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# Study on Cloud Service Mode of Agricultural Information Institutions

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**Abstract.** As a new service mode, cloud services become the growth point of the service innovation of agricultural information institutions. This paper presents three-layer cloud service model of agricultural information institutions which includes infrastructure layer, automated management system layer and service layer from bottom to top. Based on this model, this paper studies the cloud service mode and construction content of agricultural information institutions from four angles of IaaS, PaaS, DaaS and SaaS. Finally, the cloud service mode facing internal member institutions and readers of the national science and Technology Library is designed to verify the cloud service model.

**Keywords:** cloud computing, cloud services, agricultural information institutions, service mode, IaaS, PaaS, DaaS, SaaS

## 1 Introduction

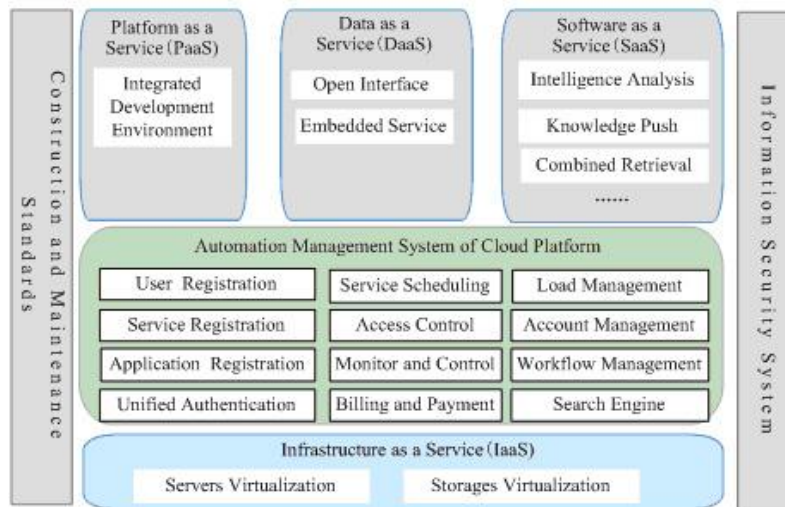
With the development of cloud computing technology, the cloud service application research becomes a hot issue. As a cloud service guide, Google puts forward a complete set of distributed parallel cluster infrastructure according to the characteristics of the large scale network data. And Google provides a series of SaaS for individual users and enterprises including the Google search engine, Google maps, photos&videos sharing, social networks, Gmail, Google calendar, Google Apps Market place and so on. As a non-profit and the world's largest library cooperation organization, Online Computer Library Center (OCLC) launched the Web collaboration library management service cloud in April 23, 2009. And OCLC provides a full set of cloud computing library information management service such as joint cataloging, interlibrary loan, WorldCat.org, WorldCatLocal, Questionpoint, CONTENTdm, circulation management, procurement management, and copyright management. China Academic Library & Information System (CALIS) joined nearly 800 university libraries to open the SaaS including E read, current contents of western journals(CCC), unified authentication system (UAS), interlibrary loan (ILL), distributed collaborative virtual reference system (CVRS) and the unified data exchange system (UES) (Wenqing Wang et al, 2009). Baidu Inc opens their own core

cloud capabilities to provide a series of cloud services and products such as Personal cloud storage(PCS), Site App、mobile test cloud (MTC) and Baidu application engine (BAE) for the developers and users.

Agricultural information institutes own rich resources and strong talent team. And they should undertake the social responsibility to provide high quality and efficient service for agricultural users. To apply cloud computing technology, resource utilization and service efficiency will be enhanced obviously.

## 2 The Cloud Service Model of Agricultural Information Institutions

To design the cloud service model, agricultural information institutions should evaluate the existing software and hardware facilities, technical strength and financial support comprehensively. Three factors are very important for the cloud service hierarchy. Firstly, it should be guided by the principle of applicability, economy, maintainability, safety, reliability, scalability. Secondly, it should be based on the standards system. The last but not least, it should be supported by the operation maintenance and security system. The hierarchy includes infrastructure layer, automated management system layer and service layer from bottom to top. The relationship and structure are shown in figure 1.



**Fig. 1.** The Cloud Service Model of Agricultural Information Institutions

The IaaS layer is the underlying structure of the three layer cloud service model. This layer consists of some hardware facilities such as the cloud computing cluster equipments, cloud storages, cloud network transmission equipments and cloud physical resource management servers. The server, database, memory, operating system, I/O equipment, storage and computing power become a virtual resource pool by virtualization technology. Thus the virtual resource pool can provide the resources on the basis of calculation, storage, network and a single operating system etc..

The automated management system layer is the underlying service based on IaaS. The layer includes a set of middleware service such as user registration, service scheduling, unified authentication, search engine, load management, unified authorization, log statistics and service register.

The service layer is a set of services based on IaaS layer and the automated management system layer. This layer consists of PaaS, DaaS and SaaS. PaaS provides the cloud application development platform which includes application development, application testing and application hosting. DaaS provides data service for users by the open interface. SaaS is a software application model which provides cloud application service by the Internet transmission (Chen Chen et al., 2012).

### **3 The Cloud Service Mode and Construction Content of Agricultural Information Institutions**

Cloud service requires not only depth investment in hardware and virtualization software but also high-level technical staff. So agricultural information institutions should be guided by the demand and focus on DaaS and SaaS.

#### **3.1 Virtualization of Hardware Resources as IaaS to Improve Resource Utilization**

For internal business, the existing hardware equipment should be deployed and managed by virtualization to provide a basic customized platform Including CPU, memory, storage, network resources etc.. Based on the platform, users can deploy and run the operating system and applications. Data center is responsible for hardware maintenance, resource allocation and operation monitoring. The construction mode of combining the business solutions and self-developed scheme should be adopted. Construction steps are proposed to implement step-by-step according to the demand of business and cloud computing technology study.

#### **3.2 Building the Integrated Development Environment as PaaS to Improve the Management Efficiency**

For internal developers, the integrated development environment based on virtualization should be built to manage unified development, storage, testing etc.. By integrating the procedures and tools including database, Web server, network storage space, package class libraries, third party application module, debugging tools, version control etc., developers can use the highly reusable architecture.

### **3.3 The Data Access by Opening Data Interface as DaaS to Produce the Advantage of Agricultural Information Resources**

After many years of accumulation, agricultural information institutions have owned rich research achievements and information resources. Agricultural information institutions have also the social responsibility to help those public service institutions which have not full resources and sufficient funds in order to carry out effective information service and enhance the value and influence of information resources. Standard interface can be opened for the domestic public information service institutions or group users. Users can embed the information resources into their local information service platform by standard interface. The query submitted by the user can be dynamically mapped to local and remote information sources so as to achieve one-stop access to local resources and remote resources.

### **3.4 Opening Software as SaaS to Make Full Use of the Software Resources of Agricultural Information Institutions**

Agricultural information institutions should play their technology advantage to provide the network software with independent intellectual property rights as renting services for the organizations which have not strong technical strength. SaaS can carry out from three aspects. Firstly, only software can be rented and databases are constructed by users own. For example, users can rent the web content management system, scientific research projects management systems etc.. Secondly, software and data can be rented together. This is using software based on databases. For example, users can rent the intelligence analysis system, knowledge service system etc.. Thirdly, several institutions establish the sharing system together. The one which owns stronger technical strength provides software and all institutions co-construct data resources. For example, many libraries carry out joint reference, the original offer, check by services and so on (Xiaobo Xiao et al, 2012) .

## **4 Application Case**

National science and technology library (NSTL) is a united service organization of national science libraries in various fields covering science, engineering, agriculture, medicine. After 10 years of development, NSTL has developed a number of application systems with independent intellectual property rights, more than 40 databases and 180 million records. With the development, the current main business of NSTL is stable (Xiaodong Qiao et al, 2010). But new service mode is needed to improve the utilization and the competitiveness of resources, to reduce the maintenance cost of equipment and personnel, and to reduce the workload of system maintenance.

According to the existing conditions and future development goals, suitable cloud service mode based on the cloud service model of agricultural information institutions is designed for the internal member institutions and the readers. Firstly, IaaS is provided for internal business by virtualizing servers and storage devices. The third

phase system, traceback system, citation system, monitoring system can be deployed in a virtual machine to guarantee system continuity effectively. And new applications can be deployed quickly so as to improve work efficiency. Secondly, by establishing virtual centers and virtual service stations, integrated development and operation environment as PaaS is provided for 9 member institutions and 50 service stations all over the country. The management efficiency is improved greatly and the performance of NSTL platform is improved. Thirdly, DaaS is provided to public information organizations in china by the open standard interface. Thus the organizations whose resources are not full and funds are not sufficient can access to NSTL resources more conveniently. Forth, softwares with independent intellectual property rights are made full used as SaaS. Federal libraries can use information analysis tools and knowledge service tools based on federate databases.

## **5 Conclusions**

As a new service mode, cloud services become the growth point of the service innovation of agricultural information institutions. However, limited by the technology, cloud platforms provided by the current domestic IT manufacturers need the same physical equipments in brand, machine model, configuration and so on. Thus the original brand equipment can be not used, which is contrary to the original intention of resources conservation of cloud computing. So cloud services should be guided by the demand and constructed in accordance with the principle of pilot first, implement step by step, steady transition, comprehensively promote. And the construction of talent team should be strengthened and specialized technical personnel should be fostered to keep track of the development of cloud computing technology sustainably so as to make technical preparations for large-scale cloud services.

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