

# Basic Architecture of University Digital Campus under Cloud Computing

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## Abstract

After the introduction of typical university digital campus architecture, this paper puts forward a digital campus platform system architecture based on the cloud computing service environment, which focuses on the cloud computing technology. Combined with the specific requirements of the construction of digital campus, some suggestions and design ideas for realizing the digital campus in the cloud computing environment are given.

## Keywords

Digital campus; cloud computing; basic architecture.

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## 1. Introduction

With the rapid development of computer network technology, digital technology is changing the natural environment and social environment which human beings rely on, this irresistible revolution will surely cause profound changes of educational concept, educational method and educational organization form. Application of digital technology in higher education field makes educational environment, educational resources and educational methods be developing towards digitization gradually, digital campus has been the main development orientation of colleges and universities. Based on traditional campus, digital campus uses advanced information means and tools to implement the digitization of each resource on campus, forming a digital space for real campus to extend in space and time.

## 2. Construction of Digital Campus

### 2.1 Connotation of Digital Campus

The large scientific research project "The Campus Computing Project" sponsored and hosted by Professor Kenneth Green of Claremont Graduate University in 1990 put forward the concept of digital campus firstly. In January 31th 1998, the former American vice-president AI Gore made a speech entitled "The Digital Earth: Understanding our planet in the 21st Century" in California Science Center, firstly put forward the concept of "Digital Earth". Since then, the world generally accepted the concept of digitization, "Digital Campus", "Digital City" and other concepts also are gradually known to the world.

"Digital Campus" is to use modern information and network technique to implement the informatization and networking of teaching, scientific research, management and service of the whole campus. The fundamental features of digital campus are mainly embodied in networking, intelligence, individuation and other aspects.

① Networking: it is a trend and development, all the work, study and life of higher education are endowed with distinct network features, all of this will be associated with Internet directly or indirectly.

② Intelligence: is to make equipment or system have human intelligence partially through a series of intelligence technologies, so as to replace the labour work partially.

③ Individuation: the influence of individuation has been already greater and greater, colleges and universities teachers and students can release their own various individual requirements, or get the materials with same requirement through other website and custom systems.

Networking, intelligence, individuation will be another entirely new stage of digital development after infrastructure network, it will be a hot spot of future digital campus. Among the three, if networking is foundation, environment, individuation is the standard, and intelligence is the purpose, a wonderful aspiration that human have dreamed of for thousand years.

## 2.2 Typical Digital Campus Framework

Typical digital structure generally includes Campus All-in-one Card System, Teaching and Educational Administration Management System, Digital Library, Distance Multimedia Teaching System. Some colleges and universities who have abundant capital also may consider building campus self-service system to facilitate teachers and students' daily data query and management of simple tasks.

### 2.2.1. Campus All-in-one Card System

Campus All-in-one Card System is a "Golden Card Project" of colleges and universities management which integrates technological development, application and popularization, market development of computer, campus network, IC card, card reader device and management system. The construction of campus all-in-one card system is to form E-wallet with the storage function of IC card, build a high level application system which embodies advanced management means and service quality with the support from campus network through the connection with bank network system.

According to different subjects of implementation, this system will be divided into two major parts generally: campus part and bank part, which are relatively independent. Campus part implements the issue, reissue, cancellation and consumption of IC card. Bank part mainly implements the issue, deposit, earmark, reissue, cancellation, blacklist management and other functions of magnetic stripe.

### 2.2.2. Teaching and Educational Administration Management System

Teaching and Educational Administration Management System includes two parts: educational administration and teaching service, they can be dismantled flexibly, combined, freely matched, also can form campus educational administration management or teaching management system. The system mainly includes the following subsystem:

- Enrollment Management System: manage the essential informations (including photo), registration, resume, entrance, rewards, punishments, transaction, year grade and other informations of students;
- Teacher Management System: manage the essential informations (including photo), resume, education background, rewards and other informations of teachers, calculate and estimate teachers' workload and achievements;
- Examination Management System: automatically generate the examination room, time, invigilator and other data of this term according to curriculum;
- Course Scheduling System: automatically generate the class schedule according to curriculum planning and teachers;
- Curricula-variable Management System: implement the formulation of students' personal learning plan through online course selection;

- Score Management System: input, query and summarize the exam results, keep various kinds of statistics;
- Teaching Plan System: includes course type setting, credit points setting, credit hours setting, other settings and management;
- Teaching Management System: manage teachers, semester teaching plan, course scheduling and exam schedule totally according to the range and characteristics of teaching plan;
- Teaching Evaluation System: automatically generate the statistical results of teaching quality score for teachers' teaching attitude, content of courses, teaching method, teaching effect and so on.
- Graduation Management System: auto-process for students' graduation, manage graduate information, degree awarding, credentialing and alumni information at the same time;
- Class Management System: all the operations aiming at students management, student score management, student attendance management, class course arrangement, students personalized corner and so on are all in class.

### 2.2.3.Digital Library

This system consists of data processing, query, duplicate checking, statistics, print, acceptance, data maintenance, letter stitching and other functions. Chinese cataloging subsystem can implement book cataloging, query, duplicate checking, print, statistics, format conversion, library maintenance and other functions; circulation subsystem can implement book circulation, renewal, reservation query, penalty, documentary evidence management and other functions; journal management subsystem can implement subscription, backissue management, data statistics and other work; book reservation subsystem can implement library registration, password change and other functions; public access system can implement collection catalogue retrieval, thesis information retrieval, joint catalogue library retrieval, reader data retrieval and other functions.

The network constriction of digital library should consider the features of multimedia information, such as large information, being sensitive to time delay and so on; there is a such phenomenon that dozens of readers are performing the same operation online, so the control of concurrent information should be considered; when readers dial-up access to library network at home, the information of books management will transmit online, so the security of network also should be considered to prevent hackers from destroying network, or readers copying books illegally; while digital library faces the readers and office workers of all knowledge levels, it can help us improve work efficiency and learning interest better, therefore, the application and management should be easy and convenient, the interface should be friendly and not too specialized. In the construction of digital library, schools should fully consider the specific circumstance of each library, such as function, scale, finance and so on, so as to choose an appropriate solution for digital library.

### 2.2.4.Distance Multimedia Teaching System

Distance Multimedia Teaching System uses the key technology of advanced distance education to implement the multimedia teaching activities with Internet. The system undertakes high tensile compression to audio and video data transmitting online, making the distance teaching based on Internet be possible. This system can implement online visual remedial teaching, classroom broadcast, audio free communication (such as chatting), video conference and other functions. Figure 1 is the topological graph of synchronous distance interactive teaching.

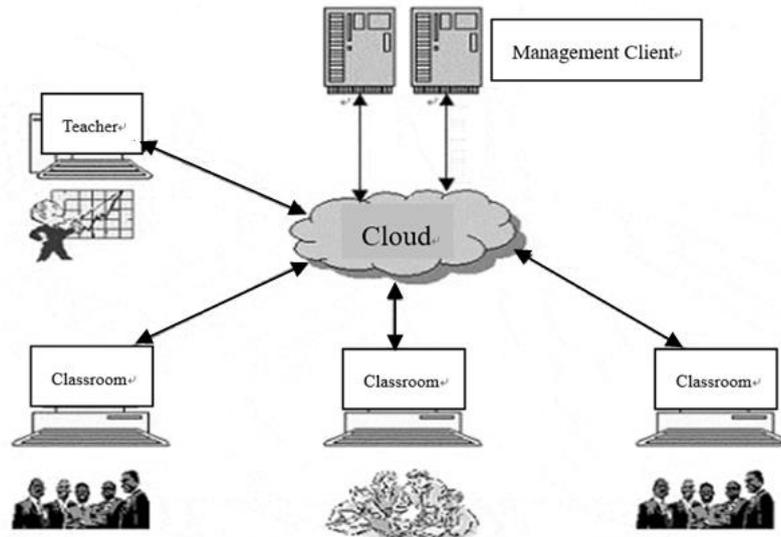


Figure 1. Topological graph of synchronous distance interactive teaching system

Online class on demands teaching system can produce teachers' explanation, demonstration and course experiments in class, video on demand technology can be used to implement class teaching on demand on campus network. Combining with their own actual learning situations, students can listen repeatedly to make up missed lesson by "original teachers".

In order to implement multimedia distance teaching, campus can integrate advanced network interconnection technologies, such as satellite access, ADSL access, CABLE access and so on; and integrate information retrieval (Web Proxy), information issue (Web), exchange of information (Web) and other Internet applications, as well as enrollment management, teachers management and other application systems.

### 3. Construct Digital Campus with Cloud Computing Technology

Cloud computing is a style of computing in which dynamically scalable and often virtualized resources are provided as a service over the Internet, it integrated the whole Internet into a supercomputer, realizing the full sharing of computing resource, storage resource, data resource, information resource, knowledge resource, experts resource and other various resources. With the increase of education information level, various kinds of application systems on campus network emerge continuously, such as enrollment and vocation system, equipment management system, education administration management system, personnel management system, office automation system and so on, network resources are growing geometrically, but due to the heterogeneity of network and operation system, data sharing between different systems is difficult, there will be one and one information isolated island, which makes it difficult to implement resource management and interoperability, therefore, it is significant to realize the interconnection of campus network resource with cloud computing technology, implement the high-performance resource sharing and cooperative work in network virtual environment, eliminate information isolated island and resource isolated island.

The platform architecture is the technical infrastructure for supporting and realizing centralized management of network resources, sharing and utilization of information resources and platform application service architecture, Figure 2 is the architecture of the cloud service platform.

The infrastructure layer is the ground layer of the cloud service platform. The installation and deployment is easy to implement. This layer includes hardware resources such as server resources, storage resources and network resources. It provides the computing power, storage capacity and transmission capability for the upper layer of the platform. Platform hardware requirements for the server is very low, in the lack of computing power, you can use low-cost minicomputer as a supplement.

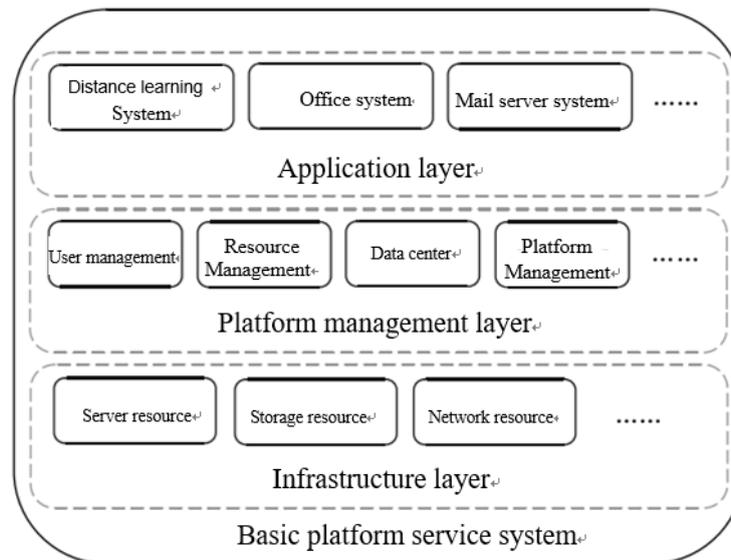


Figure 2. Architecture of the cloud service platform

The Platform management layer is the second layer and also the core layer of the cloud service platform, including virtualization management of the infrastructure layer resources and transaction management of the platform. In this layer, we use the virtualization technology to pool the server resources, virtualize the storage resources, remove the restrictions of physical hardware resource compatibility and connectivity restrictions, reduce the difficulty and maintenance costs of hardware resource management operation, improve the utilization of hardware resources and ensure the platform's high scalability. Transaction management includes the platform configuration management, user permissions and role management, log management and analysis. The main role of transaction management is to control the resources, transfer the resources of the infrastructure layer to the application layer, and ultimately meet the needs of business systems and applications.

The Application layer provides users with personalized software services, Users can access the digital campus network through web browsers and mobile phones. The common application layer services of digital campus network includes mail service system, office system, scientific research system, distance learning system, electronic library system. With the support of the platform layer and the infrastructure layer, the application system can be built into software services cloud, it can be flexibly expanded under the cloud architecture. Users with relevant rights can get the corresponding software service after logging into the cloud. They can access the cloud service at any location without undertaking the tedious routine maintenance work.

#### 4. Suggestions on Digital Campus Construction Based on Cloud Computing Technology

Colleges and universities have unlimited advantages to implement cloud computing architecture, which primarily lie in the following needs: ① internal needs for shared data, computing resource, storage resource and application resource; ② needs for complicated computing environment and greater computing power; ③ abundant technology power which is very sensitive to new technology.

Applying cloud computing technology to build digital campus is a crucial measure for colleges and universities to keep pace with the next generation Internet technology wave, an ideal means which can comprehensively the information infrastructure of digital campus.

Because of the maturity of WLAN technology and wireless product, wireless network has been accepted by more and more users. Wireless network is an ideal access for cloud computing, the increasing PC, mobile PC, multimedia information terminal on campus also provide the possibility for cloud computing environment.

The influence of cloud computing technology is all-round, involving all the aspects of university campus work and life, while the application of cloud in digital campus mainly are embodied in resource sharing and application integration, which are manifested in the following aspects:

- (1) Accurate and rapid computing power. Cloud computing technology makes computing resource on campus local area network be fully utilized, providing high performance computing of virtual supercomputer to speed up computation speed and improve the accuracy of computations involved in digital campus.
- (2) Data memory and management capability. Using cloud computing technology to extract and combine the data required together from different data bases in a short time will leave out the trivial detail of multiple assesses.
- (3) Capability to improve resource utilization. Using cloud computing technology, schools can take full advantages of idle computing resource for computation, data backup and data recovery, so as to improve resource utilization, reduce the investment of educational infrastructure; the growth of various kinds of information resources in school is fast, the full application of cloud computing technology may improve the resource utilization of Internet greatly.
- (4) Improve the work efficiency of colleges and universities staff. Using cloud computing technology, staff can acquire necessary resources cross- system and platform, solving complex problems in a short time
- (5) Support analysis and decision making capability. In various analyses in school, the application of auxiliary means for data analysis, such as data mining, on-line analytical processing and so on, usually may use a large amount of data and complex computation, make use of the powerful computing power and resource sharing capability offered by cloud computing technology to speed up the access and extraction of data, providing the informations which managers need for decisions in short time.

## 5. Conclusion

In short, cloud computing technology integrates various application systems of university campus to realize the interconnection of all resources on campus local area network, implement the sharing and collaboration of high-performance resources under network virtual environment, as so to eliminate the existing internal and external "information isolated island" on university campus, this has a positive promotion to the information and digitization of colleges and universities, generating new digital campus model. As a kind of new technology, cloud computing technology is maturing continually, its application prospect in future campus network is worthy of further research.

## References

- [1] Niu Junzhu. Digital campus construction based on the cloud platform [J]. *Electronic Technology & Software Engineering*, 2017 (09): 11-12.
- [2] Wang Jian. Research on construction of campus virtualization platform in cloud computing environment [J]. *Computer knowledge and technology*, 2016 (33): 49-50.
- [3] Chen Xi, Zhang Chen. Design and Implementation of Wisdom Campus Based on Cloud Computing [J]. *Digital Technology and Application*, 2016 (08): 182-85.
- [4] Xu Anling. Design and implementation of digital campus cloud platform [J]. *Intelligent computer and applications*, 2017 (04): 67-69.
- [5] Gao Jianhua, Hu Jingjing, Deng Yaming. Digital campus construction based on cloud architecture [J]. *Computer Security*, 2014 (12): 68-70.