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Research on key technology of data storage safety based on cloud computing

Chao Chen

School of Computing Science, Sichuan University of Science & Engineering, Zigong, 643000, (CHINA)

ABSTRACT

With the rapid research and application of Internet of things, a huge amount of data will be generated. However, the traditional storage mode is out of date as it cannot guarantee data's completeness and security any longer. Data storage and maintenance does not only require low cost, but also require good extendable performance. For the sake of an easier data management, the stored data shall be safe and clear. The proposal of cloud storage can well solve the problems in the development of Internet of things. However, cloud storage faces a big problem, i.e. how can its security be guaranteed? During the application of cloud storage, we need advanced technologies to guarantee the security and availability of cloud computing. The data security concerns national security and personal privacy. Thus storage security is crucial. In this paper, we mainly introduce key technologies of cloud storage. Under the condition of data security, compared with traditional ones, cloud storage has lower cost and larger capacity for data storage. This can meet the requirements of modern enterprise development. Cloud storage accelerates development of Internet of things, and also provides a better solution to the data explosion.

KEYWORDS

Cloud computing; Data storage; Security architecture of cloud computing; Secure storage.



INTRODUCTION

With the developments of society and science technology, computer technology and Internet of things improve rapidly. New large amount of data are generated during research and application of new network communications. Users need to save these data; however, traditional hard disk storage cannot meet this huge demand. If we continue to enlarge storage space of hard disk, or to by high-performance servers, this will increase storage cost. Users spend more money on larger storage space, but it is still inconvenient to manage these data. Troubles come.

Well adapting to Internet server, cloud computing provides a better solution. The traditional network server has some problems such as high cost, high concentration and low generality. On the contrary, the network server of cloud computing has some features such as dense distribution, low cost, high generality, and more novel computing mode^[1]. Cloud computing is based on Internet, by which all sorts of data and hardware resources can be reasonably distributed as per different demands. This will make the maximum resource utilization.

Low-cost and flexible, it can be fully used in modern computer realm. However, the key question is: how to keep the confidentiality and completeness of data stored in cloud end? In this paper, basic information of cloud computing is introduced. Also we research about storage system and key technologies of cloud storage. Cloud computing storage will be a realm of more challenges and larger potential application. Therefore, we need more high technical personnel to participate in. This realm will gain more and more attention from research teams, and become a new development direction for IT.

CLOUD COMPUTING AND ITS SECURITY SYSTEM

Cloud computing enjoys much support from some scientists as well as bears much controversy from other scientists. There is not a better solution yet to how to guarantee its security. CSA-Cloud Security Alliance gave complete and scientific analysis and guidance to its security problems^[2], and then proposed a security system based on cloud computing.

Introduction to cloud computing

Cloud computing is a developing concept since its being. If we say, its main contents are to store and manage large amount of data with many storage equipment, then, the cloud computing system becomes cloud storage system, as shown in Figure 1. Cloud storage does not only involve just one device, but many components. So we shall be clear that, cloud storage mainly proves a service for users, not just a storage method.

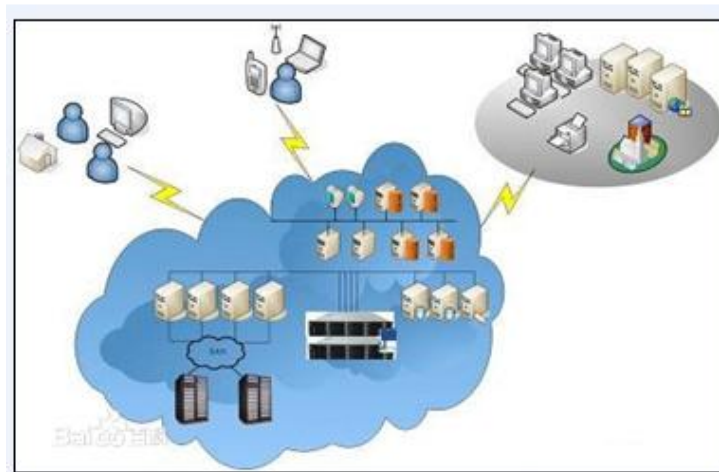


Figure 1 : Composing of cloud storage

Cloud computing is actually a final outcome through developments of distributed computing, parallel computing, network storage and virtualization, etc. Cloud computing does not have a unified concept. We call it “cloud” because it shares the similarity with cloud of “being unknown”. We can understand it in this way: many different storage devices work under the coordination of Apps, and provide data accesses and data storage for users. And users can access data at any time anywhere via Internet devices.

Cloud computing is much advanced than the traditional computing modes though its many unsolved problems. This is undeniable. On one hand, the storage and management methods are very concentrated, thus it is easy to manage and

monitor; on the other hand, cloud storage service is in the charge of professional technical personnel who have better protecting measures. Therefore, data enjoy better protection.

Security system of cloud computing

CSA, Cloud Security Alliance, gave a security system model in accordance with computing’s service model. The basic structure of cloud storage is the bottom layer --- IaaS layer, which provides all sorts of computer resource service, including data calculation and data storage, to upper layers. In the whole system, it is responsible for basic construction and security of abstraction layer. Others will be in the charge of customer end. In addition, as IaaS uses a lot of virtual technologies, it faces many risks. The middle layer, PaaS, is the joint between top layer and bottom layer. It is in charge of self-security and security of user’s interfaces. Its risks are mainly from distributed files and database protection. The top layer is SaaS, which provides software platform for users^[3]. However, it is used by many users, thus its security problems are outstanding. Multi-tenancy technology is one solution to this problem.

Cloud computing system consists of 4 parts: storage layer, management layer, application interface layer, access layer. Its basic structure is shown in Figure 2.

(1) Storage layer is the basic part, including many devices like fiber channels, NAS, ISCSI, DAS and other cloud storage devices. The large amount of storage devices are distributed in many different locations and devices are connected by Internet or other fiber channels^[4]. Storage device needs a managing system to monitor hardware and breakdown maintenance.

(2) The basic management layer is the core part of cloud storage system. It is also the most difficult part to realize. This parts needs coordination between different storage devices to ensure that cloud storage devices can provide better service and data access performance.

(3) The application interface layer is the flexible part. Different users can develop different interfaces and apply different application services as per their demands, including long-distance data backups, application of VOD (video on demand), and network storage drive, etc.

(4) Any authorized users can enjoy cloud storage service. Users can access cloud storage system via standard access application. As there are many operating agencies for cloud storage, there are corresponding accesses to cloud storage. User can choose as they like.

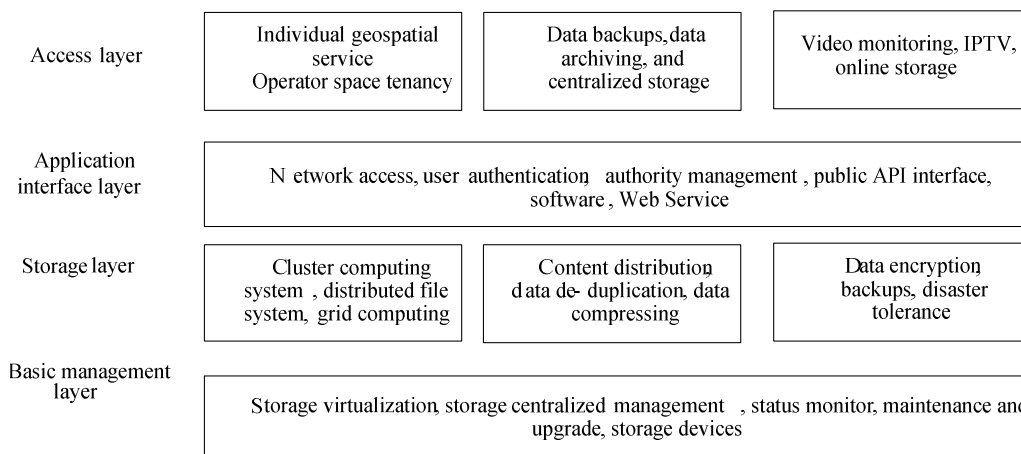


Figure 2 : Structure model of cloud storage

SECURITY SYSTEM DESIGN OF DATA STORAGE BASED ON CLOUD COMPUTING

Huge amount of users’ information is stored in cloud end, thus its security gains people’s focus. On one side, data may be artificially attacked; on the other hand, it is difficult to maintain. Therefore, a safe and effective cloud storage system is necessary. In the cloud storage design, security technology is the main part. Current most used two technologies, storage area network and IP storage network, can ensure security and completeness of data. In addition, they also allow encryption operation to prevent users’ illegal modification and damage.

Key technology of cloud storage security

One of the security technologies is to manage and authorize user’s identity. In order to keep different users’ data isolation and security, we shall set identifying and managing system to control data visitors in public used clouding computing system. To provide the best service and user experience, it is suggested to set single sign-on and federated Identity verification (i.e. to use one account to visit different cloud service platform), as adopted in OpenID^[4] agreement. Therefore, users just need to register for once and sign on, and then they can enjoy cloud storage service. Limited access permission could limit damages to data. However, some administrators’ privilege to access data could also threaten data security.

The core technology of cloud storage is data security. One of the main functions of cloud computing is to store data. It does not only store and protect static data, but also provide dynamic insulation protection. However, data is mainly static in cloud computing, and the key points in cloud computing is the confidentiality and restorability. For the sake of data's completeness, we can adopt encryption and control access. This is the research point in this realm. For the dynamic data protection, there is current protection mechanism based on information stream.

At present, the research hot points in cloud computing security realm include "Bret Hartman^[5]", which means, data can be transmitted by reliability of data in order to integrity verification of cloud storage. As the reliability is dynamic, thus we shall combine it with virtualization technology to ensure the security of data stored in cloud.

The basic premise to research SaaS cloud service is virtualization technology. The virtualization security of server needs security isolation and virtual machines to be completed. Network virtualization is the main way to realize cloud computing. Therefore, access security and distribution of virtual groups, based on real development, are important. On virtualization of data storage, to protection research about redundancy of data storage is the key point in cloud computing security system.

System management technology (SMT) includes large scale of integrated installation technologies, as generally in GFS^[6] cluster, there are joints that need corresponding supporting technologies. Besides, SMT also includes fault detection technology, as the system won't always work well. Once problems happen, they need to be solved at once. SMT also includes energy-saving technology, as energy saving, high efficiency and low consumption are the main goals of development in new times. In addition, SMT still includes dynamic joint, as the system will change, and the new servers shall not break system's functions and work states. SMT is shown in Figure 3.

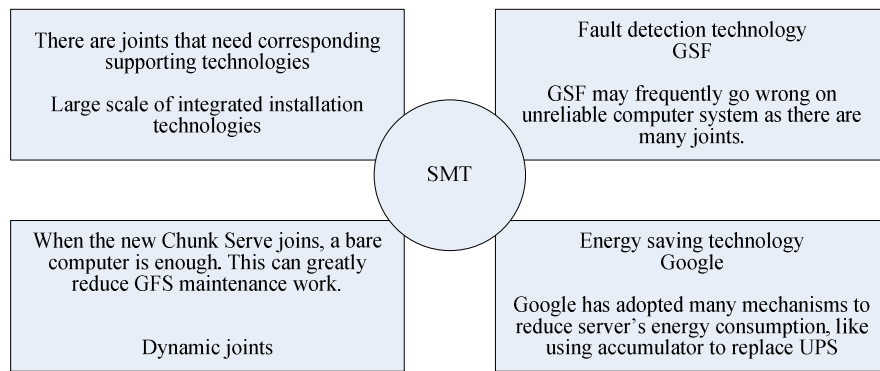


Figure 3 : SMT framework

Design of cloud storage system

Figure 4 shows the design of cloud storage system. All component coordinate to accomplish cloud storage.

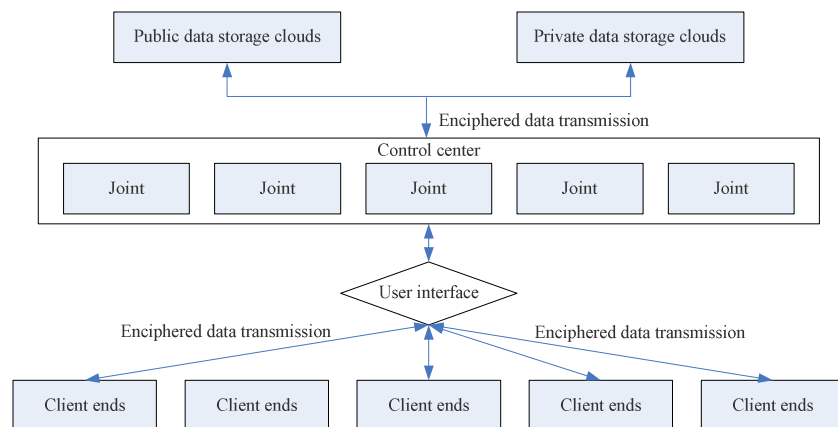


Figure 4 : Design of cloud storage system

For the user interfaces, we shall consider that different users' demands are different. Thus, we shall prepare different serving interfaces. Of course, it also contains function of data conversion^[7]. For the sake of data security, in design of user interfaces, we shall also take access right into account, and user can only enter cloud after security verification.

All the data saving and other operations are in the charge of cloud storage. However, cloud storage module does not need computing capacity. Cloud storage mainly consists of private cloud storage^[8] and public data storage. The former one is

a storage way to provide security data for enterprises, while the later one is to help users to save storage space and guarantee data security. Figure 5 shows logics among all modules.

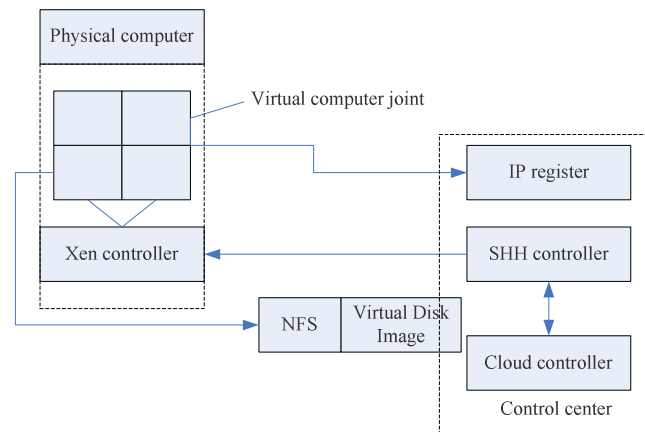


Figure 5 : Logics among all modules of private cloud

The main task for control center is to encrypt, index, decode and compress data and conduct other computing.

The ultimate goal of cloud storage design is to make available to users. Clients can send all requests to servers, and when control center receive such requests, it can parallelly process multi requests, and ensure every request could gain response^[9]. Then, control center can send the needed information to users. In order to ensure security of request and data, the requests from client ends shall be encrypted.

CONCLUSION

With the rapid development of Internet of things, cloud computing is now gaining more and more importance from IT and other realms. Its large data storage and data calculation can present users with more useful values. It does not only give solutions to many traditional problems, like large data calculation, insufficient storage space and difficulties in data security, but also have some advantages, like mighty computing power, and that storage functions and resources can be shared. Thus it is now a sweet pastry for many enterprises. From long term, the cloud storage is more saving, and could better back-up data, and allow user to transmit data anytime anywhere. It is a new trend; however, its security problem is now a priority. With improvement of cloud computing, many relevant searches, application technologies need to be improved.

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