Design and Implementation of University Intelligent Library Based on Cloud Computing

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Abstract: With the development and wide application of the internet, the cloud computing technology with powerful functions has been initially applied in the fields of industry, agriculture, scientific research, medical treatment and so on. Its technical advantages undoubtedly bring the development power to the library. Intelligent library is the advanced form of intelligent library. Cloud computing service makes the user's data storage and application software in the operation of the internet server, which makes the library network data high integration, intelligent and efficient. On the basis of discussing the basic meaning of cloud computing, we build a cloud service platform of Intelligent library and put forward the architecture design of modern and information-based intelligent library in the cloud computing environment. This paper discusses the function realization of university intelligent library based on cloud computing to provide some references for the innovative paths of university reader service in the new era.

1. Introduction

In recent years, with the rapid development of cloud computing technology in China, there are more and more related products and solutions. Many national cloud computing bases or service centres have been established in China. The application and practice of cloud computing technology in university libraries have also gained some experience. Cloud service can not only provide a good platform for the library to save, calculate and other functions, but also make use of cloud service, a special service, to solve and deal with problems and businesses, which to a certain extent reduces the cost of purchasing books and the labour cost of making books. Cloud computing technology uses the same platform to manage all kinds of different information books in the library, so as to accommodate more network information. Of course, these application problems and data management can be shared. With the help of the fast cloud computing, the library also uses the web service to upload to the cloud, so that readers can easily share and change the service. The Internet service is a software program system that connects every machine on the Internet. Therefore, the library should not only provide relevant services for people like the traditional model, but also provide various services for the machine, which has no vitality. This service includes providing a platform, institutional repository, data storage resources and other related open resources published on the Internet. We have built a description mechanism system for resources, which perfectly penetrates into other websites and shares their resources. There is no doubt that this will be the domain expansion of cloud computing, a new application system. Through the construction of intelligent library service platform, we can efficiently and intelligently choose for users or directly provide them with the most targeted book information.
2. Cloud computing and university intelligent library

2.1 Cloud computing technology
In essence, cloud computing technology is an organic combination of virtualization technology, infrastructure and services. The core is to provide users with services of renting computing resources after virtualizing the computing resources of one or several data centres. Cloud computing includes cloud platform and cloud service. Cloud platform refers to the website that provides resources, and cloud service refers to the service that can be elastically extended based on the abstract underlying infrastructure. Cloud computing can realize the scale and concentration of resources. The construction and operation and maintenance of cloud computing system are completed by operators, so that ordinary users such as schools can focus on their own business and improve the efficiency and flexibility of information construction. For different user object ranges of cloud services, we can divide cloud computing into three types according to deployment mode: public cloud, private cloud and comprehensive cloud. Public cloud refers to the cloud that provides some services needed by others. All the services he owns are provided for others, not just for himself. For users, the biggest benefit of public cloud is that all its things are stored in the provider of the service without any investment and transformation. Private cloud means that enterprises use their own cloud services, and it will not give services to others, but only to their own internal staff or their own branches. Private cloud is more suitable for large enterprises or governments with more branches. Comprehensive cloud refers to the cloud service that you and your customers use together. It can be used by others or yourself. By contrast, it requires more from providers.

2.2 University intelligent library
In recent years, many scholars in the field of library have focused on the theoretical research and practical exploration of intelligent library, and have made a series of achievements. The intelligent library should embody the characteristics of comprehensive perception environment, complete network interconnection, massive data support, free learning atmosphere, personalized service, etc. According to the requirements of such characteristics, there are few cases of Intelligent Library in the real sense at present, that is, no library dare to claim that it has been built, but we must see that the construction of intelligent library has entered the practical stage from the concept. Relying on the development of modern information technology, many libraries have begun to plan and build intelligent libraries. According to the current theoretical research results and partial construction practice of intelligent library, the goal of building intelligent library is very clear. We want to build a perfect intelligent perception environment and comprehensive information service system for readers, so as to provide personalized services to users by role. We will deepen the information service from the computer network into all the service categories of the library, complete the interconnection between the library and the network, the library and the library, the library and the document information resources, the library and the user, and build a multi-dimensional information acquisition and sharing platform across time and space. Through the intelligent perception environment and comprehensive information service system, we establish a channel of communication and mutual perception between the library and resources, between the library and users, and even between users and users. Intelligent library is the inevitable result of the development of intelligent library and the advanced stage of intelligent library construction. Cloud computing and Internet technology provide basic idea support and technical support for the transition and development of intelligent library to intelligent library. Intelligence, high efficiency, intelligentization, networking, personalization and sharing is a realm that intelligent library service should reach.

3. Framework design of university intelligent library based on cloud computing
At present, the library generally adopts three kinds of technologies for data storage: direct attached storage, network access server and storage area network. However, with the growth of massive data, various data types, complex structure, limited storage capacity and capacity of disk equipment,
traditional technology is difficult to meet the needs of data backup, expansion and recovery. Cloud computing technology based on big data establishes "intelligent cloud library" for University Intelligent Library, realizes resource sharing of all kinds of collection information in the cloud, and improves the utilization rate of data. Cloud computing combined with traditional computer and network technology can provide platform as a service (PaaS), infrastructure as a service (IaaS), software as a service (SaaS) support for big data analysis and decision-making of Intelligent Library. The cloud service platform of University intelligent library is divided into three levels: user layer, cloud service layer and resource layer. The resource layer mainly includes all kinds of paper resources, intelligent resources as well as remote electric database or electronic resources with use authority; storage and operation of resource information and scheduling and load of user resource information Balance is managed by IaaS layer. IaaS resource pool is mainly composed of CPU, storage and network entity layer and virtualization layer composed of application, computing and server virtualization. PaaS layer classifies, stores and publishes all kinds of library resources to provide effective personalized services for users of Intelligent Library. SaaS layer directly provides software services by Internet and users directly Then rent the network software provided by the cloud service provider to manage the personalized business activities, and the later software maintenance and management are carried out by the service provider. In this mode, the library administrators do not need to manage and control the infrastructure, operating system, network and server of the lower layer, but only manage and control the application security of the operating layer. The framework of university intelligent library based on cloud computing is shown in Figure 1.

![Figure 1. Framework design of university intelligent library based on cloud computing](image)

In addition, with the popularity of mobile intelligent devices, the cloud service platform of Intelligent Library is used to realize the sharing and switching of intelligent resources among different intelligent terminals, so as to meet the requirements of information resources acquisition and information services for university users. In a multi network environment where the same user has multiple types of terminals. In order to enable users to easily choose a terminal device, the intelligent library supports the mobile access platform of intelligent identification, and focuses on the research of intelligent identification and selection function, and puts forward the solution and implementation scheme of intelligent selection, which makes it possible for network teaching resources to realize intelligent selection among multiple terminals in the heterogeneous network environment. In the network environment, when the same user has multiple and types of terminal equipment, it is convenient for the user to choose a terminal equipment as a learning tool, accept the network teaching resources for learning, and provide a multi
terminal mobile network library for the intelligent identification access platform. The architecture of university intelligent mobile cloud library based on cloud service platform is shown in Figure 2:

![Figure 2. Framework design of mobile intelligent library based on cloud computing](image)

Based on the above platform architecture, the intelligent library can design the following basic functions. The data collection of intelligent library system is a data import solution based on large capacity messages and events. It not only collects the information of books, but also readers' identity information, readers' account data, various equipment information, library space and environment information, even the data of the third-party database and other heterogeneous data. For structured and unstructured data of different formats, the system provides a variety of data source management and format conversion as well as temporary storage services for original data; its core capabilities include data channel management, data source management and data format conversion. The intelligent library system based on cloud platform can manage the latest resource information, environment information and service information such as collection information, circulation information, bibliographic data and transaction data through the system. All kinds of heterogeneous systems are audited according to unified standards, and only the audited data can be displayed. The data management function can not only store all kinds of data, but also enrich the database system of daily operation data, and integrate the data warehouse of different historical data and current data. The intelligent library system classifies and integrates the data from different sources. Integrate application systems including interview data, consultation data, literature collection, data resource retrieval, information reference consultation, education and training, conference and exhibition, intelligent processing, etc. Intelligent Library has a business intelligence search engine for structured data, unstructured data and streaming data.

4. Functions implementation of university intelligent library based on cloud computing

4.1 Accurate and active service

Through the wireless ubiquitous network, the intelligent library can understand the readers' reading needs and habits at any time, grasp the readers' behaviours and trends at any time, analyse the readers' behaviours and habits through various data analysis tools, grasp the readers' future needs and possible needs, and provide accurate and complete demand solutions for the readers through big data, cloud computing and other analysis tools. The scheme makes the content of reader service more refined and precise. Through the wireless ubiquitous and mobile Internet network, the intelligent library can serve anyone in any way, so that readers are not limited by time and region, and provide readers with all-round and integrated services, so as to make the service object wider, the service area wider and the service content wider. The ubiquitous wireless network has changed the readers' reading needs and habits, changed the ways of acquiring information and knowledge, and changed the readers' service work in the
The ubiquitous network environment has brought great enrichment and access to information resources, changed the traditional service concept of valuing storage rather than use, fully explored and integrated network resources, increased knowledge and the development and opening of information resources provide readers with convenient ubiquitous services. We expand a variety of new services on the basis of traditional services, such as user experience services, intelligent academic space, vertical portal services, reservation services, cluster services, etc. We can also carry out various services of the library in a variety of flexible ways, such as network communities, blogs, microblogs, etc., to achieve knowledge sharing and information exchange between various groups. The most important thing in the library is information resources, especially digital resources. After the establishment of the smart library, all resources will be centralized in the cloud and integrated for unified management and push, fully realizing the data exchange and sharing of all resource systems. It solves the problem of lack of technology in the library in the past, the need to purchase network equipment such as servers and switches separately. Intelligent library based on cloud computing greatly improves resource utilization efficiency and response speed.

4.2 Characteristic resource supply service
The construction of characteristic resources is an important part of the construction of the intelligent library in Colleges and universities. It is a planned and purposeful way for the library to gradually form a collection structure and system different from other libraries around the characteristics, development plans and goals of the disciplines and specialties of the school. Its core purpose is to effectively carry out comprehensive services for the teaching and scientific research work in colleges and universities. Under the cloud computing environment, the focus of the construction of intelligent library resources in colleges and universities is the construction of characteristic resource library. In the process of resource allocation and characteristic resource construction, we should comply with the demand of knowledge economy era, and pay attention to the coordination of the comprehensiveness, similarity and supply speed of cloud information data. Intelligent library provides users with one-stop centralized service. Users only need to register and log in to the cloud platform interface through a unique user name and password. After entering the interface, they can operate the same as the traditional computer, and through search, they can enjoy all the public resources in the cloud. People's biggest wish is to be able to act according to their own wishes. In the intelligent library, users can get and apply resources as they wish. With the continuous development of wireless networks, users can really enjoy cloud resources and information at anytime and anywhere in the future, as long as you want. In addition to improving common services, the pursuit of personalized services is one of the driving factors of library services. The establishment of the intelligent library provides better personalized services for readers.

4.3 Virtual subject embedded service
One of the important tasks of university intelligent library is to provide professional knowledge service. Compared with the past subject service, embedded subject service is to transfer the service focus from the library to the users, establish the characteristic service concept, form the specialized service mechanism and build the professional subject knowledge platform guided by the user's professional subject demand. Cloud computing technology is also applied to the subject embedded service of the library. The following aspects should be achieved: first of all, build the subject service team from the application reality, develop the virtual embedded subject service process and service strategy, develop the service assessment and incentive methods, and establish the virtual embedded cloud subject service system. Secondly, cloud discipline service should break the boundaries of time, space, content and mode. Do a good job of user information demand research, and win the trust of users in a unique way. For example, subject librarians can use many tools to create instant communication, asynchronous communication and common cooperation, use RSS to realize resource aggregation and push, and use technology to realize virtual network services such as subject featured navigation. Finally, in the virtual subject embedded service, the professional ability and service level in the library are precipitated, the entry point of service is constantly improved, the connotation of subject service is enriched, the deep
information demand problems in user learning, teaching and scientific research are truly solved, and the service based on knowledge unit is provided, so as to promote users to tap and utilize knowledge and form a harmonious cloud interactive service relationship. Using wireless networks and wireless terminals, it can provide readers with various types of personalized services, such as personalized customization, push, retrieval, collection, knowledge management and other services, as well as personal historical information management and personal account management. With cloud computing technology, user-defined functional service types can be realized, that is, users can choose the content they want to open and the type of information they want to receive according to their own specialties and hobbies. The mobile library system can also set up various columns, such as loan expiration reminder, appointment to library reminder, overdue reminder and reminder.

4.4 Cloud user interaction service
Under the cloud computing environment, the characteristic service resources of university intelligent library include internal resource service, external resource service and user-built resource service. Users in the cloud can build their own resource library under the copyright protection, and users can apply, analyze and evaluate resources on the library portal. The service process of cloud computing intelligent library in universities includes service discovery, service mining, knowledge service and sharing, etc. Service discovery is carried out in the interaction with cloud users; service mining is based on personalized mining of cloud user behaviour, and user participation is necessary. Through the collection of all kinds of information resources of cloud users, especially the collection and analysis of unstructured data information, the teaching and research trends can be accurately obtained. The main body of knowledge service and sharing is cloud users. From the discovery and organization of knowledge to the collection and development of knowledge, the integration of knowledge service needs the participation of cloud users. Therefore, in the cloud computing environment, it is in line with the characteristics of the university library to carry out the interactive service of cloud users. In the process of linkage service, we should strengthen the role of cloud users' participation, cultivate the ability of cloud users to learn knowledge and use the cloud computing technology to use the library, establish a one-stop, virtual integrated service with two-way coordination, learning and interaction, and make the service develop towards specialization, discipline and personalization. In the era of intelligent library, all kinds of service resources, including collection resources, open access resources, network resources, institutional knowledge base, personal knowledge base, community information, can be interconnected through intelligent design. Various resources can be integrated, processed, classified, processed and stored in the cloud library by using intelligent technology. Through the wireless ubiquitous network environment, on the basis of comprehensive perception, one-stop access can be carried out anytime and anywhere to provide intelligent cloud services for readers. In this way, it can greatly expand the service resources of university library, enrich the service resources, and make the utilization rate of resources higher.

5. Conclusions
The increasingly mature and popular application of cloud computing technology provides conditions for the creation of intelligent library. The research of intelligent library should not be limited to the theoretical discussion, we must transfer the research focus to the practice of the establishment of intelligent library, and carry out in-depth and systematic research on the technical issues, platform construction, resource access and related policies, standards and specifications involved in the construction of intelligent library. The research of intelligent library should be based on the reality of digital library development in China to integrate new technology, achieve high intelligence and create high efficiency. The intelligent library can't be the island of information. We should strengthen the communication and cooperation to realize the exchange of information resources of different intelligent libraries.
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