Research on Traditional Structure Optimization in Cloud Computing Environment

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Abstract. This paper discusses the structure and optimization of current cloud computing system, focuses on the research objectives of reducing costs, improving the reliability and scalability of the original structure, and introduces the layout technology and the latest research progress of cloud computing. Given the limitations of new cloud computing applications and cloud computing, our paper also explores and looks forward to future research directions.

Introduction

As technology is developing rapidly in the information age, data generated in many applications such as finance and computers is rising. Traditional data calculation methods are no longer applicable to contemporary society. In such a situation, Dr. Eric Schmidt, CEO of Google, first proposed the idea of cloud computing.

Cloud computing is a pay-as-you-go mode, which is available, convenient and on-demand network access, access to configurable computer resource sharing pools (resources including network, server, storage, application software, services), these resources can be quickly provided with very little management investment.

Current Work Related to Cloud Computing

Depending on the current level of cloud computing, the currently structure is generally become three parts: user access interface, service management and core services (show in figure 1).

The core service layer transforms software environments, hardware, and programs into services. These services have most of the features of cloud computing to meet different user needs.

Service management supports core services to ensure the security of core services.

The user access interface layer Implementing the Interface between user computer and cloud Computing.

![Figure 1. Current Cloud Computing Architecture.](image)

Core Service Layer (IaaS, Paas and Saas)

There are always three sub-layers in cloud computing core service layer: IaaS (infrastructure as a service), PaaS (platform as a service), SaaS (software as a service). In fact, to achieve localization of computing resources, there is also a new service model nowadays called HaaS (hardware as a service), but we won't discuss it in detail.
IaaS provides hardware deployment services, providing users with network, virtual computing and storage resources. In this layout, users need to provide needed information and related user data to IaaS layer services. IaaS layer services with high reliability, strong customization and scalability can be provided by using some tools related to virtualization.

PaaS is functioned in cloud computing applications as running environment. through the PaaS layer, application developers can use services by uploading program code and data without paying attention to the management of underlying storage, network and operating system.

SaaS is an application based on cloud computing infrastructure. Enterprises can solve the problem of enterprise informatization by renting SaaS layer services. For ordinary users, SaaS layer services migrate desktop applications to the Internet, which implement the ubiquitous access to applications. SaaS not only focuses on the implementation of the underlying layer (PaaS, IaaS), but also consider the specific function implementation and optimization of the software.

Service Management Layer

Service management provides assurance of the availability, reliability and security of the core service layer.

The cloud computing platform is large in scale and complex in structure, and it is difficult to fully satisfy the user's requirements. To this end, the cloud computing service provider needs to negotiate with the user and develop a service level agreement (SLA), so that the two parties agree on the quality of service. When the service provided by the service provider fails to meet the requirements, the user will be compensated.

User Access Interface

User access interface implements access to cloud computing services. Usually it includes command line, Web service and so on. Cloud computing migrates users’ desktop applications to the Internet, so that users can access data and programs anytime and anywhere through browsers, which will increase work efficiency.

Traditional Data Tree Structure in Cloud Computing

The traditional structure is generally connected into a three-tier tree structure, namely the aggregation layer, edge layer and core layer. Figure 2 give us a detailed illustrations.

The core layer plays a vital role in the connectivity of the entire network. Interconnection with the upper level network is implemented in the core layer to provide high speed data exit. It is of great importance as the core layer is the hub of the network.

Convergence layer: The aggregation layer is the transportation hub of the network access layer and the core layer. That is, the aggregation is done before the workstation accesses the core layer to reduce the load on the core layer device.

Access layer: The access layer provides workstation access to the local network segment. User data transfer through access technologies and line resources in the access layer.

The data switch computer is usually connected to a top-of-rank switch (ToR) to form an edge layer. The edge layer data switch connects with aggregation layer data switch through a certain structure to achieve data aggregation and balance. Finally, the aggregation layer data switch is connected to the core layer routing device to provide a way for users to access the data center from outside. Figure 2 above is a simplified typical cloud computing data structure.
Shortages in the Traditional Structure of Cloud Computing

However, to face these challenges, the traditional tree-structured network has the following shortcomings.

1. The reliability of data is low. If the network devices in the aggregation layer or the core layer are abnormal, the network performance will decrease dramatically.

2. The scalability is poor. As the ports of core layer network devices are limited, it is difficult to support large-scale networks.

3. Network bandwidth is limited. The bandwidth used to connect the edge layer is generally larger than the network bandwidth used to connect the core layer. Therefore, the traditional structure makes the network communication easy to be blocked.

Proposed Framework - A New Structure Design

A new network cloud computing structure was proposed in order to improve the traditional topology (show in Figure 3). The new tree structure makes nodes more connected and scalable, at the same time more easier to load balance. Meanwhile, this kind of topologies will be built using small computer switches to resulting in construction costs and easier node expansion.

This new structure is still composed of a core layer, edge layer and aggregation layer.

At the core layer, a multiple of four as a basic unit was considered, and the whole system consists of multiple basic units.

The edge layer and the aggregation layer are combined into multiple regions, each of which has four switch computer, belonging to the edge layer and the aggregation layer (two switch computers in edge layer and two switch computers in aggregation layer). The interior of the regions is connected by a completely binary tree structure.

The aggregation layer switch computers is connected to the core layer switch computers as well as the aggregation layer switch is connected to two core layer switches. The edge layer switch computers connects to the compute nodes, and each region can connect multiple nodes.

Advantages of New Structure Proposed

By using this binary tree structure, non-blocking communication between the two node at any time can be ensured, it makes the connectivity and fault tolerance between nodes higher and also easier to reach the load balancing.

Figure 2. Current cloud computing data structure model.

Figure 3. Proposed new structure.
In the meantime, since the new topologies are constructed by using small-size date switch computers, so it will reduces the cost of network construction and makes nodes easier to expand. This kind of structure meeting the **high reliability** and **high liquidity** requirements of the cloud computing data center.

Also, this new structure makes the use of small switches to connect to large-scale computing nodes, not only brings excellent scalability, but also reduces the construction cost of the data center.

**Conclusion**

As a newborn information technology, cloud computing has developed rapidly. It aims at sharing computing and storage resources of each node in cloud, its main function is to provide computer resources needed by end users. Although cloud computing is powerful and innovative, it also has its own deficiencies.

This paper review the previous work related to cloud computing architecture, give a brief explanation of core services, service management and user access interface. The key point of our paper is structural optimization and comparison, after discussing the advantages of the new structure, we know that this new designed structure has higher reliability and higher liquidity compared to the traditional one, which can not only reduce the cost of network construction, but also reduce the construction cost of the data center.

All in all, cloud computing research is still in the development stage, the impact of cloud computing is huge, but from the perspective of broadening the application mode of cloud computing, as there are some factors such as reliability, scale elasticity and energy consumption, we people still have many problems to study and solve.

**References**


