A Private Cloud Platform Supporting Chinese Software and Hardware

Man Li[1], Zhiqiang Wang[1(✉)], Jinyang Zhao[2], Haiwen Ou[3], and Yaping Chi[1]

[1] Department of Cyberspace Security, Beijing Electronic Science and Technology Institute, No. 7 Fufeng Road, Fengtai District, Beijing, China
wangzq@besti.edu.cn

[2] Beijing Baidu T2Cloud Technology Co., Ltd., 15A#-2nd Floor, En ji xi yuan, Haidian District, Beijing, China

[3] Department of Cryptography and Technology, Beijing Electronic Science and Technology Institute, No. 7 Fufeng Road, Fengtai District, Beijing, China

Abstract. This paper designs and implements a private cloud platform deployed on an office system that supports domestic software and hardware. With the rapid development of cloud computing, more and more enterprises and users choose cloud platform as a vital Internet resource. At present, most private cloud technologies rely on mature foreign commercial applications and frameworks, and it isn't easy to achieve compatibility between Chinese software and hardware. Therefore, it is urgent to design a private cloud platform that supports Chinese software and hardware. The key private cloud technology of the cloud platform designed in this paper is the key technology of private cloud that supports independent and controllable Chinese software and hardware. The cloud platform uses virtual computing, virtual storage, virtual network, and other technologies to complete the virtualization of computing resources, storage resources, and network resources. Users can centrally schedule and manage virtual resources.

Keywords: Private cloud platform · Virtualization · Cloud computing

1 Introduction

The rapid development and innovation of the Internet have made traditional IT infrastructure platforms increasingly bloated, leading to longer deployment cycles, making it more and more challenging to adapt to business changes. In recent years, as a new type of IT infrastructure platform deployment architecture, cloud computing has frequently appeared in the public's field of vision. Traditional IT platforms have long deployment cycles, high system failure rates, and later operation and maintenance difficulties. The cloud platform attracts more and more people's attention through its low IT cost investment, efficient resource utilization, flexible system adjustment, and low business integration difficulty [1].

Nowadays, with the continuous development and popularization of cloud computing technology and related products, more and more companies and individuals have

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adopted the cloud computing platform as the primary choice for using IT resources [2]. Many excellent features of the cloud platform make it widely used in people's livelihood, finance, military, and business [3]. Many countries have included cloud computing in their national key development plans. Under the current international background, the localization of cutting-edge technology industries is safe and controllable. At present, most of the Chinese cloud platform technologies and solutions are based on mature foreign commercial applications or open-source frameworks, and it is challenging to be perfectly compatible with Chinese office software. Therefore, it is necessary to actively carry out relevant research on cloud platforms that adapt to Chinese software and hardware.

The key technology of private cloud involved in the private cloud platform designed in this paper is the key technology to realize the autonomous and controllable Chinese software and hardware, which provides strong cloud support for Chinese office systems.

The structure of this paper is as follows: first, introduce the research status of the cloud platform; then raise the cloud platform system architecture in more detail; then analyze the system function and performance test results; finally, summarize the paper.

2 Research Status

In 2006, Amazon launched the first batch of cloud products for Amazon Web Services, followed by a series of AWS cloud services. Users can deploy applications with the help of Amazon Elastic Container and perform a series of application extensions as needed [4, 5]. In 2008, Google launched the Google App Engine (GAE) cloud computing service platform [6]. Microsoft released the Microsoft Azure Platform public cloud platform in the same year.

3 Architecture Design of Cloud Platform

3.1 Overall Design

This system uses virtual computing, virtual storage, and virtual networks to complete the virtualization of computing resources, storage resources, and network resources. Through the user portal and administrator portal, users use platform-as-a-service (PaaS) and infrastructure-as-a-service (IaaS) related applications to centrally schedule and manage virtual resources, thereby reducing business operating costs and ensuring system security and reliability.

3.2 Overall Architecture

The cloud platform designed in this paper draws on the best practices of mainstream cloud platforms to provide standard cloud services. The main content of this cloud platform is deployment and application to the cloud, forward-looking planning for operations, and reference to the three-level protection requirements for security. Realize the unified management of traditional IT equipment and resources and the current popular open-source technology on a cloud platform. The overall architecture design of the cloud platform is shown in Fig. 1.

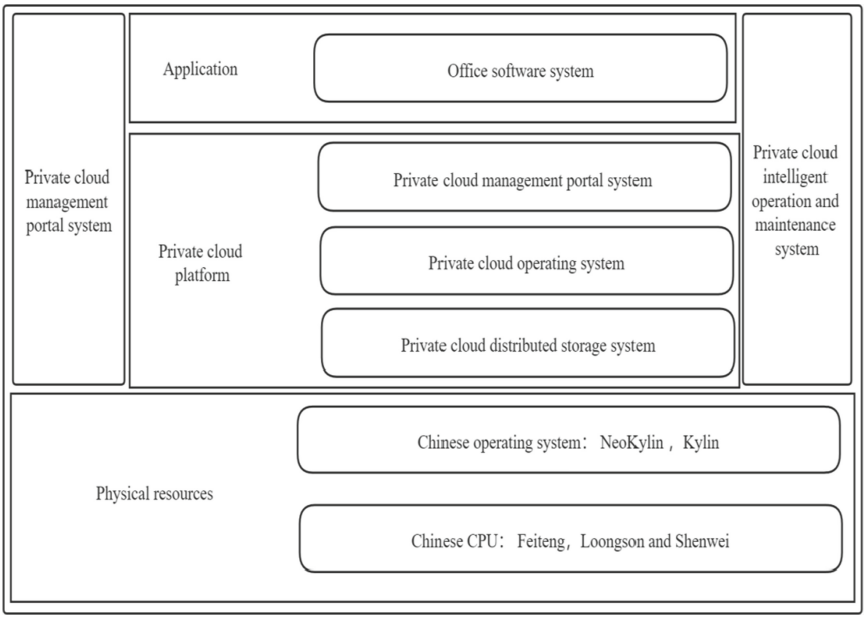

Fig. 1. The overall architecture.

The private cloud platform mainly includes (1) Private cloud management portal system (2) Private cloud operating system (3) Private cloud distributed storage system (4) Private cloud security protection system (5) Private cloud intelligent operation and maintenance system. This cloud platform is compatible with Chinese software and hardware, supports Chinese office software systems in terms of software, adapts Chinese operating systems such as the NeoKylin and Kylin in terms of hardware, and supports Chinese CPUs as Feiteng, Loongson, and Shenwei.

3.3 Technology Architecture

The cloud platform comprises five parts: infrastructure layer, platform service layer, cloud management center, security, and operation and maintenance. Through the collaboration of multiple components, the core service capabilities of the cloud platform are realized.

Infrastructure Layer Design. The infrastructure layer uses virtualization technology to organically combine resources such as computing, storage, and network. The overall IT environment has higher applicability, availability, and efficiency than separate physical hardware resources. It meets the demands of enterprises for cost reduction, simplified management, improved safety, and agile support. Provide core virtualization technology and capabilities for the migration of key businesses of enterprises to the cloud computing environment and the construction of enterprise cloud data centers [7]. The overall structure of the infrastructure layer is shown in Fig. 2.

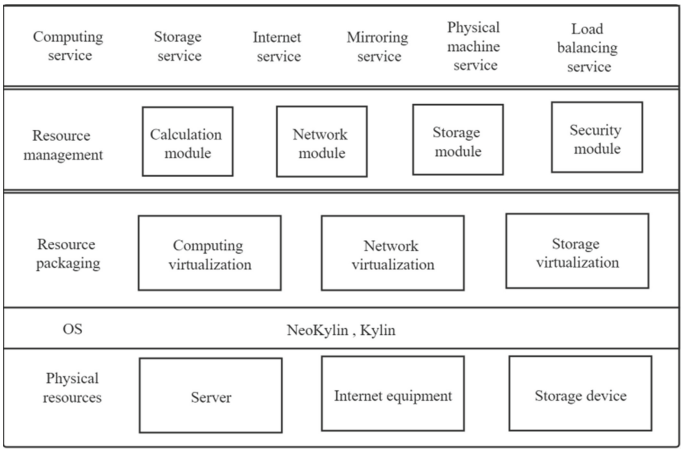

Fig. 2. The infrastructure.

The infrastructure layer includes three layers: physical resources, resource packaging, and resource management. Physical resources mainly include servers, network equipment, and storage devices. The resource encapsulation layer realizes the pooling of different types of physical resources through different virtualization technologies. In addition to driving the resource encapsulation layer, the resource management layer is also responsible for managing various kinds of resources. Finally, the resource management layer provides computing services, storage services, network services, container services, mirroring services, physical machine services, load balancing services, and other service interfaces to the cloud management platform [8].

Platform Service Layer Design. The platform service layer provides information system development and runtime platform environments by creating standard templates and interface packaging to help improve the deployment efficiency of development, testing, and production environments. End users directly develop application system functions and complete configuration and deployment on the platform service layer. The platform service layer includes eight key components of microservice governance, machine learning, integrated middleware as a service, process as a service, message as a service, application middleware as a service, database as a service, and big data as a service.

Software Service Layer Design. SaaS usually positions application software programs developed by PaaS as shared cloud services, which are provided as "products" or available tools [9]. Manufacturers uniformly deploy application software on their own servers. Users can order the required application software services from the manufacturers through the Internet according to their actual needs, pay the manufacturers according to the number of services ordered and the length of time, and obtain the manufacturer's provision through the Internet Service. Users can access through the client interface on various devices, such as a browser. Users do not need to manage or control any cloud computing infrastructure, including networks, servers, operating systems, storage (Fig. 3).

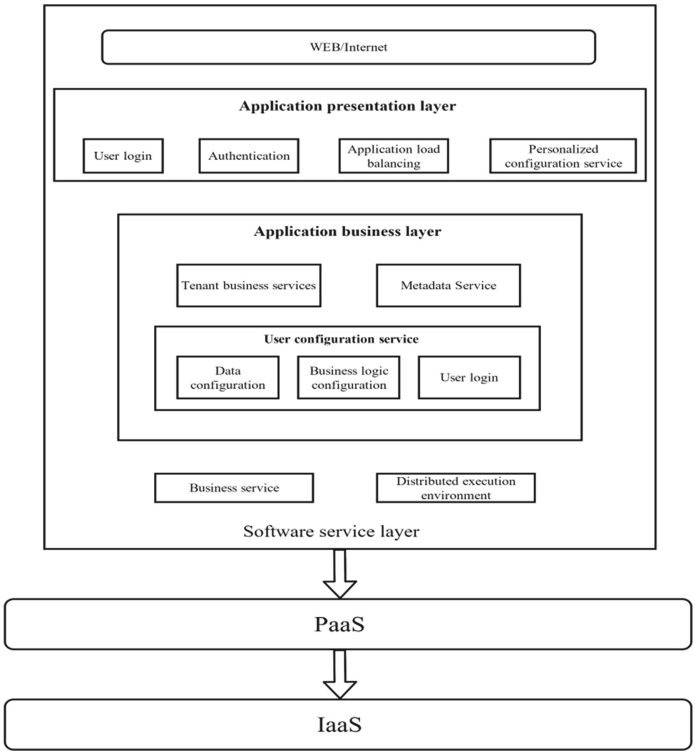

Fig. 3. Software service layer design.

Automation Capability Design. Flexible strategies can provide users with resources and services. Users can increase and decrease the scale of IT infrastructure resources according to system parameter settings to meet business development needs in real-time and save costs. The flexible strategy function supports snapshots and mirroring as templates to create cloud hosts. Users can set the threshold according to the average load of the CPU. When the average load of the cluster reaches the threshold, the system will allocate the resource elastically according to the rules. Elastic distribution is divided into flexible expansion and elastic contraction. When the average cluster CPU load is greater than the threshold, the system expands resources elastically. When the average cluster CPU load is less than the threshold, resources elastically shrink.

Cloud host failover. The system performs periodic detection. When a physical server failure causes a virtual machine failure, the system will migrate the cloud host to other physical servers to quickly recover the cloud host. On the corresponding page, the user can choose whether to support the HA function.

3.4 Security Technology Architecture

Network and Communication Security. Network and communication security ensure the security of the network environment through means such as regional isolation, boundary protection, and traffic identification.

- Deploy an intrusion prevention system.
- Set up Virtual Private Network (VPN).
- TAP replication shunt access platform.
- Perform network system security performance testing.

Equipment and Computing Security. Equipment and computing security adopt measures and technical means such as identity authentication, access control, security audit, intrusion prevention, malicious code prevention, resource control [10].

4 Function Test and Performance Test

4.1 Test Environment

The cloud platform test environment is mainly composed of four server nodes and a test machine. The network topology of the test environment is shown in Fig. 4.

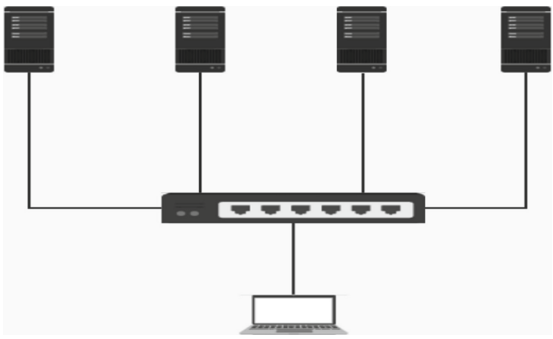

Fig. 4. Test network topology diagram.

The node server used for the test uses the Galaxy Kirin V4.0 operating system, the CPU model is FT1500a@16c CPU 1.5 GHz, the server memory is 64 GB, and the hard disk capacity is 1.5 TB. The software is configured with T2OS cloud operating system V4.0, MariaDB V10.3, and RabbitMQ V3.6.5.

The client used in this test is a Thinkpad T420 laptop, using the Windows 7 flagship operating system. The CPU model is Intel Core i5-2450M 2.50 GHz, the memory is 4 GB, the hard disk capacity is 500 GB, and the client configuration software is Google Chrome 52.0.2743.116.

4.2 Test Results

The cloud platform system designed in this paper realizes the cloud host management and high availability of the virtualized cloud platform. Cloud host management realizes the creation, login, migration, snapshot management, security group management, and other functions of cloud hosts. High availability realizes resource cluster HA capability and master node high availability.

Creating a single cloud host takes an average of 38.8 s; deleting a single cloud host takes an average of 2.2 s; creating a single cloud disk (10 GB) takes an average of 1.0 s. It takes an average of 7.9 s to start a single cloud host.

5 Conclusion

This cloud platform has successfully realized the creation and management of cloud hosts in the cloud platform. It is a unified management platform and has high operating efficiency. This cloud platform realizes a comprehensive high-availability design from business to IT resources, supports on-demand allocation of virtual resources, supports multiple operating systems, uses QoS technology to ensure various resources, and supports multiple hardware devices. This cloud platform's successful research and development provide better and strong cloud support for Chinese office systems. A series of private cloud key technologies have been adapted and optimized in the Chinese software and hardware environment.

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