [4, 5]. At the same time, as a novel web application mode which is of high reliability, high cost-effective and high scalability, the cloud computing technology exactly meet the demands of effective utilization on higher education information. So it is an inevitable choice to apply the cloud computing technology in higher education field.

At present, some colleges and universities use the cloud computing technology to integrate the massive educational information resources, and develop education platforms of various functions, such as the resource sharing platform designed by Hongmin Gong [6], the education service platform designed by Tiebin Tang [7] and the digital resource management platform designed by Junke Song [8], and so on [9–13]. These educational platforms have improved the education level of colleges and universities, enrich the education form in colleges and universities, and expand the pattern of personality study. Therefore, addressing at the problem of multimedia teaching in

colleges and universities, by analyzing the advantages of the cloud computing technology deeply, a novel construction and design of multimedia learning platform of colleges and universities has been proposed in this paper, which is based on the cloud computing technology. The theoretical foundation, object analysis and design principle are discussed in this paper to illuminate the rationality and validity of the construction and design. And the functions and applies of the multimedia learning platform are analyzed and demonstrated. This work will provide several theoretical references for the application of the cloud computing technology in higher education in the further.

2 Theoretical Foundation

2.1 Learning Theory

The network learning platform based on cloud computing is a platform that based on multimedia resources in the network environment. The traditional learning theory and the new learning theory under the network environment have a very important practical significance for the design and construction of the cloud based network learning platform [14].

The purpose of using network learning platform is to improve the quality of education. To cultivate college students' learning interest and learning ability, also to solve the problems and problems in classroom learning, to cultivate their creativity and self-learning ability. Therefore, to guide the network learning platform for cloud computing based on the theory of learning should be diversified, mainly including behaviorism learning theory, constructivist learning theory, humanistic learning theory, educational communication theory, learning theory and learning theory of micro Unicom etc.

2.2 Object Analysis

Object analysis, also called learner analysis, is a key part of instructional design. The purpose of this study is to understand the learner's learning readiness and learning style. In order to determine the students' learning task, importance and difficulty of teaching, from teaching a starting point, clear target system, the design of teaching activities, teaching contents, teaching strategies of the organization and arrangement of the selection and use of teaching media, teaching evaluation and the use of the design to provide the basis. It is the concrete embodiment of the teaching idea of "student is the foundation".

For network learning this form of learning, object analysis in addition to the need to analyze on the learners, learning environment should also be analyzed, because only by understanding and considering the particularity of the learning environment, learners can better analyze play its role in guiding teaching. Through the analysis of the object, it can be seen that the network learners are more diverse, individual, independent and interactive than the traditional learners. At the same time, it is found that autonomous learning is a process of active and independent self-knowledge construction [13]. The characteristics of online learning requires learners to have a certain amount of

knowledge, positive learning motivation and correct learning strategies, and the need for efficient hardware facilities and a wealth of learning resources. Therefore, it is very important to carry out a comprehensive analysis of the design of the entire network learning platform.

2.3   Design Principles

The network learning platform based on cloud computing is an open learning resource integration environment, which can integrate various resources. The combination of teaching and learning by means of information technology [15]. Therefore, it should be designed in accordance with the following principles:

(1) It should be an interactive, heuristic and autonomous online learning system, so as to provide effective support for the cultivation innovative ability of students.
(2) It should be independent, flexible convenient, and with a powerful background management system. Then all teachers can easily modify their teaching plans and manage their teaching resources.
(3) It should establish a flexible dynamic management for all kinds of multimedia source materials, such as text, film and television, animation, sound, pictures and other multimedia materials. And it has to provide a flexible retrieval mode.
(4) It can realize scientific, reasonable and effective online instruction that online or asynchronous based on expert knowledge and teacher experience.
(5) It should be of fully functional, and easy to operate.

The function of the platform should be able to meet the requirements of students' autonomous learning, such as course learning, data downloading, online testing, collaborative communication and so on. The use of the platform should be as simple as possible, to take into account the level of computer literacy of junior high school students.

3   Demand Analysis

3.1   Network Learning Environment in Cloud Computing

The network learning environment in cloud computing environment contains four important components: client, network learning system, server cluster in the cloud, database in the cloud. The relationship and data flow between them can be described as Fig. 1.

3.2   Application Analysis

Application analysis is an important stage of software development, and it is an effective guarantee for the whole design process of the software. So it is necessary to pay more attention to application analysis at first. Here, the application analysis will achieve a series of related tasks in software development, such as the specific
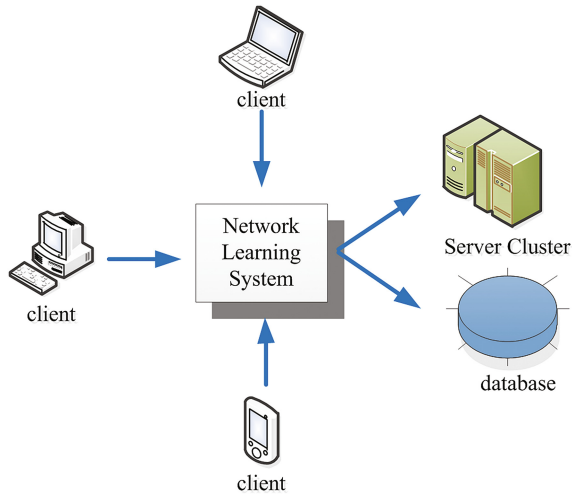
Fig. 1. The relationship of components in network learning environment

stipulation of technology requirements, the explicit functions of the each modules, so as to reduce the workload in design, and improve the efficiency in development and test, reduce the workload caused by rework.

In network learning platform in cloud computing environment, applications can be divided into two categories, functional and non-functional. Functional applications are primarily user oriented, they are directly related to the user's actual application. The demarcation and fundamental function of each module contained in the platform should be clarified. They are the most concerned contents by the user. Non-functional applications is developer oriented, they are designed to analysis the technical requirements, which are used to guarantee the normal operation and the post-maintenance of the system.

As in common system in cloud computing environment, application layer and resource layer are the most important constituent part in our proposed network learning platform. Application are realized in application layer, this layer provide user interface to all kinds of user, and do data read-write with resource layer. Overall, the most important functional application contain three categories. The class about knowledge learning that contains instructional design, teaching management and knowledge hierarchy. The class about learning place that contains distance training, virtual classroom, and network course. The class about entrance that contains several network college and universities. The applications can be described in a block diagram as shown in Fig. 2.

3.3   Function Analysis

Through a concrete analysis of application of network learning platform system based on cloud computing, the system function is designed for the user management module, public information module, online learning support module, tool module and data processing and analysis module of interactive learning module, as shown in Fig. 3.
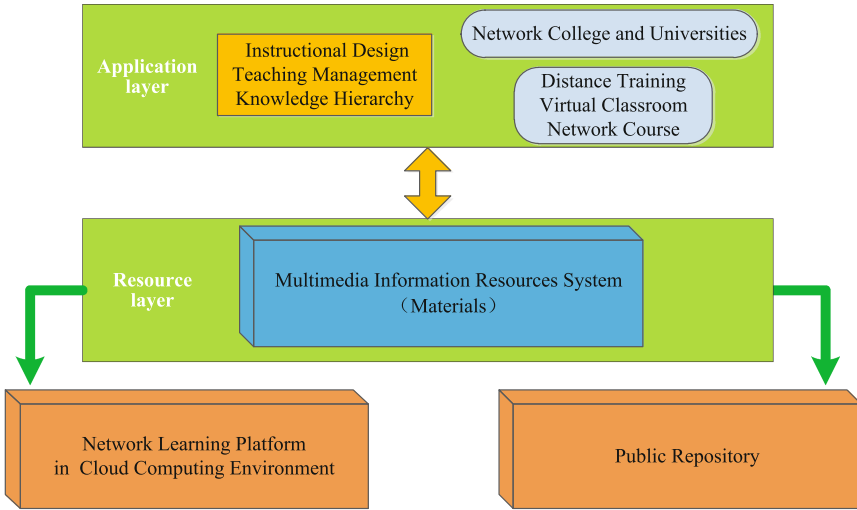
Fig. 2. Application block diagram of proposed network learning platform
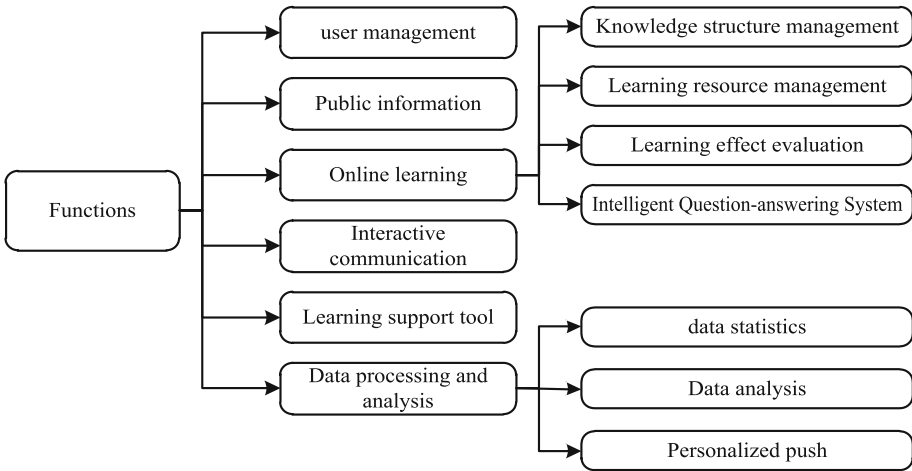

Fig. 3. Function block diagram of proposed network learning platform

The user management module diagram to ensure the legality of access and oper-ation for the learning of the users of the system; public information module has issued the basic information of the website maintenance and information announcement function; online learning module is a network learning platform for cloud computing core module based on the realization of it is responsible for the teaching function. The interactive communication module is a module of communication between students and students, between students and teachers and between teachers and teachers. Learning support tool mainly consists of teachers' teaching experience according to

their own design, and in accordance with the provisions of the standard complete summary information files and documentation in the form of attachment, then uploaded to the platform through the network system. Data processing and analysis module is to achieve intelligent learning process management, intelligent learning content recommendation, the learning platform for the intelligent check missing trap and other aspects of the foundation to realize.

4   System Architecture

4.1   The Architecture of Our Proposed Platform

Network learning platform for cloud computing using the hierarchical architecture based design, according to the application as the center, the construction of ideas to function as the goal, building architecture, the hierarchical idea extends from a single business application architecture to the system, according to different components of the system physical and logical characteristics in the system within the scope of the level of stratification.

The layered structure of this system, can give full play to the function of the cloud computing platform for large-scale distributed system resource gathering, management and scheduling, can be extended to provide high performance communication, distributed storage and computing ability, and integration of the concept of SOA, to provide a unified support for the data in the system range, life cycle management, support service interaction management, reliability and availability management, realize the loose coupling architecture within the scope of system.
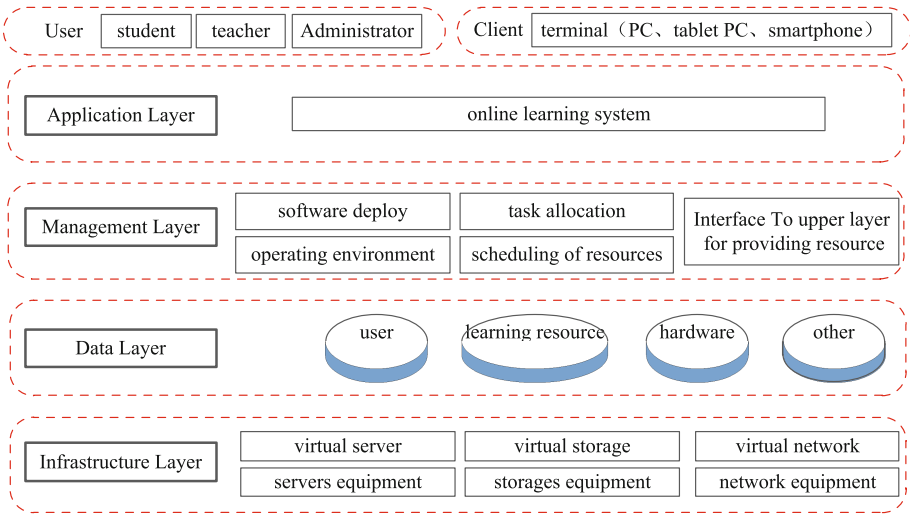
Flexible, transparent, building blocks, dynamic, universal and multi lease, is the six core technology ideas of cloud computing platform. According to the characteristics of cloud computing technology and the practical needs of the construction of network learning platform, this paper designs the network learning platform system as shown in Fig. 4. The learning platform system is composed of learning resources, storage space, computing resources, application system and operating interface. Among them, the user terminal, including user and client is the cloud computing system of the consumer, the application layer, platform layer, data management layer and infrastructure layer is the cloud computing system's supporters and service providers.

4.2   The Modular Construction of Our System in the Cloud

The network learning platform design uses a top-down idea of modular design, in order to make system toward distributed, miniaturization, direction, and enhance the system scalability and operation stability.

In our proposed network learning platform, it is composed by six modules, as shown in Fig. 5.

Operation Maintenance Module. This module is responsible for the entire system configuration and control, which including rights management, monitoring alarm, applications management, faults management and so on.

| User | student | teacher | Administrator | | Client | terminal（PC、tablet PC、smartphone） |

| Application Layer | online learning system |

| Management Layer | software deploy | task allocation | Interface To upper layer for providing resource |
| | operating environment | scheduling of resources | |

| Data Layer | user | learning resource | hardware | other |

| Infrastructure Layer | virtual server | virtual storage | virtual network |
| | servers equipment | storages equipment | network equipment |

Fig. 4. The system design of our network learning platform based on cloud computing

Data Acquisition Module. This module is responsible for collecting data from external interface. Configuration management, data filtering, data preprocessing, and other tasks are implemented in this module.

Data Storage Module. This module is most important part of the whole system. Its kernel is integrated data management cell. This module contains relational database cluster, distributed real-time data, distributed file systems. This module is responsible for distributing the data synchronization of the whole system, database management, access control, redundant strategy implementation, and so on.

Data Services Module. There is a web service APT in this module, to exchange important date with service delivery module. This module contains a service management system, which is responsible for service registration, alteration, design, review, distribution and cancellation. This module also provides data access services and business logic services.

Service Delivery Module. This module achieves load balancing. And it also provides services for the management of the former servers and functional business delivery management of all data.

Data Analysis Module. This module use a distributed computing model to do data transformation, data aggregation, data correlation, and data mining.

All the six modules are mounted on a uniform distributed data bus. Using the distributed data bus to exchange data and order with each other.
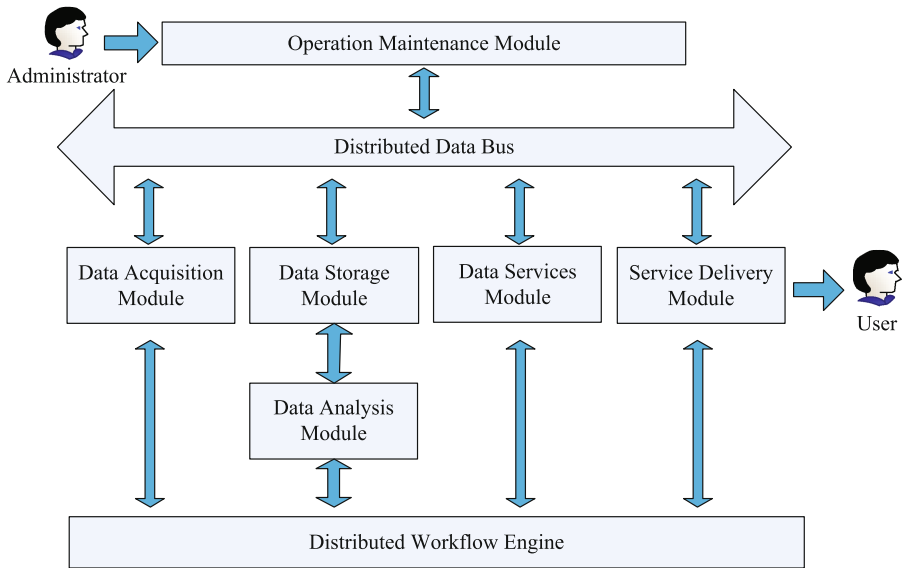
Fig. 5. The modular construction of our system

5   Conclusion

The development of cloud computing technology is gradually changing the way of higher education today, all kinds of education resources platform construction based on cloud computing is an important part of the application of cloud computing in higher education. This paper focuses on the advantages of cloud computing and the demand for higher education, research and analysis learning theory and application requirements of network learning platform based on the cloud computing and detailed design functional requirements of each module, and on this basis, construct the multi-media learning platform architecture and system, which can provide theoretical and technical reference for the integration, sharing and maximum utilization of information resources in colleges and universities.

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