The Feasibility Study of Building Sharing, Premium Teaching Repository Based on Cloud Computing

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Abstract—**The construction of sharing, premium teaching repository is an important constituent part in the development of both the Chinese Universities' quality engineering and key higher vocational colleges. Given the status quo of the application of cloud computing in informatization development of higher education, this paper discusses the feasibility and application prospect of clouding computing in building the sharing and premium teaching repository in terms of hardware, software, data storage and user information security.**

Key words: Cloud Computing Teaching Resources Shared resources Informatization Data storage

I. INTRODUCTION

According to the speculation and anticipation of Internet data centre, the global market size of cloud-computing services will expand from 16 billion U.S. dollars in 2008 to 42 billion U.S. dollars in 2012[1]. Cloud computing will bring education tremendous changes, which include not only its far-reaching influences on platform of teaching resources, but also the changes of people's learning styles. Currently, the construction of sharing, premium teaching repository is an important constituent part of the development of both the Chinese Universities' quality engineering and key higher vocational colleges, and one of significant measures to improve the teaching quality and serve to life-long learning. Due to the lack of enough money or technical reasons, however, it seems to be impossible or very difficult to realize the sharing of the mass teaching resources by utilizing currently common technologies. Cloud computing can implement unified management and unified control capabilities for distributed heterogeneous resources, which makes cloud computing workable for construction of sharing, premium teaching repository. This paper first mainly analyzes the existing problems in the construction of the sharing and premium teaching repository, and then expounds the core thought, current application, deploying model and application prospect of cloud computing.

II. RELATED PROBLEMS ABOUT CONSTRUCTION OF SHARING AND PREMIUM TEACHING REPOSITORY

As a huge systematic project, the construction of sharing and premium teaching repository is chiefly divided into resources construction, resources management and resources utilization. For the time beings, there are still some highlighted issues as follows:.

a) Resource data is irregular, without unified standard, which results in many troubles for the data flow and share amongst various network devices or systems.

b) The enormous need for capital in prophase stage of infrastructure construction, off-speed updating, and repeat purchase of hardware and software bring about low utilization rate and a lot of waste of some devices.

c) Resource data works in an unsystematic manner, that is, value construction, but depreciate management. Through several years of data accumulation, the number of teaching resources has reach the order of magnitude of TB-scale and it is quite possible to grow continuously. Meanwhile, duplicated and chaotic storage of resources, lack of cleaning, screening and updating for those resources, and the slow pace of resource backup are very detrimental to the unified management of those resources.

d) Computer rooms are largely distributed and there are fewer rooms with advanced computers. Those low-end computers cannot satisfy the very need for the computers' high performance in some subjects, such as animation designing and producing, and computer network technology.

e) The utilization and sharing rate of resource repository is very low. Many information islands that isolated from each other are formed and, as a result, effective query and total share for teaching resources become impossible.

f) The searching service for the teaching materials, for example, the students' dissertations, is still not available because of the vast workload and time for arranging and typing those data of enormous size.

g) The teaching resources, like teaching videos, can be easily accessed in the school's LAN (Local Area Network). But, when the students or teachers are not in school, such as during the students' rotating internship, in vacation and travelling for business, they cannot use those resources.

III. THE CORE AND APPLICATION OF CLOUD COMPUTING

The core of cloud computing lies in unified management and scheduling of the mass computing resources connected by network, which comprises a computing pool to supply the

users with on-demand services. The network that provides resources is known as Cloud, where its resources are deemed as unlimitedly expanded from the users' viewpoints. That is, those resources can be available at anytime, used on-demand, expanded at anytime and paid by used traffic.

With the rapid development of cloud computing technology, cloud services feature high scalability, reliability, security and flexibility for the supporting system of rich Internet applications, especially the broader development prospect in implementing on-demand and improved informatization experience.

The industry of cloud computing consists of three levels: cloud software (SaaS layer), cloud platform (PaaS layer) and cloud device (IaaS layer).

In 2006, Amazon released EC2—Elastic Compute Cloud to provide corporation users with computer and storage services. The charged services of EC2 included used storage server, bandwidth, CPU, monthly rent and etc. The researchers and administrators can easily fetch comprehensive computing, storage, cluster and some other useful resources from EC2 and run their application software in the most open manner.

In 2008, Google released Google App Engine, known as representative of PaaS application. It is also developer-oriented that permit developers to write applications and deploy them under Google's underlying infrastructure. Meanwhile, it is very convenient for App Engine's users to create new services and run those services application in this cloud computing platform[3].

Recently, IBM released Blue Cloud that data centre performs computing task under the Internet environment by framing a distributed and globally accessed resource structure. Microsoft has also released Azure services which are deemed as an important platform against its competitors such as Google and Amazon in the next stage. SUN puts forward a plan named "Blackbox" to offer cloud products and services. AT&T signed Olympic Committee of United States to serve to the TV broadcast relays of Olympic Games by utilizing cloud computing. HP, Intel and Yahoo co-founded the "Experimental Platform" project to start cloud computing research. DELL and Facebook also plan to release cloud services jointly.

Certainly, some universities in China also have application plans based on cloud computing. For example, Zhejiang University hopes to build a smart campus and its Zijingang school district under construction now will be a test field. Lanzhou University has already started to implement a private cloud plan for integrating the school resources, not only including all hardware resources, but also a solid underlying support for the school's all kinds of services such as the digital library and the One Card Through Of the School. Sun Yat-Sen University's cloud system mainly provides integrate environment and portal services based on cloud computing, and builds service-oriented campus network of the next generation and virtualization-oriented data centre with high utilization rate.

IV. DEPLOYMENT MODE OF CLOUD COMPUTING

Cloud computing can be classified into Public Cloud, Private Cloud and Hybrid Cloud in terms of deployment mode.

Public cloud describes cloud computing that the pool of all cloud computing resources and capabilities is owned by a organization selling cloud computing services to the average people and corporate users. All services in the Public cloud are used by other people or organizations excluding its owner. Data security has risks because users' data is stored in cloud not the users' data centre. Meanwhile, the availability of the Public cloud is out of users' control, and thus there are also certain risks in it.

Private cloud is a kind of cloud that owned by an individual company or organization and all services are only used by the company or organization itself. Thus, data security and system availability in the Private cloud are totally in control. However, an obvious drawback is its huge just-for-once investment for construction [4].

Hybrid cloud is a composition of two or more clouds (private or public) that remain unique entities but are bound together by normative or proprietary technologies. Thus, multiple cloud systems in Hybrid cloud are connected in a way that allows programs and data to be moved or transformed easily.

Many features of cloud computing are in accord with the essential need of construction of sharing, premium teaching repository. That is, cloud computing, based on IaaS and PaaS, can be perfectly employed in an integrate platform of teaching information services geared to people at school. By means of open architecture, different faculties, professional local services, the average or industry public services, and the third-party public services can all be integrated to solve the problems occurred in construction of sharing, premium teaching repository.

The colleges-or-universities-oriented education cloud can be tried to adopt the deployment mode of Hybrid cloud. Though this mode poses a higher demand for the providers, it can reduce by a noticeable amount data risk in Public cloud and access inconvenience across platforms or networks in Private cloud. According to the Figure 1, utilization of rich and advanced Internet operation or service experience of big companies in Public cloud makes possible the storage of teaching resources in different platforms and networks. In addition, users can be free to download or use so many ready-made and ripe applications of all sorts owned by big companies. The Private cloud can then provide the students and teachers of this school with internal resources and services, and store those sensitive data of core competency. The existing mode is utilizing windows Azure of Microsoft to deploy Public cloud, and System Centre of Microsoft to deploy school's Private cloud rapidly.

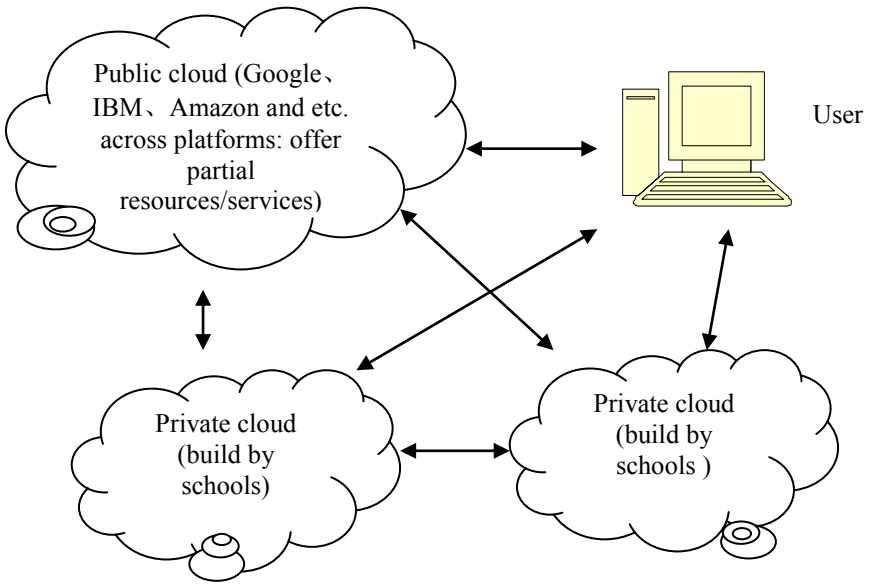

Figure 1. Model of Education cloud in colleges or universities.

V. VALUE ANALYSIS OF CLOUD COMPUTING IN CONSTRUCTION OF SHARING, PREMIUM TEACHING REPOSITORY

A. Cloud computing is favourable toward the decreasing input on school's hardware

Cloud computing can furnish approximately unlimited resources according to demand and end users don't need to prepare plans or budgets for computing capabilities. That is, users can gradually increase or replace hardware resources whenever necessary without considering capital input. Cloud computing offers its users with great flexibility of short-term resources using. For example, users can buy processing units by hour or storage capabilities by day, and easily release these resources when they recognize them unnecessary.

The TABLE I is the charging standard of Google App Engine. The charging standard of cloud services from another magnate Amazon is as follows: $0.15 per GB for storage space; $0.10 per hour for renting servers. From above we can conclude that the public cloud services offered by Google and Amazon are both good and cheap. One of the reasons Google can supply such superior services is the scale economic effects from its Public cloud computing service App Engine. In other words, larger scale, cheaper price, and the data centre scale of Google and Amazon is undoubtedly very huge.

TABLE I. The charging standard of Google App Engine

（DATA FROM HTTP://IT.SOHU.COM/20090225/N262445933.SHTML）

Charging Standard	Free Quota	Excess
Time	6.5 hours per day	$0.10 per hour/device
Data received	1GB per day	$0.10 per GB
Data sent	1GB per day	$0.12 per GB
Storage	0	$0.15 per GB/month
E-mail	2000 per day	$0.0001 per mail

A typical example can illustrate the prominent economic effect of public cloud service. The New York Times wants to supply free archive searching service by transforming more than ten million articles from 1851 to 1922 into the PDF form. By means of Amazon's cloud service, they complete all such work in less than 24 hours. The whole process only spends $240 and produce additional data up to 1.5T scale. You cannot imagine the awful long time to complete the same work by using the newspaper's servers, and even impossible [5].

The universities can supply different groups of people in school with cheap computing and hardware resources through cloud computing services, saving the school huge expanses in buying computers, network wiring, electricity supply, computer room management and labour costs. For example, teachers can set up a virtual laboratory with great computing capabilities to carry out classroom teaching,

which makes possible the 3D rendering in animation designing and producing that cannot be done in common computer room. And more specifically, if a 10-mintue animated film need to reach the quality of 30 frames per second and the average rendering time for each frame is 20 seconds, it will totally cost one hundred hours by using common computers. However, the time can be greatly reduced into merely 10 minutes by renting enough of virtual computers to perform cloud rendering.

B. *Cloud computing is favourable to reduce software cost*

By virtue of customized and application-oriented services, university can provide individual services for its users and integration of services and information. Software in cloud is available at almost any time, not existing version troubles of software updating. For example, Google Docs, like MS office online, can process and search files, spreadsheets and slides, and share those resources with other people through network. There is no installation needed to use these functions without charge only if you have a Google account. The virtualization technology in cloud can also be employed to setup some specially designated environments to teaching in terms of different subjects.

C. *Cloud computing can guarantee security of data storage*

One of essential technologies of cloud computing is data reliability and security. Chief carriers of cloud platform are tackling this issue about data lost and leakage. GFS (Google File System) has been specially designed by Google to store mass searching data. As shown in Figure 2, every block data has three default replicas that stored in different Chunkservers, and as a result lost data can be recovered instantly even if two storage blocks are both damaged [6].

Many cloud storage companies still supply special users with both the dynamic and static data encryption services. And certain companies, like Zetta, even set the data encryption as a default service. Thus, it can be clearly seen that the data stored in cloud is greatly guaranteed. Certainly, the very demand of sharing education cloud is to share some resources in public cloud. When it comes to sensitive data, we can store them into university's private cloud.

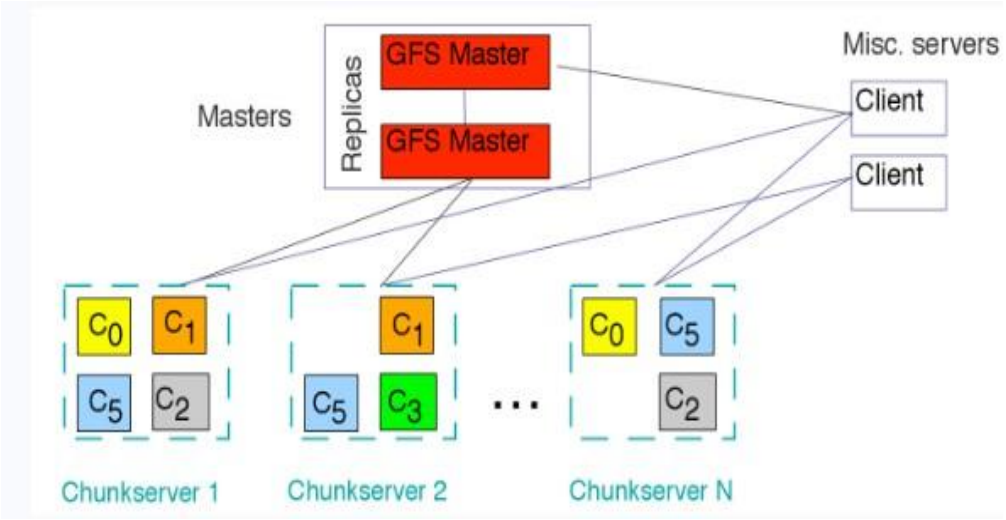

Figure 2. GFS architecture of cloud storage

D. *Cloud computing can improve user experience in using teaching repository*

Construction of teaching repository includes two aspects: teaching resources construction and networking courses construction. Only those teaching resources that are capable of running on a standard web browser can satisfy the need of teaching repository users. The sharing teaching resources based on cloud computing can offer unified digital resources and end users can arbitrarily access all sorts of teaching resources by means of non-stop searching. In addition, due to the low demand of cloud computing for terminal devices, users can use various portable devices, such as smart phone, PDA and ipad, to access teaching resources anytime, anywhere. Besides, there are several solutions available in aspect of user interaction. Given nearly unlimited bandwidth, for example, students outside or inside the school can equally experience fluent teaching videos, which thereby greatly encourages active learning, autonomous learning by means of information, and also largely improves the students' capabilities of analyzing and solving issues. By making great use of open resources, various kinds of web 2.0 services, like wiki or students' blog, and students' active participation, the distance between students and teaching repository has been shortened.

VI. CONCLUDING REMARKS

Owing to the special vales of cloud computing, education will embrace a drastic reformation; people's learning style will be changed; teaching resource platform will be profoundly influenced. Construction of teaching resources based on cloud computing can boost the utilization rate of

teaching resources and implement unified control for teaching infrastructure, such as the servers, network, storage and software. Effective regulation for teaching resources also reduces the cost to satisfy the green energy-conserving need. At the same time, centralization is quite favourable for system maintenance and operation support, and strengthens information security of teaching system as a whole and quick response for the need of teaching resources from different groups of people in campus. In a word, cloud computing is beneficial to upgrade in an overall manner educational work of higher vocational colleges, and will become a powerful support for building national key colleges and implementing education modernization. Application of cloud computing means a great deal to the construction of sharing, premium teaching repository in vocational colleges in terms of four aspects that hardware input, software input, data security and user experience. Thus, all statements above validate the excellent feasibility of cloud computing.

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