

# Research on Key Technologies of Cloud Computing and Its Application in Telecom Industry

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**Abstract.** Cloud computing is an Internet-based super-computing model and it is also an innovative business computing model. This paper describes the definition and characteristics of cloud computing, analyzes the key technologies of cloud computing, and makes an in-depth study of cloud computing applications in telecom industry.

## Introduction

Cloud computing is considered to be another major change in information technology electronics following the PC and the Internet. It can effectively aggregate various resources through virtualization, supply on-demand resources through the network, and provide a wealth of application services through specialization. The new computing resources patterns of organizational, distribution and usage will help the rational allocation of computing resources and improve its efficiency, reduce costs and promote energy conservation to achieve green computing. The technology infrastructures of cloud computing development mainly include the Internet, grid computing, virtualization technology, computing services as well as pay-as-mechanism. Its goal is to provide users with on-demand service based on virtualization technology, and the providing form is divided into Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). According to the basic underlying infrastructure ownership between providers and users, cloud computing platform can be divided into public cloud, private cloud and hybrid cloud.

Relying on cloud computing, telecom operators will take this chance to force the integration of internal IT resources for business systems, improve the utilization and management of internal IT resources to reduce the cost of providing services. Based on external resources, the operators can build new business models through cloud computing platform, provide a common IT services to enhance the efficiency of traditional telecom economy, to accelerate the consolidation trend of platform trend and industrial chain, and to promote cloud computing landing at the application level.

## Definition and characteristics

Cloud computing is evolved from grid computing, and the front desk provides services for users over the Internet by paying way of adoption. By the way that a large number of cluster systems use virtual machines, the cloud background consists large virtual resource pool through the interconnection of high-speed Internet network. These virtual resources can make self-management and configuration. By redundant data, we can ensure the high availability of virtual resources, and it has many features such as distributed storage and computing, high scalability, high availability, user-friendliness and others.

Cloud computing system can provide a service. Service implementation mechanism is transparent to users, so users do not need to understand the specific mechanisms of cloud computing to get needed services.

Provide reliability with redundancy. Cloud computing systems provide data processing services to users by a large commercial computer clustered. As the number of computers increases, the probability of system error is greatly increased. In the absence of dedicated hardware parts

supporting, use the way of software, namely, adopt data redundancy and distributed storage to ensure the reliability of data.

High availability. By integrating the computing power of mass storage and high-performance, the cloud can provide higher quality of service. Cloud computing system can automatically detect failed nodes and rule out them, which will not affect the normal operation of the system.

High-level programming model. Cloud computing systems can provide high-level programming model. Through a simple learning, Users can write their own cloud computing program make implementation on the cloud system to meet their own needs.

Economy. The formation funds of cluster using a large number of commercial aircraft cost much less than that of supercomputer with the same performance.

Service diversity. Users may pay a different fee to obtain different levels of services.

## **Key technologies**

Cloud computing is a new way of supercomputing. Based on center of data, it is a data-intensive supercomputing. In services optimizing the management, applications building and integration, applications continuous operation, multi-mode client and many other aspects, the cloud computing has its own unique technologies.

**Cloud platform services optimizing the management technology.** Service optimizing the management is a key issue to improve the service quality of cloud platform and platform performance. The key technologies include the following aspects. Cloud service resource management, the research on demand management and partition isolation mechanism of physical machines, virtual machines and virtual clusters. Cloud task management, the research on classification, university scheduling, load balancing, power management and fault tolerance of cloud computing tasks. Cloud data management, the research on modeling, organization, storage, manipulation, retrieval, and data backup of massive structured, unstructured and multimedia data. Applied behavior analysis and system evaluation, the research on cloud computing load characterization, monitoring tasks, evaluation metrics and benchmarks set. Cloud security and privacy protection, the research on the performance and fault isolation of different users, the privacy protection of user identity and user data.

**Cloud computing applications building and integration technology.** Cloud computing applications building and integration technology is the key issue to provide services for the industry. Key technologies include application services, application virtualization and application service integration technologies. Apps relying on software as a service, the research on the theoretical model of applications demand services, application service creation, deployment, placement scheduling and execution, the backup, transfer, scheduling strategies and optimization method of application data. Application virtualization, which can provide a virtual operating environment for application software, enabling service-oriented applications run on any computing resource sharing. The main research is the creation, distribution, transport demand, application isolation technology and operating platform of virtual devices. Application service integration provides customers with complete service through the application joint of a number of service providers. The main research is application integration architecture, browser-based application integration methods and general service bus technology.

**Cloud computing applications continuous operation technology.** In order to support the critical business of enterprise, the continuous run of cloud computing platform applications system is a basic requirement, therefore, we need to study the continuous operation technology of cloud computing applications system. The main research include the following aspects. The dynamically monitoring technology of physical resources and virtual resources in cloud computing platform, monitoring technology of cloud computing platform services, monitoring technology of cloud computing applications and user activity, monitoring-based failure prediction, exception handling, fault tolerance and recovery mechanisms, seamless migration technology of software services. The continuous operation technology of computing systems, the research on virtual machine error

migration mechanisms, fault tolerance cluster virtualization, virtual machines and other security mechanisms in cloud computing platform.

**Cloud computing multi-mode client technology.** In the era of network, computing has three major centers, namely, data, users and services, cloud coexistence and interaction is the future trend of cloud computing architectures. Cloud Client includes the traditional PC, notebook, mobile phones, PDA, mobile terminals and home appliances, automotive terminals and other smart mobile terminal equipment. Therefore, we need to study the multi-mode client cloud computing technology. The main research includes various forms of cloud client access technologies, multi-mode client cloud service environment. To meet the cloud computing needs of typical industry applications, we should develop lightweight cloud client access technology to provide users with cloud computing services.

### **Application in telecom industry**

In the cloud computing architecture, the main telecom operators can be regarded as a service provider to provide cloud computing services. In addition, the service developer is also a very important role, and operators can become service developers. Judging from the type of service, there are three types of services: Infrastructure as a Service (IaaS), Platform as a service (PaaS) and Software as a services (SaaS).

**Transformation of IaaS.** In the IaaS infrastructure services, telecom operators can integrate the basic resources in internal systems, and improve the ability of storage and calculation of IT infrastructure. Through virtual technology, these physical devices can be transformed from independent resources into a shared resource pool. Management platform manages the CPU, memory, storage and network bandwidth and other resource in resource pool together, and these resources are allocated to each user on demand to provide services for the upper layer service to improve resource utilization and reduce energy consumption.

The earnings in resource pool renovation of telecommunication network are significant, but the transformation process is a gradual process, so it need to follow certain planning principles: simplicity, flexibility, standardization, openness, stability, reliability, security and efficiency.

**Business innovation of PaaS.** The traditional telecom service mainly relies on telecom operators and manufacturers, so it is much more closed and difficult to develop a new business. The development of Internet services is more concise, for there are many mature frameworks and tools, and interface protocols is also more flexible. In fact, most of the telecom business is not complicated in logic, and the main difficulty is the complexity of signaling and protocol, high availability and scalability of processing, as well as an expensive platform deployment. In this case, the operator can learn from the Internet's open, cooperative, innovative ideas and PaaS. We can adopt a unified platform architecture, open platform means to provide an open platform operating environment, shield the heterogeneous and differences of business systems and open a third party, to attract business innovation from external partners to promote the continuous development of the telecom business.

In the telecom network, using PaaS model enables developers to reduce the cost of telecom services entry greatly, so a large number of developers can enter the telecom business development team, thereby forming telecom operators to interact with the developer, to develop personalized models of telecom products. Achievement and innovation in Internet business can be integrated into the platform, making the telecom network as an open and converged network.

**Applications of SaaS.** Up to now, telecom business mainly can choose voice, video, SMS, MMS and some derived business. In software services, due to the relative weakness of telecom operators in software development, they cooperate with the more successful SaaS business management software vendors to provide SaaS business. Software provider is responsible for providing a wealth of software products and technology development, telecom operators are more responsible for infrastructure, technical support, daily operations, marketing and customer service and so on. In addition, telecom operators can also use their own advantages to cooperate with the

government, health care, education, transportation, security and other sectors to introduce SaaS business of industry solutions class.

## Conclusion

Cloud computing has broad prospects for development, the key technologies will also develop rapidly. Cloud computing technology represents the future development trend of the Internet, it appears as telecom operators to bring new challenges and opportunities. Telecom operators have a wealth of network bandwidth resources, computer hardware and software resources, many of the regular users have a wealth of operational experience and a natural advantage in business transformation, but they also need to recognize themselves into the cloud computing market late and relatively weak area. Telecom operators should use resources and timely deployment of their own cloud computing platform as soon as possible to develop an appropriate cloud development strategy based on market demand, and change from a traditional telecom operators to an integrated information service provider.

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