

Research on the Construction of Digital Library Platform Based on Cloud Computing Technology

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Abstract

The Digital Library has begun to enter the Cloud Computing era after experienced the Internet era, Web era, grid era and Web2.0 era. Construction and management of digital libraries using cloud computing technology, can effectively utilize resources, reduce costs, achieve better information sharing, and improve the service function of libraries. Based on analyzing the advantages of digital library in cloud computing environment and the issues needed to be solved by digital library platform, the target system model of digital library platform based on Cloud Computing were put forwards, and the three layer structure model(model data lawyer, control algorithm layer and application layer) were elaborated in more details

Keywords

Digital Library; Cloud Computing; Construction of Platform.

1. Introduction

The digital library is a product with the development of library and information science, network technology, storage technology, multimedia processing technology and data mining technology. The digital library is the entity that collects, arranges, stores, issues and utilizes the information in digital form. Once the “digital library” concept was proposed, it has been widely concerned. China formally put forward the concept of digital library in 1996 and began the research and construction of digital library [1]. Now it has begun to take shape. With the development of information technology, especially the emergence of cloud computing brings great change to digital library. Cloud computing in libraries reduces technological costs, increases capacity reliability and performance, while limiting computer user maintenance. Special, historical and rare documents can be scanned and stored in online database through local area network (LAN) – networks for easy access and use [2]. This paper mainly discusses the system model of the general digital library platform under the cloud computing environment.

2. Cloud Computing and Its Working Principle

Cloud computing was firstly proposed when Google CEO Eric Schmidt expounded the Google business model in 2006. Then the concept of cloud computing was widely perceived. As a new research and application field, it has obtained the high attention of academic circle and industrial circle [3]. In general, cloud computing is a computer tool for distributed processing, parallel computing, grid design, virtual access and mass data processing. It has large scale, virtualization, high reliability, versatility, high scalability and other characteristics [4].

The working principle of cloud computing, according to different manufacturers and engineers to define, cloud computing model can be divided into software as a service, utility computing, network services of cloud computing, managed service providers, service business platforms and network

integration model [5]. Working principle is by distributed on the computer of the network to simulate large-scale supercomputer to calculate. The running of library management data centers is similar with network running, so that the library service resources can be switched to the desired application, depending on different demand access to different computers and storage systems, cloud computing working principle is shown in Fig. 1[6].

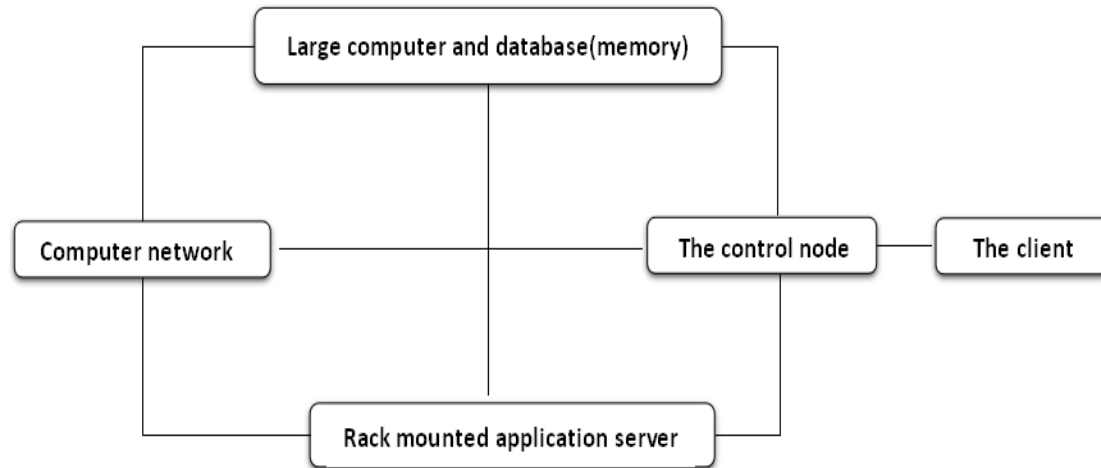


Fig. 1. The working principle of cloud computing

The researchers in computer and information technology, library and information science fields carry out a large number of research about cloud computing from different angles. The research on cloud computing of the domestic and foreign library and information fields mainly includes [7]: 1. The definition of the connotation and characteristics of cloud computing and other basic theories; 2. The challenges brought by cloud computing for the library in information security and application mode; 3. The application of cloud computing in the library, the digital library cloud computing model and other aspects. Especially, as a kind of information technology infrastructure and computing framework, the cloud computing can not only provide the basic hardware and software platform for the construction of the library information system, but also provide new environment for the sustainable development of library and information service. It especially provides referential research ideas and technical references for the construction of large-scale distributed digital library.

3. The Advantages of Digital Library in Cloud Computing Environment

First of all, cloud computing can help the university library to conduct information resource sharing to a greater extent, help teachers and students in various schools to obtain real-time library information and better meet the information needs of users; secondly, the cloud computing enhances the business processing ability of digital library with the needs[8]. So the computer can obtain more network bandwidth and computing power in access peak and return it back in leisure time, so as to realize the dynamic management of business; in addition, the cloud computing uses enormous data resources and computing power to provide personalized service for digital library. Under the premise of ensuring the privacy, it analyzes the browsing, borrowing and retrieval records of users through behavior pattern, pages access and other information, and provides more perfect personalized service; meanwhile, it can reduce the construction and maintenance costs of digital library. The library staff don't need to maintain, upgrade and update the library computer and server usually. Namely, the large-scale investment is not required and they only need less cost to rent the data storage, retrieval, network access and other services of cloud computing, so as to realize the payment by service procedure adopted.

4. The Problems to be Solved by Digital Library Cloud Platform

The universal platform of digital library based on cloud computing is the collecting and distributing center of excellent knowledge resources. It is a knowledge center without time limit, which is easy to

use. And it can realize the crossing-base seamless connection and intelligent retrieval. In order to reduce the construction cost and realize the hyperspace and barrier-free communication for rich and colorful multimedia information, several problems of the universal platform shall be solved.

First of all, The versatility of the platform needs to be addressed. The digital library platform shall meet the generality needs of various types of digital library construction projects. Furthermore we should analyze the generality needs of the construction of digital library and abstract them as independent minimum functional units; secondly, The digital library platform shall adapt to the special application environment of different users. The builders of digital library can define the feature of platform through a certain mechanism in order that it can be adapted to the actual situation; thirdly, how does digital library platform express resources, how to describe the meta-data information of the resource, which way is used to browse resources and how to edit resources. All these questions need to thorough research; finally, the constructed digital library with the use of platform shall not be isolated digital library. The digital libraries shall acquire and browse information each other through certain communication mechanism, provide the system expansion application interface and achieve an unified system entry.

5. The Target System Model of Digital Library Platform

Digital library platform is a transparent digital library service platform for users built on cloud computing. It can not only provide different end users with differentiated user interface service, but also provide the corresponding interface. And it provides support for the application program developed on the basis of the platform. The system model is shown in Figure. 2.

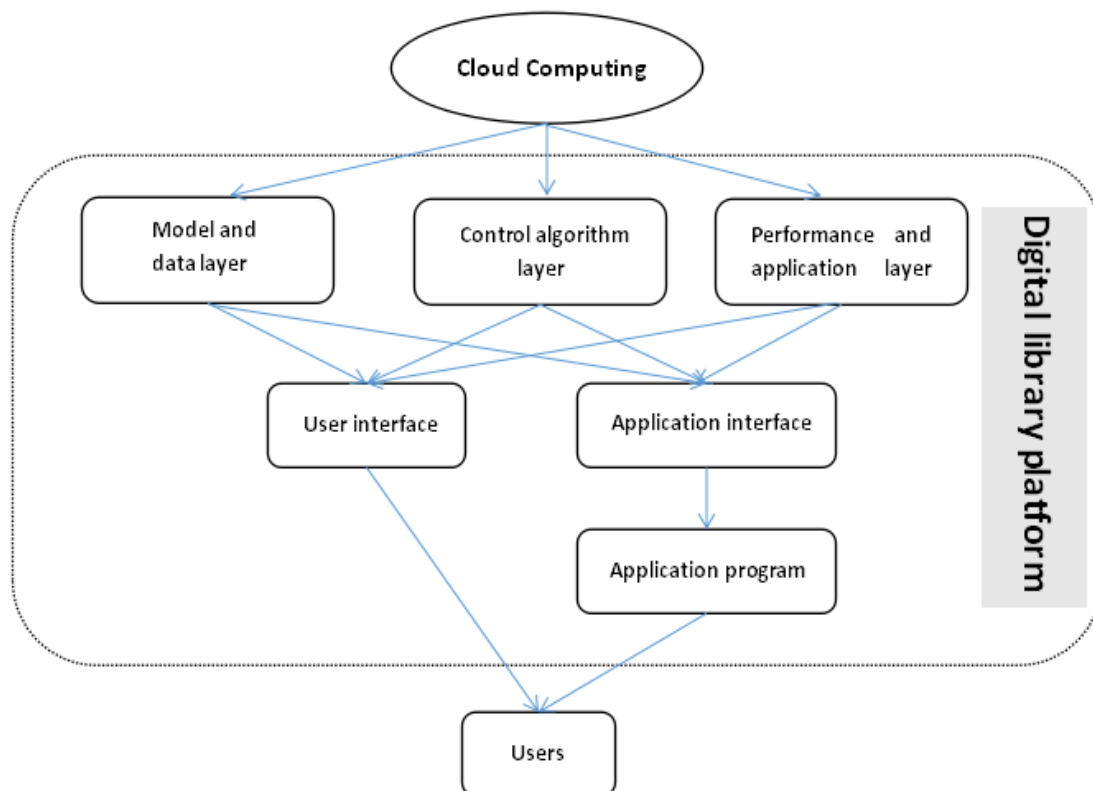


Figure 2. The target system model of digital library platform

Ordinary users use the platform through direct access to user interface of the platform, while professional users use various functional unit services which were provided by the platform through calling the open application interface of the platform. The realization of platform function is transparent to different users. Users do not need to know realization of the function and also don't need to consider the computing power and storage capacity of the platform. It only needs to select different function units of the platform to provide users with required service and submit the required

services to the platform in the form of various tasks. The platform automatically implements the content and provides users with services.

The internal function module of digital library platform provides services through two forms, user interface and open application interface. The services provided by open application interface are visible services for all external procedures, but the use of system management and other system security permissions is only available for platform system user interface, in order that the safety of the platform can be ensured. The user interface can invoke the application interface to achieve the callable service of external program.

6. The Framework Design of Digital Library Platform

The framework design of digital library platform is shown in Figure 3. Each layer from bottom to top provides transparent services for upper layer. The model data layer provides the corresponding application interface for cloud computing platform, the performance application layer provides user interface and open application interface. Users can invoke open application interface, share the heterogeneous data sets of the platform, invoke the related algorithm provided by the platform and easily integrate them into the application system of user development, showing the platform shareability and openness [9].

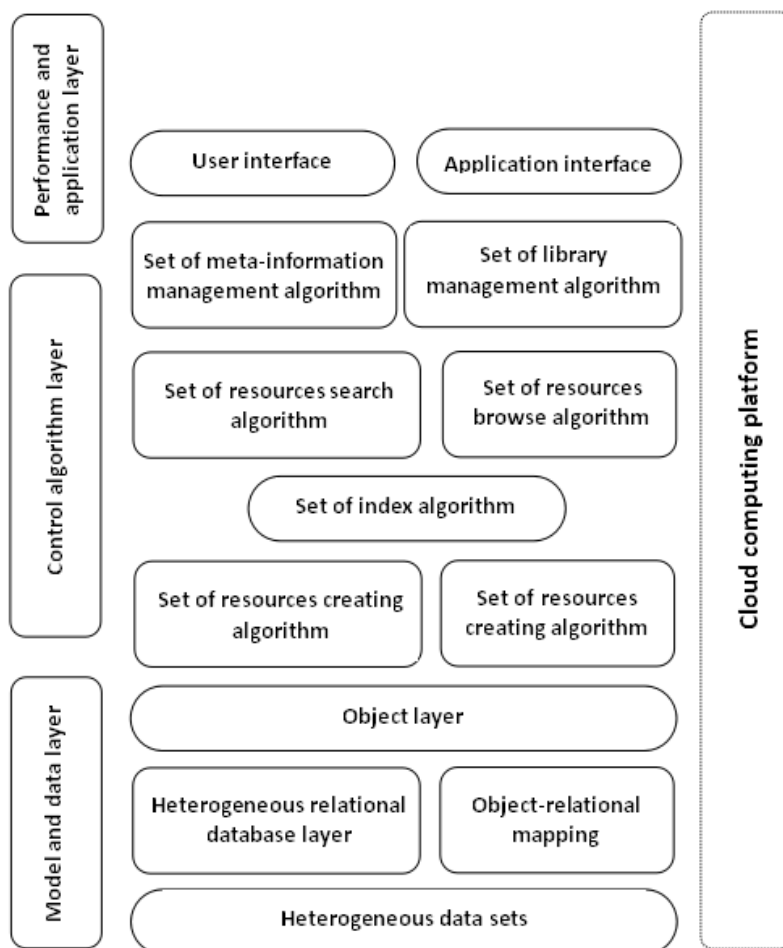


Figure 3. Digital library platform framework

Between the upper and lower layer of digital library platform and in the provided service, XML is the communication language and it is converted into Web service for internal call, so as to support the scalability of service function in each layer [10]. Finally the development services are provided in the form of open application interface. According to the independent design principle of view-model-control, the architecture of digital library platform based on cloud computing design is

shown in Figure. 3. Among them, ①the model data layer is to realize the basic data structure in digital library platform based on cloud computing; ②the control algorithm layer is to realize the internal processing logic in digital library platform based on cloud computing; ③the performance application layer is the method to realize the digital library platform service based on cloud computing, which provides support for other high-level digital library [11].

6.1 The Design of Model Data Layer

The model data layer maps the heterogeneous data in bottom heterogeneous database to the resources object invoked by the internal function logic of digital library platform, and it provides the algorithm call of heterogeneous data source and the open application interface of heterogeneous data source management. The model data layer can make the following refinements.

6.1.1 Heterogeneous Database.

It is composed of popular commerce or open source database provided by many manufacturers. Different databases have specific drivers, different access methods and the corresponding SQL language to realize the relational database features in different degrees. In constructing the corresponding digital library with the use of platform, users can choose the database products of the corresponding manufacturers according to the current resource status.

6.1.2 Relational Database Object Mapping.

According to the heterogeneous characteristics of different relational databases, it encapsulates the corresponding heterogeneous relational databases into objects and provides the mapping of heterogeneous relational databases.

6.1.3 Object Set.

Various resource object stored in digital library includes resource files, meta-data information, source data directory, etc. The data resources can be the storage of different database table structure. The object used in digital library platform shall conform to the fixed format and support the object inheritance and polymorphism, so that the corresponding function provided by the system has greater independence and scalability. The digital library administrators can complete book cataloging and other relevant digital library database construction work with the use of platform object.

6.2 The Design of Control Algorithm Layer

There are seven kinds of standard services provided by digital library platform based on cloud computing: resource creation service, resource catalog service, index service, resource searching service, resource browsing service, meta information management service and library management service. The seven services are respectively composed of different application scenarios and the application scene is composed of a series of related events. The basic data invoked by control algorithm layer is the heterogeneous data object mapped by model data layer through relational database. Each heterogeneous data object defines a corresponding set of object operation. Each object operation can complete the creation, updating, searching, deletion of data object and other basic operation points. The internal control algorithm in the digital library platform established on the object of model data layer can be completed through multiple modules. Each module completes an atomic function, which is easy to achieve the reusability of module function. It adopts virtual technology structure, defines function interface at the software compilation phase and invokes the construction function dynamics of function module in platform operation to upload the object that shall be established. The platform uses configuration file to conduct initial setup for the platform system. The users using configuration file in constructing digital library can construct the digital library, which is more suitable for the actual situation.

6.3 The Design of Performance Application Layer

The expression application layer makes the model data layer and control algorithm layer more abstract, defines the data source and operation algorithm involved in the whole construction process of digital library into tasks, provides application interface to be invoked by users, offers the system maintenance interface and the call of user authentication and authorization. Ordinary users can complete the creation, catalogue, data search, digital library management work and so on while using Web-based method to establish digital library.

The digital library stores dynamic data object resources, so the platform provides development application interface for users to develop application program which can reflect the characteristics of digital library platform based on cloud computing. The application platform can invoke various services and make the digital library platform provide a wide variety of services.

7. Conclusion

This paper provides the prototype system of digital library platform based on cloud computing, summarizes and extracts the common needs of digital library fields, divides the needs into the customization for demand and combined atomic function module to reduce the management and maintenance cost of digital library in the platform based on cloud computing. Meanwhile, the platform also strengthens the interaction between the resources and between the resources and users and improves effect of user experience. This research can provide references for the structure design and specific implementation of the future digital library based on cloud computing.

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