

# Study on Transformation of Distance Education Management by Cloud Computing

Li Yi Qi, Li Xin, and Feng Jian Li

**Abstract**—Distance education has two modes: television teaching and internet teaching, both of them have disadvantages in lack of system expansion capabilities and scalability. However, cloud computing can integrate all the distance education systems into a “cloud” system, the concept introduced in this paper is to apply cloud computing to distance education management system design, and the system employs technologies of application virtualization, improves resource utilization rate, achieves the demand for large capacity distance education, large population, strong sharing ability, hence the effectiveness of distance education management is obtained. The test shows that this system has made significant progress in education service capability, resource sharing, configurability and scalability when compared to conventional system. System which based on cloud computing has greatly changed the philosophy and operation of distance education, improves the entire level of distance education management.

**Index Terms**—Cloud computing, distance education management system (DEMS), improvement, management level.

## I. INTRODUCTION

With the development of the internet, great changes have taken place in modern education, and distance education has become an indispensable way of learning in our lives, more and more people benefit from distance education. However, resulting from the hugeness of China’s territory area, large population of participants, lack of software and hardware resources, reiteration of resource construction, poor sharing, lack of system expansion capability, poor configurability, high expenses, the development of distance education is incomplete. In 2007, the conception of “Cloud Computing” [1] was brought out for the first time, once proposed, people soon found out that cloud computing has great advantage due to its effective computing processing capability and infinite storage capability, which makes it excels at processing complex problems, therefore, researches about cloud computing and its application become more and more prevalent.

Previous researchers, i.e. Jia Haiyan[2] have come up with a distance education platform based on Agent and provided teachers and students with a good education mode, which enables teachers and students to arrange their time flexibly and improves teaching efficiency. However, it has a major disadvantage in data complexity, data recovery and privacy.

Therefore in this paper, a new DEMS based on the idea that combines the highly effective computing ability of the cloud computing and its infinite storage ability is presented. The research shows that the new DEMS has made great progress in education service capability, resources sharing, configuration and flexibility, which guarantees conduction of large scale distance education activity.

## II. DESIGN FOR CLOUD COMPUTING DISTANCE EDUCATION MANAGEMENT SYSTEM

With the increasing population of distance education learners and amount of information, internet learning environment grow increasingly bulky and complex, according to its present development, there still exist some technical problems, hence adopting the cloud computing distance education management method becomes the most preferred approach to conventional distance education internet problems.

### A. The Overall Configuration Design for Cloud Computing DEMS

Based on the types of provided resources of cloud computing, it can be divided into 3 levels[3] the bottom level provides infrastructures like CPU, RAM and storage, which is called “Infrastructure as a Service, IaaS”. Above the IaaS level, is the hosting environment platform made for the special needs facing service, which is called “Platform as a Service, PaaS”. The top level provides users with applications which they are going to use, which is called “software as a Service, SaaS”. Web service usually use cloud computing service provided by IaaS, while web browsers are usually used to gain access to applications supported by SaaS. The levels in cloud computing system structures are independent of each other, i.e. one single level can independently perform a requirement from the customers without support and services from other levels. Among which, PaaS provides users with development environment, service platforms and hardware resources, users can develop applications and transmit them to other users via internet based on services supplier’s elementary framework. This research aims to choose the most suitable PaaS platform and design new distance education system by studying and analyzing cloud computing technology[4], hence apply the advantages of cloud computing technology to education field.

### B. Logical Structure Design for Cloud Computing DEMS

Distance education system mainly uses internet education, which utilizes high quality education resources to provide a flexible, open, time and district independent learning mode. Meanwhile, it enables learners to arrange learning plans and

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schedules according to their own knowledge structure, achieving “personal education” and “self-conducting learning” which cannot be obtained by conventional education.

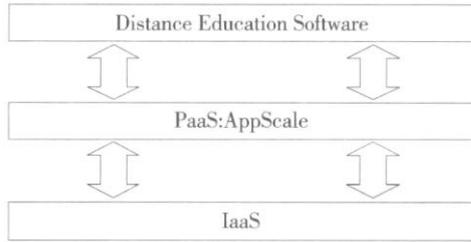


Fig. 1. Overall system structure

For distance education in China, the system is based on online learning platforms from CRTVU (central radio and TV University) and other ordinary universities, TV universities in each province also have their own learning platforms, also there are other distance learning platforms like Chinese education television station. Being a result of network flow distribution, these platforms also causes large amount of iteration in education resources construction and waste in money. The design for cloud computing distance education system in this paper is to: provide superior, more convenient and higher quality services; utilize system advantages and use resources as a whole to build a more efficient, suitable, economic education system [5]. Fig.2 is the logical structure of cloud computing education management system.

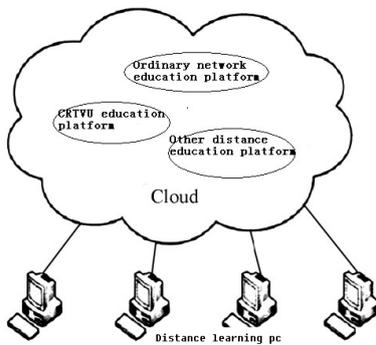


Fig. 2. Logical structure of cloud computing education management system.

The “cloud” consists of resources from different distance education centers; it can automatically search new resources and choose the best route to transmit data, when a server breaks down, other servers can be automatically used. The design of each module enables effective resource sharing, renders visitors’ access to resources without having to know which server it resides in. Hence the resources can be obtained regardless of time and district limitation through a list provided by the system. For an arbitrary resource visitor, the system will automatically analyze his IP address to identify the connection which enables fastest and best visiting experience; the one-time registration is realized, registered resource can be shared by all the resource servers, multi-registration is avoided. This system can fully utilize both software and hardware in the “cloud” to provide strong service capability. [6]

### C. Core Module for Cloud Computing DEMS

There are seven sub modules for the core module for the new DEMS based on cloud computing, they are administration module, visiting controlling module, work flow module, electronic autograph module, document administration module, data extracting and searching module, life cycle supporting module[7-8].

Administration module is used by SaaS providers or application administrators to install and deploy the system’s relating parameters for the lessees.

Visiting administration module uses three categories to differentiate users: SaaS providers or application administrators, lessee or lessee administrators and users. According to their ID numbers and roles in the organization, the specific documents administration is carried out through authentication and accredit. In order to provide comprehensive service to all kind of clients, SaaS application must suffice requires of different work flow. Work flow deploying tools in the work flow module supports work flow inside the corporation or the system.

Electronic signature module records and stores electronic files signature information, it generates a visible electronic signature file (e.g. PDF) and watermarking of the signature information, theses information of the signatures belongs to specified users and is based on metadata of the lessees.

Documents administration module uploads, administrates, stores and recovers all electronic files and relating files, theses files are all stored in the same lists resides in the sharing database which uses the ID numbers of the lessees, they are separated among lessees.

Data extracting and searching module collects data from electronic files, provides users with metadata and keywords searching functions. Electronic files and relating files can be found in database or other storage positions, searching can be carried out according to ID numbers of lessees and by using metadata service.

Life cycle supporting module is a backstage service program, it automatically executes a series of electronic files administration tasks, like activating signature files, cleaning denied files, deleting expired files.

### III. REALIZATION AND TESTING OF CLOUD COMPUTING DISTANCE EDUCATION MANAGEMENT SYSTEM

To justify the rationality of cloud computing DEMS, VC++6 and SQL2008 is used as the software platform to achieve simulation system. The functioning module and technical realization methods will be briefly introduced in the following part. Cloud computing DEMS’s functioning modules

According to the features of cloud computing like high-performance computing resources, mass storage space and high quality technical service, the DEMS consists of four modules: user login, virtual community, cloud computing service and system administration Users’ information is collected and categorized by the users’ login module through registration, which enables users to have access to all the functions of distance education system through web browsers; to cater to different users’ requirement, the system allocates users to different

professional web services to acquire resources according to their network flow. The users' login interface includes users' information, which facilitates community's administration. The virtual community builds resource platforms for users; the main idea is to divide users into different communities according to their districts or other factors, by appointing each community with an administrator to manage each community. The administrators can recommend suitable resources according to users' interest by collecting and analyzing users' visiting history. In the cloud computing service module, all the resources are uploaded to the cloud server, which solves the problems caused by large population of users and high frequency of visiting. Cloud service mode can save expenses for users from high speed internet broadband, firewall and load balancers, it can also solve core problems like cyber safety, complex computing, incomplete data. Cloud computing can use XML technology's foundation data exchange in data level, and realize online Q&A, real-time network information service. System administration module is the controlling module of the whole distance education system; it can supervise the functioning condition of each module, and make global settings for users' information, visiting conditions, resource storage. Dynamic management of the system can be achieved, by using load balancer to effectively allocate and utilize resources. The diagram of each module's functioning condition is shown in Fig. 3. DEMS technique realization base on cloud computing

Cloud computing is not a new technology in the view of technical stage, it is the development of distributed processing, parallel processing and grid computing, in a sense, it can be regarded as a new technique realization scheme. For now, application of cloud computing in DEMS is still in the elementary stage, and its concept is first adopted by our department and applied to practical usage, and solved some key problems with relatively fewer resources input. We mainly apply .NET, JQuery and some other technologies in the design for the system, and we mainly employed XML technology in the data exchange with cloud server, and the elementary database adopts SQL Server2008, operation system uses the latest version from Microsoft Windows2008 R2. In the primary stage we used VMware software to do large amount of tests regarding online video watching and downloading for the server, due to the large population of learners, we assumed a ten percent online proportion to compute, the expected population was at least 8000, if the video compression ratio is 128k/s, the broad band width would have to be at least 1000M and have to be a special line, meanwhile servers and storage devices used to improve service abilities were also necessary, which is more than expensive, hence the conclusion that the present devices and broad band cannot support large scales of learners online studying and files downloading is reached. Therefore, the concept of "cloud" is introduced, the resources for downloading and online learning is uploaded to cloud server, which utilizes SaaS to realize instant messaging, email, Q&A functions. The academy rented a 500M broad band to suffice 4000 learners to study online at the same time, and the rest 4000 learners use cloud storage to finish the task. At present, there are a lot of corporations

providing this kind of cloud service, and charges a significantly lower price, and guarantee a secured use experience. The application of "cloud" effectively saves the expenses of hardware resources, ensures exchange software services, and improves the security of the teaching system in all aspects. "cloud computing" indeed come up with a new idea for DEMS development, the application of this concept will enable effective expand of the system and allows for more learners to study online.

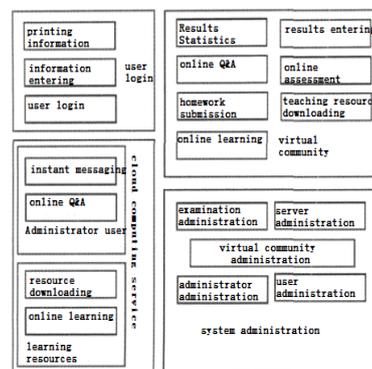


Fig. 3. System function module

The application of cloud computing improves distance education management standard

All the DEMS adopt conventional mode design all over the world, this kind of B/S structure is only appropriate for small scale and small user population. Through the test it can be observed that this system exhibits capabilities which outperform the conventional ones, and is very suitable for large scale distance education, as shown below:provides powerful education service capability.

Cloud computing education management system can thoroughly utilize the advantages of it, can use scattered hardware and software resources as a whole, hence provides strong distance education capability and resource supporting capability. e.g. in less developed region in China like middle and western region, software and hardware construction lag prevails, which cannot be solved in short term. System based on cloud computing can combine software and hardware resources in western and eastern region and provides unified and strong service. effectively avoid resources construction iteration

Due to configuration problems, conventional distance education system cannot build a unified system, distance education center in different places construct their resources separately, causing large amount of iterated construction, bringing unnecessary loss. Cloud computing enables distance education centers in different places to allocate constructing resources uniformly, which effectively avoids iteration in resource construction.achieve effective resource sharing

When completed, cloud computing distance education system enables highly effective resource sharing, renders visitors' access to resources without having to know which server it resides in. Hence the resources can be obtained regardless of time and district limitation through a list provided by the system. For an arbitrary resource visitor, the system will automatically analyze his IP address to identify

the connection which enables fastest and best visiting experience.configurability and scalability

For different users, customers can function on this system rather than the code , they needn't require the deployment of independent , provides flexible customization function; Organization, work flow, documents administration system and visiting access can all be customized by users, which finely cater to different school's requirement. The system is fairly adjustable to support the department's development and change, achieving ubiquity. The configuration of the application does not need change when the population of users increases significantly, only the hardware devices needs to be increased to sustain growth in application scale, which suits the fast developing condition of distance education in China.

#### IV. CONCLUSION

In this paper, the feasibility and reason of applying cloud computing to distance education system design is discussed and elaborated. Design for cloud computing logical structure, overall configuration, core module, data safety is presented. Testing showed that cloud computing distance education system has stepped forward significantly in education service capability, resource sharing, configurability and scalability. Cloud computing is a new mode which provides learners with better services in distance education application, improves distance education administration level, and is suitable for the development of distance education in China.

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