Chapter 250
Integration of Digital Campus Resources Based on Cloud Computing

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Abstract The Construction of Digital Resources in colleges and universities has the problem of duplication of information, idleness, wasting and so on. This brings low resource utilization and difficulty in resource retrieval. Cloud Computing, based on distributed processing and parallel processing, can provide strong reliability and more storage space, reduce costs, and improve service efficiency. Article gives the integrated digital campus solution, which is based on cloud computing resources. This resources integrated approach is university exactly need.

Keywords Cloud computing • Digital campus • Resource integration • Cloud storage

250.1 Introduction

With the development of the level of university informatization, various types of school data and information have been increased dramatically. The frequently used management system, such as finance management system and educational management system are often use different forms of data. With the growing amount of information, aggregation of data between systems, data analysis, and data management becomes very difficultly [1]. Cloud computing as a new form of services,

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if applied to the integration of digital campus resources, will be able to solve these problems well, and can reduce investment costs, simplified setup and management of complex tasks, at the same time, it facilitate to the sharing of teaching resources [2].

250.2 Cloud Computing

### 250.2.1 The Concept of Cloud Computing

Cloud computing is the result of the development of distributed processing, parallel processing and grid computing development [3]. Academia and different enterprise have different expression of cloud computing, but most are based on the fact that Cloud computing make full use of network computing and storage resources to achieve the objective of high efficiency and low-cost computing, hoping to integrate the Internet and information on different devices and applications well, so as to link all the computing, storage resources together to achieve the widest range of collaboration and resource sharing. The cloud computing for the majority of users is an environment with unlimited energy and high efficiency [4, 5].

250.2.2 The Principle of Cloud Computing

Cloud computing is built on the basis of the Internet, and its computing resources and storage resources are on the Internet, and the procedures for large computing are split into a number of small processes placed in a large number of distributed computers [6]. After calculated and analyzed by the system that consists of several distributed computers, results are fed back to the user. Figure 250.1 shows the simple principle of cloud computing.

250.2.3 The Point of Cloud Computing

1. Cloud data storage is safe and reliable. The data calculation required is not stored in user's computer, but stored in the cloud, thus ensuring data security.
2. On-demand service, low-cost. Cloud computing provides massive services and resources, and users can put forward request according to their needs, thus can reduce expenditure, and improve the efficiency of resource sharing.
3. Data sharing at any time, good scalability. The massive data and service in the cloud are available to users anytime and anywhere. That give full play to the advantages of the Internet sharing, and the open architecture can meet the growing business needs.
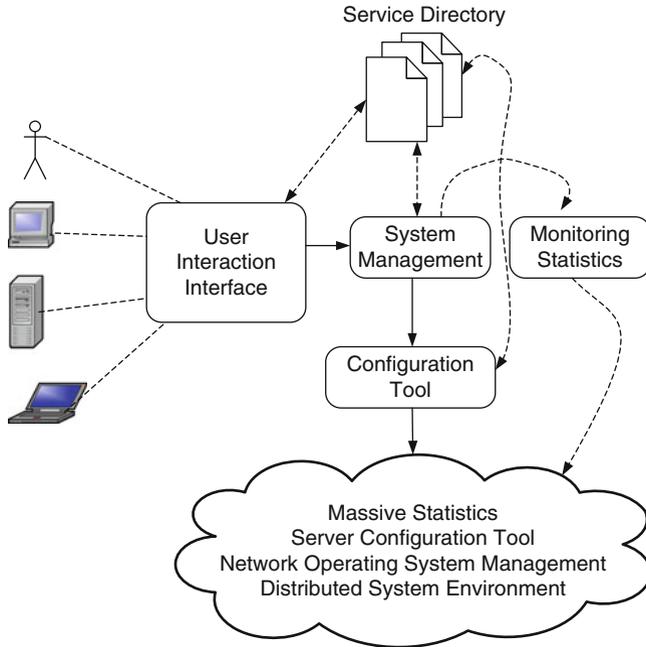
Fig. 250.1 The principle of cloud computing

4. Simplify the end user's hardware configuration. A variety of data and applications are placed in the clouds, so the end users can simplify their computer installation and configuration, thereby enhancing the user's work efficiency.
5. To integrate the network resources to meet needs. As the "cloud" has a certain scale, a variety of network resources are integrated and the users' needs could be met.

250.3   Integration of Digital Campus Resources

With the development of informationization on campus, digital resources are in large attention. Specifically, digital campus including the registry system, student management system, personnel management system, scientific management systems, digital libraries, office automation, IC card management system as well as teaching resources management system etc. Faculties and departments of campus produce and reserve large amounts of digital resources. However, time constraints, the lack of interdepartmental communication and the natural division of all departments caused duplication of the development, redundant construction and excess digital resources. Redundant construction even caused idle, wasting or

overlapping of digital resources and it brings a great inconvenience to the teachers and students who use these resources [7]. Integration of resources will process the scattered collection of idle resources and it can take full use of resources and conserve resources. The Integration of digital campus resources can create a platform for sharing information and resources for students and teachers to bring convenient campus life and enhance learning efficiency.

Every department collect as a large number of digital resources, the use of traditional methods obviously cannot meet the requirements of high efficiency, large volumes of data and high reliability. Therefore, cloud computing is a good way to integrate digital resources.

It will produce vast amounts of data resources over the time and it is unrealistic to store these resources by traditional media because of their high price. But the cloud storage has more memory than traditional media and fewer prices.

As the cloud data is distributed storage, digital resources are cut into blocks of data and stored in the node, but it also has a backup mechanism. It can ensure normal access when the data in a node is damaged. In storage of single point, it will affect system performance when users are excessive. With the advantage of the distributed storage the pressure is shared by nodes and the system efficiency is improved.

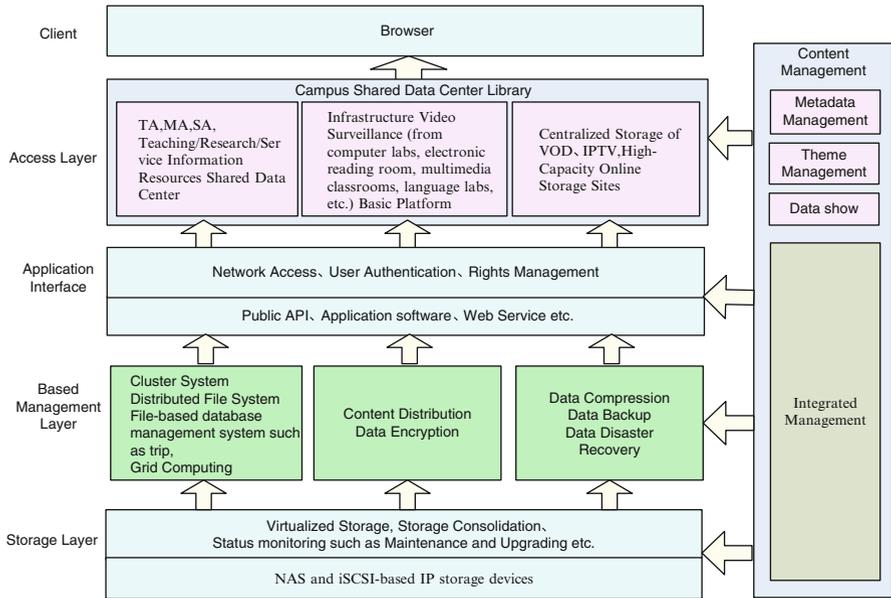## 250.4 Cloud-Based Integration Solutions

Based on the cloud framework, this paper presents an integration solution of digital campus resources. Because all the data stored in the cloud, the solution can solve the problems of data sharing and resources inequality effectively. Figure 250.2 shows the model of the integration solution.

It is clearly seen from the figure that the system is constituted by five layers: Storage layer, Basic management layer, Application interface, Access Layer and Client layer. Storage layer, Basic management layer and Application interface belong to systems integration management areas, the revelation of data and the management of metadata and the theme is encapsulated in the Access layer.

The explanations of the specific content of each layer are as follows:

1. Storage layer

The construction of Storage layer base on IP storage devices, such as NAS and iSCSI, and bring condition monitoring, including Storage virtualization, storage centralized management, maintenance upgrades. Above all, the Storage virtualization is the first problem should be solved. Storage virtualization means centralized management of the multiple storage media module, and the key of that is to let physical storage devices and the performance of its logical separated, that is, add a virtual layer between them. Let this virtual layer manage and control all storage, so that, from the perspective of the host and workstations, the storage device is not isolated, but a unified, high-capacity and high transmission performance of storage systems.

Client	Browser	Content Management
		Metadata Management
Access Layer	Campus Shared Data Center Library	Theme Management
	TA,MA,SA, Teaching/Research/Service Information Resources Shared Data Center / Infrastructure Video Surveillance (from computer labs, electronic reading room, multimedia classrooms, language labs, etc.) Basic Platform / Centralized Storage of VOD、IPTV,High-Capacity Online Storage Sites	Data show
Application Interface	Network Access、User Authentication、Rights Management / Public API、Application software、Web Service etc.	Integrated Management
Based Management Layer	Cluster System Distributed File System File-based database management system such as trip, Grid Computing / Content Distribution Data Encryption / Data Compression Data Backup Data Disaster Recovery	
Storage Layer	Virtualized Storage, Storage Consolidation、Status monitoring such as Maintenance and Upgrading etc. / NAS and iSCSI-based IP storage devices	

Description:
TA[Teaching Application] (Network classroom systems, distance learning systems, virtual laboratory systems, etc.) ;
MA[Management Appplication] (Student management system, personnel management system, educational management system, logistics management systems, scientific research management system, office automation systems, etc.) ;
SA[Service Application] (E-mail, FTP, BBS, bulletin boards, search engines, network drives, card, school portal, e-commerce, etc.) ;
Teaching Information Resource(Multimedia educational software, teaching materials, online courses,Academic, professional websites, etc.) ;
Research Information Resource(digital books, digital journals, CD-ROM databases, full text of the mirror database at home and abroad, domestic and international full image bibliographic / abstract databases, etc.) ;
Service Information Resources(WWW sites, legitimate software download, etc.) ;

Fig. 250.2 The model of integration solution

2. Basic management layer

Based management is including the cluster system, distributed file system, database system based on document management, grid computing, content distribution, data encryption, data compression, backup and disaster recovery and so on. The main purpose of this layer is to virtualize storage resources into a single file system that provides distributed data storage and the basic operation of the data.

3. Application interface

Application interface layer provides a common API interface, application software, Web Service, and integrate the function of network access, user authentication and rights management. This layer is a bridge between cloud and the end-user, so it needs to provide friendly service for outside. The Application interface is responsible for application system's calling on the cloud services and controlling the transmission of cloud data, so this layer is the most needed layer of security assurances, the high security of interface is the foundation of the whole system's smooth running.

4. Access Layer

Access layer refers to some service systems, such as teaching application, management application system. This layer provides the management of metadata and themes and can display the data. Metadata management is including the registration of tables and fields and updating database structure. The Theme Management is including the establishment of theme library and management of the theme object. The application of Access layer can call the service and data of cloud, so the system of this layer only need to consider the business processes without having to consider how to achieve too much.

5. Client layer

As a result of Internet-based cloud computing framework, end users need to access to cloud services through the browser.

6. Contentmanagement

The part sets from the perspective of system management, including metadata management, theme management, data display and system integration management. Metadata management including tables, fields for the registration and update the database structure. Theme management including the establishment of theme library and the management of theme objects [8]. The cloud data displayed in terms of the two-dimensional and multi-dimensional. In addition, to ensure system integration management solution should from the perspective of centralization of network systems.

Thus we can see the core thoughts of this system are stored vast amounts of data in clouds, then using cloud computing to provide users "cloud services". Clouds store data not only can save costs and rational utilize of natural resources, and also it can ensure that the data from the storage layer is reliable and availability which is centralized managed by the data storage layer for the use of maintaining upgrade and monitor the all process. The based management making digital resources into a virtual file system provides distributed storage for resource classification, backup and maintenance. Application interface layer to provide public API for upper layer and application software improve network access and user authentication. All digital resources in campus can publish in cloud services in the form of cloud services, depend on good user interaction interface, users can through the client browser anytime the needed to consult and search information, also can check the teaching resources, digital books that storage in cloud online, even can enter the simulation experiment environment simulation of professional experimental operation.

250.5 Conclusion

As a new distributed computing model potential, cloud computing can provide reliable, custom and maximize resource utilization services to users. Because the technology of Cloud computing is increasingly mature, its applications in digital

campus resource integration is an inevitable trend. The digital campus resource integration model in this article, which is based on cloud computing framework, can implement the sharing of network resources to the maximum and offer the simplest method to administrate the campus digital resources. However, cloud computing technology is still in exploration stage, something about security mechanism, coordination mechanism question remains risk. How to use cloud computing technology in the integration in campus more safely and efficient will be further research priorities [9–12].

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