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Library Construction in Nanyang Normal University based on Cloud Computing

¹Xing Wang, ²YiHua Lan and ³Chao Yin

¹School of Software, Nanyang Normal University, 473061, Nanyang, China

²School of Computer and Information Technology, Nanyang Normal University, 473061, Nanyang, China

³School of Computer Science and Technology, Huazhong University of Science and Technology, 430074, Wuhan, China

Abstract: Cloud computing is a super-computing model based on virtualization technology and serves in the form of supplying fundamental architecture, platform and software with the carrier of net. In this model, computer sources, including large-scale extensible computing, storage, data and application and so on, cooperate with each other. Cloud computing is widely held in esteem, for the feature that it can implement efficiency and complicated process and storing with minimized client, bringing us vast space for development. This study is based on introducing the conception, characteristics and the development of cloud computing. The purpose of this study is to build a more complete cloud services library system based on cloud computing technology, taking Nanyang Normal university as an example. The article analyzes both contents and characteristics of the digital-library users' requirements. Besides, it discusses the architecture of cloud service and the running mode. In addition, mass data processing, large-scale distributed storage and the technology of data structured management are also included in the discussing. All of them are used to design function modules of library service mode. At last, we introduce the cloud services platform of Nanyang Normal university library implementation process in detail.

Key words: Library construction, MapReduce, cloud computing

INTRODUCTION

With the rapid development of information technology and mobile network, a growing number of mobile devices have been connected to the Internet. As a result, a large amount of data needs to be processed which puts extra pressure on the internet system (Johnson, 2013). At the same time, the library is facing more and more severe challenges for the hacker's attack and higher hardware requirements. On the contrary, the form of information is becoming richer and richer. Documents, images, audio, video and other multimedia information become indispensable element in construction of library. It is hard to have a good use and control of this information to establish an easy to use, rich in content and information sharing of library. In this context, cloud computing (Vaquero *et al.*, 2009) based on the new service computing model of distributed computing, can completely meet the needs of future library construction which will become a new trend in the development of library.

Cloud computing is a kind of calculation model which distributes the computing tasks on the pool of resources which consists of many computers. Google, Amazon,

IBM, Microsoft and Yahoo are the pioneer of cloud computing. Someone called this mode Power generation which marks that Service providers can also provide Computing resources. Users should only pay according to the usage. In this way, Costs have been saving (Boulon *et al.*, 2008).

The cloud computing makes us have to think about how it will influence our library industry. Nowadays, as the third internet is flourishing, searching for innovations has become the most important problem that each industry has to consider. And the library industry is also included. Under this situation, it is important to expand some theory about the cloud computing, analyse how cloud computing influence the library industry, study the future development of the library and found the new library based on the cloud computing.

Promote innovative libraries and sort out the direction of libraries development. With the rapid development of information technology, people gradually into the third generation of the Internet era. The new information environment will trigger profound reform in the library information resources integration methods, storage of resources, library service concept, service content and means and the library will develop to the

broader information dimension to achieve a more wide information services development. Libraries should seize opportunities which cloud computing technology brings to carry on technological innovation. Through careful planning of the library development, we should design out a cloud technology library development strategy which meets China's national conditions and the trends of information technology. In order to seize the favorable position of the third generation of the Internet Information Services and break the monopoly of foreign counterparts over the years, we need everyone who committee to the libraries constantly innovate, because mastering core technology is the right direction of library development in the future.

Rich to expand the connotation of the library, library theory and practice research. Library itself is a product of the development of information technology, the development of library has been following the forefront of information technology and computer technology. With the development of library, the library has made great progress in the theory and technology. But information library must seek readers a more convenient way of service. The development of library has important theoretical and significance.

The core of library is not vast amounts of resources, but the ability to sorting messy information. But in the third generation of the Internet era, people want to obtain satisfied information service anytime and anywhere. The traditional library service model has been out of puff. Cloud computing technology will change the situation and build a new mode to make contribution to the world.

The rest of this study is organized as follows. Section 2 shows related works. The design and implementation of library is introduced in Section 3. We make conclusions in Section 4.

RLATED WORK

Cloud computing

Microsoft's cloud computing services platform-Windows

Azure: Microsoft's cloud computing services platform (DeCandia *et al.*, 2007) belongs to PaaS cloud computing model. PaaS generally intends to serve for software developers. There are two ways for traditional enterprises and users to develop and deploy their own applications: One is to buy and maintain their own infrastructure such as servers and a variety of desktop software which requires a lot of money and effort; Another way is server or virtual host renting, in which spending on the human and material resources greatly reduces, meanwhile users control of the backend server is also significantly reduced. Microsoft's cloud computing technology

effectively combined the characteristics of these two methods. The Cloud computing platform provides infrastructure including processors, storage devices and services that can be accessed through the Internet, users and companies can deploy their applications and data in Microsoft's cloud computing platform. The system uses HyPer-V virtualization technology, runs either local or cloud operating environment, supports many programming languages and deploys the improved SQLserver database which has less restrictive and achieves many functions. The number of virtual machines can be manually or programming-automatically increased. And application isolation is achieved since different applications are running on different virtual machines.

Amazon's cloud computing services: When it comes to cloud computing, there is an enterprise must be mentioned: Amazon. Amazon develops relying on e-commerce. With its accumulation of a large e-commerce infrastructure, advanced distributed computing technologies and the huge user base, Amazon entered cloud computing at an early time and had been a leader in cloud computing and cloud storage ever since. Amazon's Elastic Compute Cloud service is a basic platform of Amazon's cloud computing environment. Its main type of provided service is IaaS, PaaS and SaaS. Composition of service can be arbitrarily selected, the coupling is low. The system uses Xen virtualization technology and Amazon platform runtime environment in the cloud. It supports many programming languages. Users can run ECZ Oracle, SQLserver, etc. according to their need. Amazon's database SimpleDB is also available which has the least restrictive but realizes a lot of functions. The number of virtual machines can be manually or programming-automatically increased. And application isolation is achieved since different applications are running on different virtual machines.

Google APP engine: Google should be the biggest user of cloud computing. Google search engine distributes in a worldwide range more than 200 locations, consists of more than one million servers. And the number of these facilities is growing rapidly. Google APP Engine is a platform consists of Python application server cluster, Bigtable database and GFS data storage services. It can provide developers with an integrated, automatically upgradable online application services. Google APP Engine provides PaaS services type. All services are bundled together which has a high degree of coupling, but doesn't use virtualization technology. The operating environment of Google APP Engine is an environment provided by Google in the cloud which supports Python

and JAVA programming language, because there is a close link between Google APP Engine and Google's own operating environment, the underlying operating rarely involve and its more easy for users to start. Since, it's relatively easy to learn Python language, developers can develop their own procedures easily.

In summary, Amazon and Microsoft Azure Amazon ECZ may be more similar. User can make selections following their service needs. For example, a user with limited capital budget and unsophisticated functional requirements can select Google APP Engine. Meanwhile a user with direct manipulation of the underlying software requests should select the Amazon Anlazon ECZ. Users need offline perform operations can choose Microsoft's Azure. Therefore, it's necessary to explicit their needs before using.

Cloud computing library development: American Library scientist Michael Stephen includes cloud computing in the Top Ten Technology Trends of library community in his blog (Tu *et al.*, 2012) which is a symbol of the beginning of cloud computing technology entering library field in foreign countries. 2009 April 23th, online Computer Library Center (OCLC) announced the implementation of the library management services to web-level strategic. OCLC connect the global content, technology and expertise ability of its member libraries to create the first Web-class collaborative library services. World Cat bibliographic data, "Web-class collaborative library management services" is recognized as a cloud computing service. In July the same year, the U.S. Library of Congress announced a one-year pilot, in their national digital information infrastructure and preservation program to test cloud technology to permanently preserve digital content applications, we can expect that this trial will have a huge impact on cloud computing library applications (Xu, 2001).

The "Web-level cooperative library management service" launched by OCLC is an important landmark event of library community's accepting the cloud services (Miao and Yue, 2010). Its goal is to gather OCLC's force of innovation and collaboration in 40 years, to integrate the Web-level transmission and distribution, electronic resources, print resources and procurement and licensing agreement through the First Search, World Cat and etc. service. Currently OCLC provides cloud services involved most in the search for dynamic data, so it belongs to a cloud service based on dynamic data. Nevertheless, this is a large part marks of the substantive application of cloud services in library area including cloud computing.

The Dura Cloud project between Library of Congress and the Dura Space Company is an important witness of

further application of cloud services in library (Lopatin, 2006). Dura Cloud project provides data storage and access through cloud computing to organizations who don't need to make a local construction of technical infrastructure.

DESIGN AND IMPLEMENT

Architecture of library: The architecture of library in Nanyang Normal University is shown in Fig. 1.

Infrastructure services layer is the basement for cloud computing libraries in the bottom of the framework. It is the result of virtualization technology and the associated hardware resources after the integration of management functions which mainly includes two aspects. On the one hand, we do the operation of distributed cluster and virtualization process to the host, storage devices, network and other hardware devices, clustering them together to constitute the entire cloud computing and cloud services infrastructure to a unified whole. Users can get clouds hardware resources what they want by sending the agreed instruction issued without caring about which device they use. On the other hand, based on the available infrastructure hardware distributed cluster and virtualization process, it provides interface services of data storage management for calling and computing services management. It can provide dynamic and flexible infrastructure layer management services for the libraries.

The second layer of cloud services framework is library platform services layer which is known as management middleware layer. It is responsible for information resources management, program operation management, reader management and network security

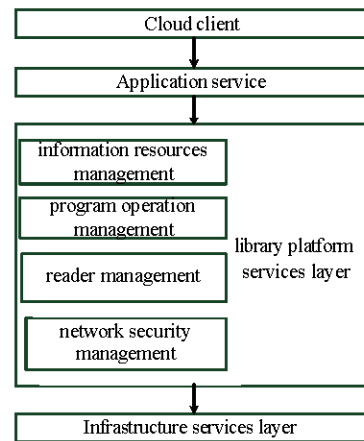


Fig. 1: Architecture of library of nanyang normal university

management. Information resource management is charge of using cloud computing information resource nodes in balance and monitoring information resource node failure. Once a node fails, the middleware layer will restore or mask the resource and count the resource usage. Program operation management performs the tasks submitted by readers or the applications, including the deploying and managing the images of the reader's task, scheduling, program execution, program feedback management. Reader management is an indispensable content to achieve cloud computing libraries, including providing user interactive interface—managing and identifying user identity, operating reader program and billing management. Network security management safeguards the security of cloud computing facilities to avoid attacks by hackers, including the reader's identification authentication, controls access and virus protection, etc.

Application service layer is on the third floor of the entire library service system and it is the core of cloud computing services. Application service layer provides library application software and services. According to the user's needs, the library software rents the software or application to readers by conducting service applications. The library provides the core services, including books management, digital asset management, public information service queries and so on. User right billing interface module supports the user management, privileges demonstration and platform for billing and payment. System management and business support module provides systems management and operational support to ensure normal and stable operation of the system.

Cloud client locates on the top of the cloud service framework of library, communicating with the cloud server. It is the reality carriers of the cloud service for users. It is no longer confined to the computer while it is any access to cloud services network PC browser, variety of mobile devices and TV set.

Implementation process: Nanyang normal university library will use centralized storage approach for storage system construction. All the data are unified management and unified protection which is the development direction of the storage system construction.

In this project, we configure disk array to store the data. The use of the disk array will make full use of new storage technology to support different storage need separately in the form of storage partitions. By the storage partition configuration, we can isolate performance between services and space contention to improve system performance and ensure data security.

Nanyang Normal University library needs to comply with certain procedures when using cloud computing

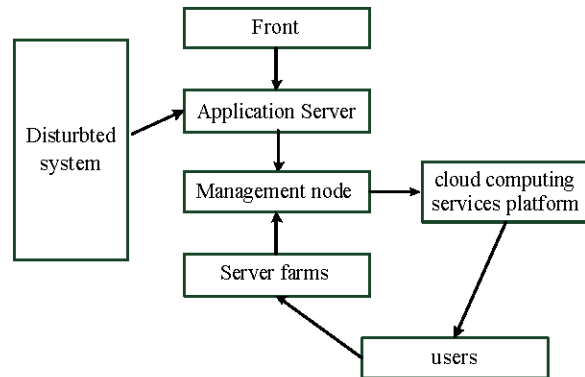


Fig. 2: Cloud services platform of nanyang normal university library implementation process

services platform programs. The operators are basically the same to provide cloud computing solutions. The Library cloud services platform implementation process is shown as Fig. 2.

Overall, cloud computing services platform implementation process was completed for the following four parts:

- **Front:** for load balancing, forwarding and static file requests forward
- **Application server:** The application server's main function is to run programs
- **Management node:** management node role is to provide complex applications start and stop billing
- **Server farms:** to provide various types of services, "these services are integrated together

CONCLUSION

In this study, a library construction based on cloud computing is acted as the research object and target, first the current development status of cloud computing and the research on the cloud computing research of overseas and domestic library circles are summarized, then architecture, workflow, service model and system functions of cloud services in library are adequately analyzed. And then we design a new cloud services system for library. Finally, we consider the construction of cloud computing services platform for Nanyang Normal University Library as a model to verify the feasibility and forward-looking in applying cloud computing to library.

Library construction based on cloud computing is a relatively new area of development. With further research, library based on cloud computing will also continue to develop and improve. Its development should show the following trends:

- Establishment of standards for library cloud service system. Currently library cloud service based on cloud computing was still in test, lacking in the unified national standards, solutions devised by different library federation may be totally different and incompatible. In the future national library will develop towards a unified cloud services platform, forming a unified cloud virtual platform which its utilization efficiency of resources will have an unprecedented increase
- Integration of Cloud Computing and Grid Technology. Although there are many functional advantages of cloud computing, but we can also clearly see its disadvantages. Integration of cloud computing and grid computing is an important development tendency of future cloud computing

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