An Efficient Cloud Storage Model
for Cloud Computing Environment

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Abstract. Cloud computing is a new trend of information technology and computing system. In the traditional computing infrastructure, operating system software, applications and data are typically stored and managed on an individual user's computer. Cloud-computing has a different form from traditional way. All kinds of service and software are stored, accessed, and used via third party servers connected to the internet. If cloud computing was used, data and information can be easily shared and managed by user and service provider. Furthermore the user can do their works without application or software. When the user wants work using the software or application, the user just access cloud computing system via the internet. On the other hand, cloud computing has large data and information. Therefore the efficient method for large data/information management for cloud computing is necessary. In this paper, we proposed a cloud storage model for cloud computing environment. The model is to consider the relation between the cloud structures; service provider, application, and user.

Keywords: Cloud computing, Cloud storage, Data center, Service oriented system.

1 Introduction

A new business model is currently being adopted which is changing the way that Information Technology (IT) resources and services are deployed and used. In this model, the acquisition of resources and services occurs whenever and wherever needed, and the amount charged is related to the amount of resources and services that are actually used. This model of IT sold as a service has been called cloud computing. One of its main selling arguments is the possibility of substantial reductions on the total cost of ownership of IT infrastructures [1]. The latter term denotes the infrastructure as a "Cloud" from which businesses and users are able to access applications from anywhere in the world on demand. Thus, the computing world is

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rapidly transforming towards developing software for millions to consume as a service, rather than to run on their individual computers. At present, it is common to access content across the Internet independently without reference to the underlying hosting infrastructure. This infrastructure consists of data centers that are monitored and maintained around the clock by content providers. Cloud computing is an extension of this paradigm wherein the capabilities of business applications are exposed as sophisticated services that can be accessed over a network [2].

With rapid development of cloud computing, more and more enterprises will outsource their sensitive data for sharing in a cloud. To keep the shared data legal against untrusted cloud service providers, a natural way is to store only the encrypted data in a cloud. The key problems of this approach include establishing access control for the encrypted data, and revoking the access rights from users when they are no longer authorized to access the encrypted data. Compared with traditional storage, cloud storage is not just hardware, but network equipment, storage equipment, servers, applications, public access interface, the access network and the client program and other parts of the system. Cloud storage is provided storage services, storage services through the network data stored in local storage service provider (SSP) to provide online storage space. Need to store the service users no longer need to build their own data centers, storage services only apply to the SSP, thus avoiding the duplication storage platform, saving the expensive hardware and software infrastructure investments.

Current cloud storage infrastructures are focused on providing users with easy interfaces and high performance services. However, there are some classes of storage services for which the current cloud model may not fit well [3].

In this paper, we propose a cloud storage model that is to consider the relation between cloud service provider, application and user. This model includes the service connection with application, platform, and infrastructure. The remainder of the paper is structured as follows. Section 2 presents related work with cloud computing. Section 3 describes the proposed cloud storage model for cloud computing considering their relation, application, platform, and infrastructure. Section 4 concludes with a discussion on this research.

2   Related Work

2.1   Cloud Computing Environment

Cloud computing has been referred to as an architecture, a platform, an operating system, and a service, and in some senses, it is all of these. A basic definition of cloud computing is using the Internet to perform tasks on computers. It is an approach to computing in which resources and information are provided through services over the Internet, in which the network of services is collectively known as "the cloud" [4]. The transient nature of cloud computing is also reflected in the various business models used to sell the service. They include [5]:

- Cloud software as a service (SaaS), where the customer uses applications provided by the seller. One example that has been in use for some time is web-based e-mail. In this respect, the customer uses the network, servers, operating systems, storage facilities, and possibly individual applications provided by the seller.
- Cloud platform as a service (PaaS), by which the seller provides the infrastructure (network, servers, operating systems, storage facilities) to enable a customer to use their own applications that they create by using any programming languages and tools supported by the seller. The seller will not necessarily offer its own or a single infrastructure to provide the service. It may act as an 'aggregator' by which the seller uses a number of third parties to provide separate applications and sets of hardware, but the buyer is given the impression that that the service they are paying for is one consolidated infrastructure.
- Cloud infrastructure as a service (IaaS) (sometimes called a 'hosted' service), where the seller provides the infrastructure (network, servers, operating systems, storage facilities) to enable the customer to use and run software of their choice, which can include operating systems and applications.

These services define a layered system structure for cloud computing as shown in Fig. 1.
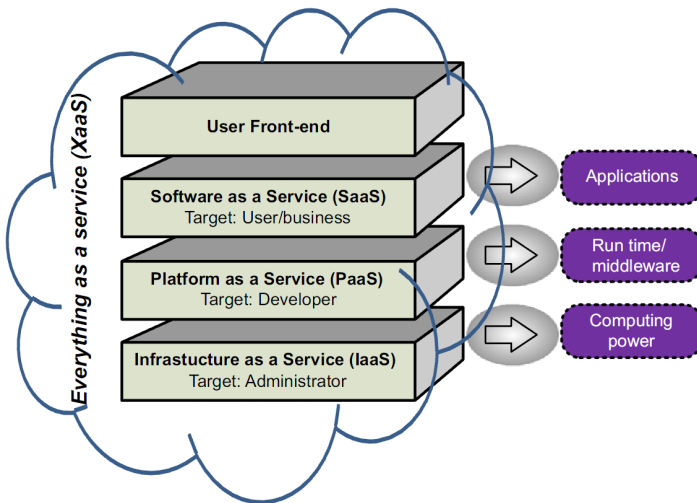
Fig. 1. Cloud computing: everything is a service

At the Infrastructure layer, processing, storage, networks, and other fundamental computing resources are defined as standardized services over the network. Cloud providers' clients can deploy and run operating systems and software for their

underlying infrastructures. The middle layer, i.e. PaaS provides abstractions and services for developing, testing, deploying, hosting, and maintaining applications in the integrated development environment. The application layer provides a complete application set of SaaS [6].

2.2   Cloud Storage

Cloud storage is typically where a business stores and retrieves data from a data storage facility via the Internet. Storing data in this way offers near unlimited storage and can provide significant cost savings as there is no need for the business to buy, run, upgrade or maintain data storage systems with unused spare capacity [6].

Fig. 2. A simple structure of cloud storage

With cloud storage to accelerate growth showing a surprising trend, more traditional dual-controller storage controller or, when capacity and performance expansion, it is often only a simple increase in the number of back-end disk when the disk to a certain number of when the front-end controller, the backplane can not follow the expansion, the formation of a performance bottleneck. Traditional storage architecture is characterized by: usually with a single powerful, comprehensive, complete and have personalized slightly expensive computing resources. But the overall structure is not easy to adopt new technologies or external, and when the whole system to a certain extent, the need to carefully match the calculation of the current system resources, not very easy to achieve the overall expansion of the entire system. Cloud storage in the cloud computing, and developed an extension of the concept of a new concept, refers to the application through the cluster, grid or distributed file systems and other functions, the network in a large variety of different types of storage devices together through the application of software work together to provide outside access to data storage and business functions of a system. Cloud storage is applied through the cluster, grid or distributed file systems and other functions, the network in a large variety of different types of storage devices through the application of software work together, a common external data storage and access capabilities of a business data storage and management as the core of the cloud computing system [3].

In this structure, data may be transferred between many computers across a number of continents during the time a person or legal entity decides to use a cloud computing service. As a result, there are at least three possibilities in relation to the data: there might be multiple copies of the data on each storage device it is stored upon as it is moved around the globe, or the data might be securely erased as it is

moved from one computer infrastructure to another, leaving no trace; alternatively, residual copies of data might be created that a user has an obligation to delete. Copies of data might not only be stored in an unknown number of computers across the globe, but there might be an unknown number of copies of the same digital document in different iterations across different jurisdictions. This could affect the identification of relevant data for criminal proceedings [5]. Rajkumar et al. [2] proposed cloud service framework with cloud storage as shown in Fig 3.
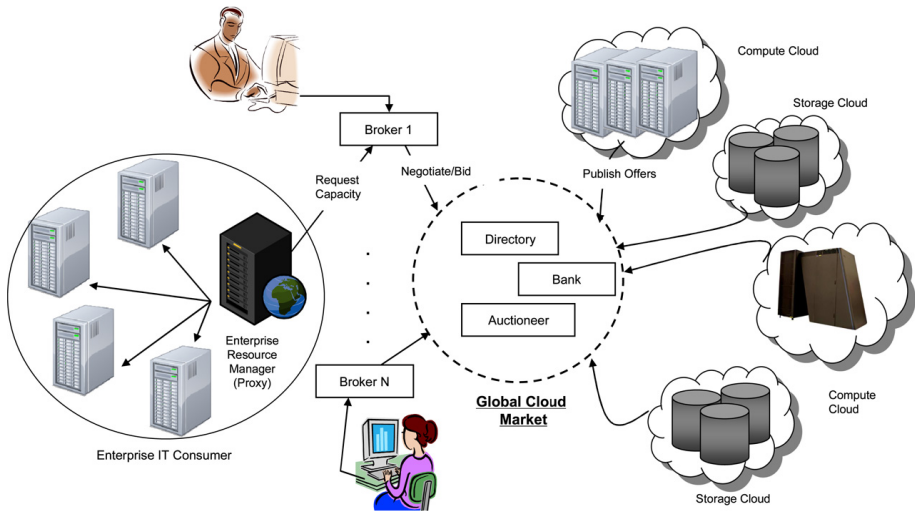

Fig. 3. Framework of cloud service with cloud storage

3   Cloud Storage Model for Cloud Computing

Most of the cloud computing infrastructure is transmitted through a reliable data center services and create different levels on the server virtualization technology. It can be any place to provide network infrastructure to use these services. "Cloud" usually presents the computing needs of all users a single access point. Cloud storage is the core software applications combined with the storage device, through the application software to achieve the storage service to store the changes. Compared with traditional storage, cloud storage is not just hardware, but network equipment, storage equipment, servers, applications, public access interface, the access network, and client and other components of the complex system [3]. Wang [3] proposed cloud storage system architecture model as four layers; Storage layer, Basic management, Application interface layer and Access layer.

- • Storage layer: Storage layer is the most basic part of the cloud storage. Cloud storage is often a huge number of storage devices and the distribution of many different regions, each other through wide area network, Internet. Cloud storage system offers a variety of external

storage services, services of data stored in a unified cloud storage system to form a huge data pool.

- Basic management layer: Cloud-based storage management is the core part is stored in the cloud part of the most difficult to achieve.
- Application interface layer: Cloud storage application interface layer is the most flexible part. Different operating units can cloud the actual storage type of business; develop a different application service interface provided by different applications.
- Access layer: Any authorized user via a standard application interface to log public cloud storage system, enjoy cloud storage service.

Through this structure, we propose a cloud storage model for their environment. The model typically consists of three parts; Storage and management layer, Application layer, and Access layer. These parts also was related cloud computing conceptual structure; SaaS, PaaS, and IaaS. Fig 4 shows our storage model.
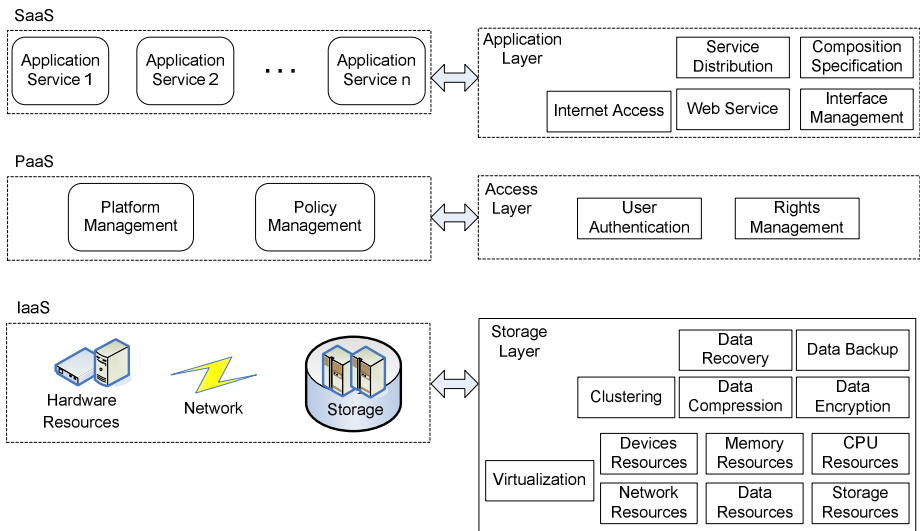

Fig. 4. Proposed cloud storage model by three layers

Application layer consists of 5 factors; Internet Access, Service Distribution, Web Service, Composition Specification, and Interface Management. Application layer has 2 factors; User Authentication and Rights Management. The most important factor of these is Storage layer. It has 12 factors; Virtualization, Devices Resources, Network Resources, Memory Resources, Data Resources, CPU Resources, Storage Resources, Clustering, Data Recovery, Data Compression, Data Backup, and Data Encryption. The Storage layer deal with the process to manage, service, handling, interface between the cloud service and data/information. Therefore this layer influence to hardware resources, Network, and Storage resources in IaaS of cloud computing structure.

4   Conclusion

Cloud computing is a new paradigm of information and service oriented technology for today's and nearly future perspective. Cloud storage is not just storage but more applications. In the cloud computing environment, cloud storage deals with the process to control and manage all kind of data and information with hardware, service (software), and platform resources. Therefore, in order to support cloud service to user efficiently, to identify and organize the cloud storage model can be very important work.

In this paper, we propose an efficient cloud storage model for cloud computing environment. Basically, cloud computing has three factors in the structure; SaaS, PaaS, and IaaS. In order to support the process with data and information storage, the storage model has to consider the relation between their factors and storage model. The proposed model connects their factors in cloud computing structure. And our model consists of three layers; Storage layer, Application layer, and Access layer. Storage layer connect to IaaS in cloud computing structure, Application layer connect to SaaS, and Access layer connect to PaaS. Through this model, we can shows the relation and behavior between the factor in cloud computing structure which is IaaS, SaaS, and PaaS, and the each of storage layer.

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