

## InforSuite Cloudware Console: A Virtual Management System Based on Cloud Computing Infrastructure

<sup>1, 2, 3</sup>Wei Fang, <sup>3</sup>Shuxian Li and <sup>2</sup>Wubin Pan

<sup>1</sup>Jiangsu Engineering Center of Network Monitoring,

<sup>2</sup>School of Computer and Software, Nanjing University of Information Science and Technology, Nanjing, 210044, China

<sup>3</sup>Postdoctoral Work Station of CVIC Software Engineering Co., Ltd., Jinan, 250014, China

**Abstract:** Cloud computing has emerged rapidly as an exciting new computing paradigm. The broader concept of converged infrastructure and shared services is the foundation of cloud computing. This study presents a middleware system of cloud computing infrastructure called InforSuite Cloudware. What we want to discuss in the study is the design processes of the InforSuite Cloudware. Then we propose an InforSuite Cloudware theory and architecture to testify the application. We have implemented a cloud middleware system and achieved good result.

**Keywords:** Cloud computing, InforSuite, middle ware, virtualization technology

### INTRODUCTION

In the era of economic globalization, information services is growing exponentially, the demands of telecommunication operators And Internet Service Provider (ISP) for IDC are getting higher and higher and due to its wide industry prospects, large numbers of small IDC service providers are emerging, it not only makes an impact on the IDC industry, but also brings new challenges to IDC service providers in cost, technology, business innovation. And, traditional IT infrastructures consist of a lot of different hardware elements, each of them consuming electrical power even in times of low usage by users (Berndt, 2012).

Meanwhile, the remarkable change happens in current software industry: users are accustomed to Web applications, online rental model of software becomes popular and middleware sets off a new wave of innovation, technological innovation emerges intensively. In the process of transforming from software to services, middleware can be considered as the foundation of supporting services.

In general, users may access to a highly heterogeneous set of compute resources, which include all kinds of different hardware and software in cloud computing (Niels *et al.*, 2011). However, the cloud scene is still maturing and there are heterogeneities between the clouds, ranging from the application paradigms to their service interfaces (Ranabahu and Maximilien, 2009). These existing problems hinder the development of cloud computing. So, the cloud middleware services built on cloud computing platform

and user-demand cloud middleware services are becoming more and more important.

### Challenges and IDC:

**High cost, high energy consumption:** IDC is an industry of low profit rate, high cost and energy consumption, especially in energy consumption, with the background of sustainable development and energy saving, the common concern for industry is how to reduce the cost of IDC enterprises. Using virtualization technology is one of the main approaches to reduce the cost of IDC services at the moment, especially in energy costs.

**Service quality affects customer satisfaction:** In recent years, as the influx of large numbers of service providers, great confusion is brought to IDC market, coupled with the lack of unified planning and industry standards, so that the service quality of IDC enterprises varies greatly and consumers are gradually losing their satisfaction and confidence in IDC. Currently, many IDC service providers are working together with software developers and solution providers to apply new technologies, new products to IDC data center, it has achieved good effects.

**Unified supervision is difficult, high management costs:** As we all know, data center is composed of thousands of servers, switches, routers and other physical facilities, as well as more virtual machines, vast amounts of information and services, how to manage these resources, how to expand hardware and how to

reduce the application complexity of virtualization technology, then reduce management costs, it's the biggest challenge for IDC service providers. So, we should have a good management platform.

**Risks of network security:** With the rapid development of Internet in recent years, the threat of network security is increasingly serious and the survival of IDC services is directly reduced by large-scale attack traffic, useless traffic squeezes a lot of network bandwidth, meanwhile the rapid spread of the virus and unauthorized users access cause a great loss of users resources and security problems faced by IDC become increasingly complex and diverse.

**Fierce peer competition, low user viscosity:** Thousands of enterprises have been providing IDC services and competition inside industry becomes fierce. Due to the alternative of users is more and the cost of migration is low, so the user viscosity (loyalty) is very low. Under this circumstance, if IDC service providers can't provide services with high reliability and security and they will eventually be eliminated in the industry competition.

**Our vision and goals:** Facing these challenges, most IDC service providers have adopted virtualization technology and gets benefits from reducing hardware acquisition costs and improving energy efficiency, but followed by, the problem of virtual devices supervision, the support of virtualization by application servers and the transformation of IDC's own service model with the full arrival of cloud computing, how to take advantage of technology and business innovation brought by cloud computing, so the focus of present competition in IDC market is to develop more value-added service products based on Cloud Computing.

With the product development, CVIC commercial Middleware Co., Ltd. has been careful research and tracking of key technologies of middleware and Cloud Computing, we have made a cloud computing platform middleware practical application, developed to provide cloud computing services cloud middle ware products InforSuite middle ware platform. It has great technical progress compared to the previous generation product, providing effective infrastructure and flexible SOA facilities; and compared to similar products in industry, InforSuite also has a lot of characters, it is developed by CVIC middleware based on many years' experience of industry application and products development, moreover, it is the practical application of cloud computing in the field of middleware and it is considered as the first cloud services middleware in industry based on the cloud computing.

InforSuite cloud services middleware effectively integrates its own services with cloud computing by

virtualization technology and high reliability and availability of InforSuite middleware are further strengthened. By effectively integrating InforSuite middleware services with cloud computing, it not only provides the traditional cloud computing, but also middleware services based on cloud computing. InforSuite cloud services middleware focuses on constructing virtualized middleware services on the basis of the IT hardware virtualization and provides services of high availability, flexible computing, management, SLA, intelligent scheduling strategy on top of middleware services. Business applications can use the supporting capacity of rapid development and operation provided by virtual middleware services, on the other hand, cloud computing services built on top of middleware services can be used to achieve higher availability, reliability and disaster recovery etc. The supporting platform of IDC application services is built by InforSuite cloud computing application server.

## CLLOUD COMPUTING

**Cloud capabilities:** Cloud computing has become one of the hottest buzzwords in the IT area. Cloud computing Integrating with middleware can improve the service quality of middleware effectively; moreover, the long-standing business model may even be changed and thus gain a return to the middleware enterprises, the most typical case is to operate PaaS (Platform-as-a-Service) business, the environment of development platform is provided as services (Armbrust *et al.*, 2009). The middleware can be delivered as cloud platform services through middleware services built on cloud computing platform and middleware services are provided according to user demand.

The introduction of cloud computing is also determined by business development of CVIC, the present CVIC is no longer the traditional middleware enterprise, it is also a PaaS provider with strong brand and technical strength. If you want to improve product availability, reduce operating and maintenance costs, calmly deal with the surge in user traffic, cloud computing is certainly the best implementation technique.

**Cloud computing and middleware:** Middleware is a distributed computing system as a set of components in a distributed computing system. In general, middleware is used to intermediate between heterogeneous systems to a uniform interface.

Cloud computing is scalability and the key technology which makes it possible is virtualization (Lagar-Cavilla *et al.*, 2009). Cloud computing is defined as both a services over the Internet and application in the Data Centers (DC) that provide those

services (Armbrust *et al.*, 2009). From the point of application development and operation, building the actual development environment by users is relatively complicated and the error rate is also high, whereas development environment provided by the PaaS can greatly reduce the workload of the users to build the environment, so the market prospects are very optimistic. However, it is also a great challenge for PaaS operators that users need a wide variety of platform environment-how to provide safe and reliable environment efficiently and neatly? The "template" technique is proposed by CVIC.

In short, through InforSuite pre-defines a variety of templates corresponding to a software environment, so that it becomes a simple pre-configured template after the user submits an environment application, a new environment can be provided by image template library right now and the problems of operating system, middleware, applications and a series of environmental installation and configuration needn't to be cared. Obviously, this allows the software environment with complete configuration to be replicated on-demand.

From this perspective, a set of business system management center should be developed for making templates, organized according to the deployment architecture of business system, such as the user needs CRM (Customer Relationship Management), the needed Web servers, database servers and other software environment will be linked together as a CRM template, which is the concept of cloud application, the overall of any business application services is packaged from the point of business, a one-off building is completed. For users, they are a cloud application rather than a dispersed composite individual.

It needs for strong technical support to achieve such a concept-cloud computing, when PaaS services are provided for users, CVIC middleware needs to deal with the fluctuations in business load and it must rely on cloud computing to provide high reliability, high security, flexible and efficient environment. On this basis, achieving package of cloud application should also be fine-grained resource allocation and management, that is, considering the personalized instances exclusive.

In order to achieve this technical objective, enterprise cloud platform based on IA hardware architecture was co-built by CVIC and Intel software sector. Through a joint technical research, a new cloud computing solution was finally succeeded to be built-CVICSE InforSuite Cloud, middleware and the underlying resource management are integrated by cloud computing and the unique PaaS cloud platform of CVIC is provided to facilitate to integrate different applications for enterprises.

The present CVIC can provide both the traditional cloud computing and middleware services based on

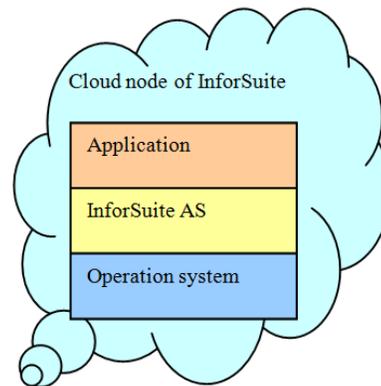


Fig. 1: Cloud node of InforSuite

cloud computing. ISV and other partners can also use this platform to reduce their development costs and get new business opportunities through the rapid deployment of SaaS applications.

### INFORSUITE CLOUDWARE CONSOLE ARCHITECTURE

**Cloudware architecture:** InforSuite with Cloud computing relies on virtualization technology and micro-kernel framework of security and controllable, middleware and virtual machine technologies are integrated innovatively, not only are the reliability and availability of traditional middleware strengthened, but also the services of cloud computing are provided by InforSuite Cloudware, such as the flexible computing, integrated resource management, SLA, intelligent resources scheduling, so higher availability, reliability and better disaster recovery business applications can be achieved by building on InforSuite. A cloud node of InforSuite is shown in Fig. 1.

CVIC Middleware solution of InforSuite Cloudware is an infrastructure by virtualization technology in the infrastructure layer and by using server virtualization technology to integrate server resources. Then, the resources utilization of data center is improved effectively, investment costs are reduced and the capabilities of disaster recovery and flexible computing are also improved.

As Shown in Fig. 2, the architecture of InforSuite cloud services middleware platform consists of four levels:

- **Resource pool of physical hosts:** At the bottom of InforSuite cloud services middleware platform, is the most basic level of computing power provided by the physical memory, CPU, processor, memory, etc. The physical host pool is dynamically extensible and can be added with the new physical host. And, InforSuite cloud services can enhance the physical computing of middleware platform.

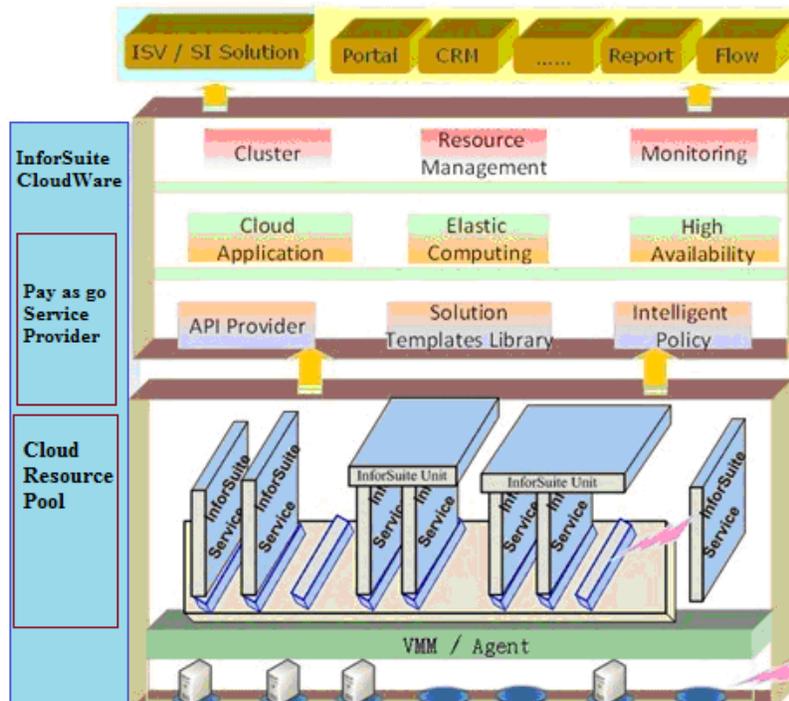


Fig. 2: Architecture of InforSuite cloud services middleware platform

Cloud resource pool adopts the current virtualization technology (VMware, Xen, etc.) to abstract the physical host into multiple virtual machines; each virtual machine can be deployed as an InforSuite cloud node. What is more, Cloud node is the main component of cloud resource pool, including operating system, InforSuite AS and applications (as shown in Fig. 1). Then, according to customer demand, several InforSuite cloud nodes can form a cloud application solution for customer to solve specific application problems and service cluster is the most typical cloud application solution. Meanwhile, shared storage server provides image of InforSuite cloud node for cloud resource pool, it supports the cloud information stored in resource pool, such as SAN, NAS or iSCSI and other shared storage devices.

- **Scalable InforSuite virtual service layer:** Scalable InforSuite virtual service layer, middleware platform in InforSuite cloud services running on a large number of InforSuite service node call InforSuite cloud nodes. In addition to external change layer provides a virtual computing capabilities, such as: virtual memory, virtual CPU, virtual memory space, but also external provision InforSuite virtual services, virtual service here InforSuite is logical, for the users, do not know InforSuite services from that physical node. In InforSuite service, based on the business applications can be deployed, component

enterprise cloud computing platform, external services can provide SAAS.

InforSuite virtual service layer can be composed of multiple InforSuite services through a virtual InforSuite unit, which corresponds to a real cloud applications provide a consistent outside services, such as: building InforSuite service cluster, supporting a unified business services.

- **Cloud computing services layer:** InforSuite virtual layer on top is a real cloud computing services, such as: elastic computing service, high reliability, service, smart strategy for services, cloud resource management. Based on InforSuite cloud middleware platform for enterprise applications, SOA services, independent software vendors can be calculated based on these services, provide high reliability of external cloud computing solutions. Typical cloud computing services as follows:
  - **Scalable computing:** Implementation InforSuite service when under heavy load, automatically adding new nodes, enabling faster response.
  - **Disaster recovery mechanisms:** Disaster recovery services provide the mechanism for InforSuite, enabled, enables disaster recovery, users do not need additional configuration.
  - **Example exclusive:** Exclusive mechanism to provide examples. In this way, able to cater for different users with different quality of service, such as exclusive a group of key users can

InforSuite service resources to ensure that critical business running smoothly.

- **Centralized monitoring:** Provides for multiple resources (hardware and virtual resources), the concentration of regulatory capacity, users can achieve through a single interface to multiple hosts, virtual machine management.
- **ISV/SI:** Virtual Machine-based application deployment solution, push developers to implement applications based on virtual machine deployment, thus reducing the probability of error-site deployment, easy maintenance.
- **InforSuite cloud management console:** InforSuite cloud management console provides a platform for cloud management, cloud platform for the management of the various parts, which divided into two main elements: Cloud resource management and Service management. Cloud resource management is the main achievement of physical computational units and virtual computing unit management. Service management can be delivered to achieve InforSuite service management, InforSuite service aggregation. Meanwhile, service uniform distribution InforSuite resources used to produce InforSuite service templates.

It is a physical server running InforSuite cloud computing application server, which is mainly used to monitor InforSuite cloud resource pool, InforSuite cloud computing application server is mainly composed of cloud computing management center and cloud service module. Cloud computing management center provides cloud management tools and command-line tools, which provides a graphical interface and a command window to support administrator to monitor and manage objects in cloud resources pool; cloud service module implements management operations for cloud resource pool, primarily including real-time monitoring of performance, the implementation of high reliability, disaster recovery mechanisms and flexible computing execution, etc.

#### **InforSuite cloudware features:**

**Powerful unified supervision:** InforSuite cloud computing management center provided by InforSuite Cloud Computing application server's supports IDC administrator for unified monitoring and management of cloud resource pool. Management center mainly manages physical hosts, InforSuite cloud nodes, cloud application solutions, application servers, templates deployment and the configuration of the system constant.

**High reliability and flexible computation guarantee to run safely and efficiently:** InforSuite cloud

computing application server is the first application server to support cloud computing in domestic application servers, allowing users to supervise the cloud resources size down to application server level and high reliability, flexible computation and other cloud characteristics are implemented; InforSuite application server provides a unified security management by Info Guard series products, application services can be assessed in advance, defense in concurrent, recovered afterward and other management or supervision of multiple phases, three-dimensional protection is carried on all kinds of threats, it shows a good safety protection.

InforSuite cloud services middleware platform defines the concept of cloud applications, cloud application is called the overall package of business applications, unified deployment, backup, startup, monitoring management and a cloud application may correspond to a business cluster, including business application needs the various elements: database, application server, load balancing, etc.

Cloud services Middleware for cluster management strategies dealing with a lot of definitions, such as: cloud computing environment, how to make the clusters more stable, external services provided by the ability to achieve smooth, will not be access to the influence of the peak.

**Flexible customization and quick deployment of operating environment:** InforSuite cloud computing application server provides tools of making deployment templates for IDC administrator, it can easily customize the operating environment of application according to user demand, the templates are imported into the shared storage after they are made and they can be deployed into the solution of application anytime. After template is deployed, it becomes one piece of InforSuite cloud node running in the InforSuite cloud resource pool.

Use InforSuite cloud services middleware platform, the real time deployment, backup at anytime, anywhere to migrate the deployment target. Administrators can quickly install and deploy application solutions and participation in the deployment of artificial minimum.

By using the image template library, you can quickly provide a new environment; do not have to consider the operating system, middleware and applications installation and configuration of a series of environmental problems. Eliminate the installation and configuration process, oversight of the impact of the entire business.

InforSuite cloud services middleware platform cloud computing environment in addition to the HA, it also provides a level of disaster recovery for business applications strategy, to ensure that business

applications can provide 7\*24 h service capabilities. Compared to the traditional disaster recovery, InforSuite cloud middleware service provides disaster recovery backup system can be achieved without errors, easy to test run without human intervention to enable the standby machine.

**Reduce the costs of operating and management:** Using the powerful services (reports, workflow, etc.) provided by InforSuite cloud computing application server in the process of development, operation, as well as the support for cloud computing, IDC service providers can develop more value-added services based on cloud computing; so that operating and management costs are reduced, customer satisfaction and service quality are improved and a service model of use on-demand and pay-as-service are provided.

InforSuite cloud services cloud computing as a middleware platform products, known as cloud computing with features such as: improve resource utilization, reduce the maintenance workload of IT infrastructure and reduce data center space and power.

Use InforSuite cloud services middleware platform, business systems migration will no longer depend on any operating environment, for transplanted, directly into the template, can be imported to the new platform. Cloud platform business applications such as the operating system and hardware dependencies are isolated from the environment, so do not worry about compatibility issues, you can smoothly deploy the platform in the latest early business

operating environment and without changing the environment under the premise of full use of the new platform advantage.

## FUNCTIONS OF INFROSUITE CLOUDWARE

**Basic functions of InforSuite management platform:** The basic functions of our InforSuite management platform includes new cloud pool, cloud pool added to the host, view cloud pool properties, connection pool, new host, view host properties, start and restart host, host added to the pool, connect to host, new cloud node, lifecycle management of cloud node, cloud node transformed to a template, view cloud node properties, virtual machines migration, new NFS/CIFS storage, view storage properties, default storage set, template properties, etc.

### Detailed functions:

**Pool management:** After the user successfully logs into the system, click the corresponding cloud pool node in the tree menu, the right side view of interface is shown in Fig. 3.

**Pool properties:** Users can view general, storage, network cards and other related property information of the existing cloud pool. When the user clicks "General" in cloud pool properties tab, the system will display name, description, creation time, master host and other related properties of the cloud pool, as shown in Fig. 4.

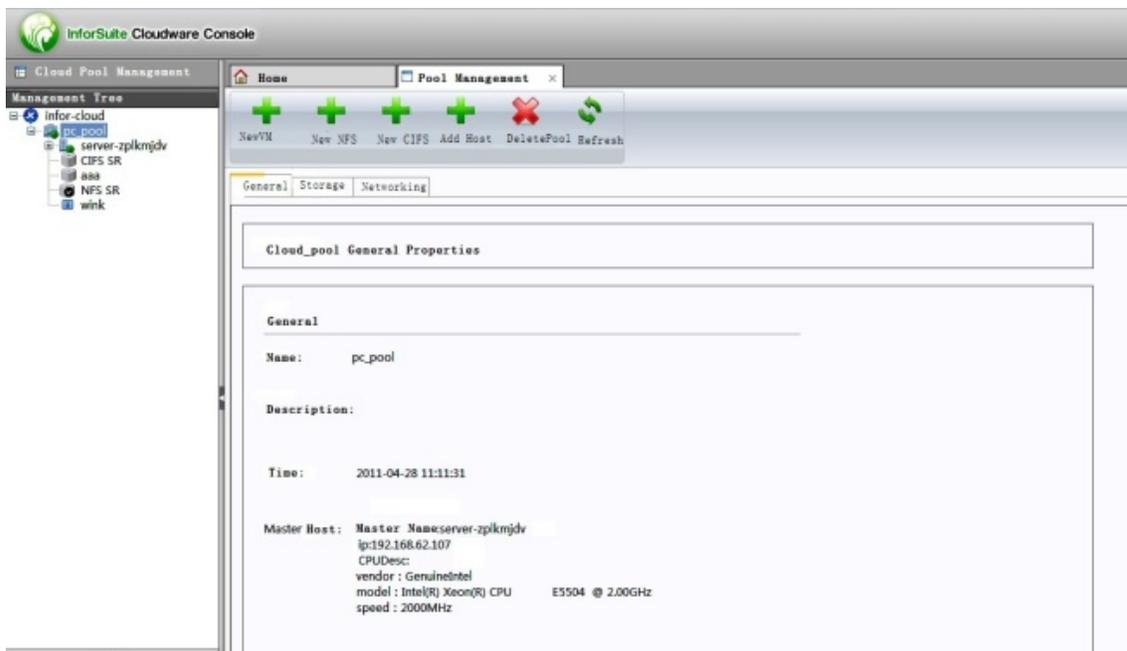


Fig. 3: Resource pool management

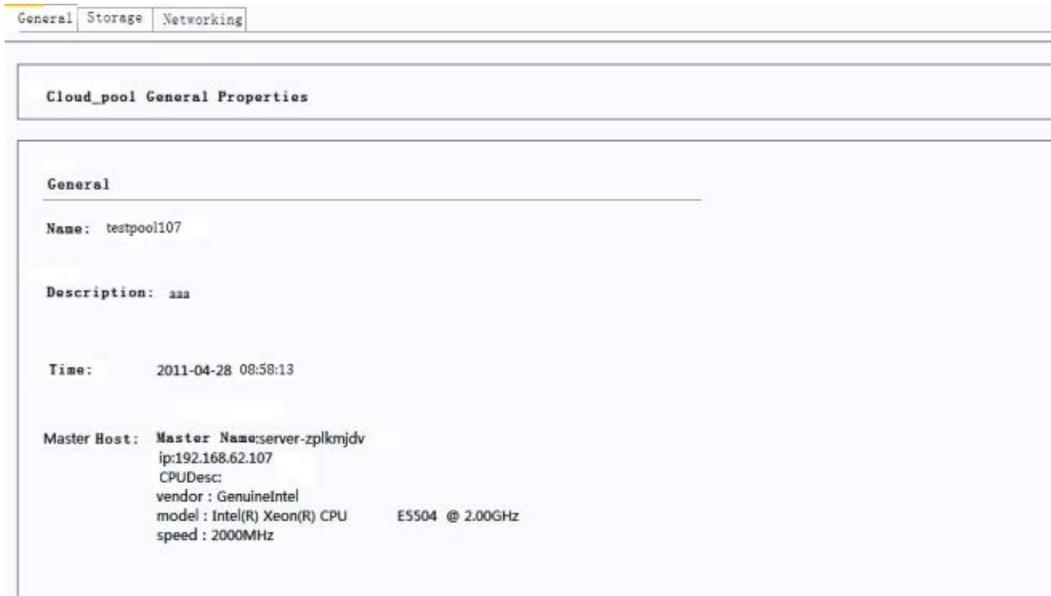


Fig. 4: Pool properties management

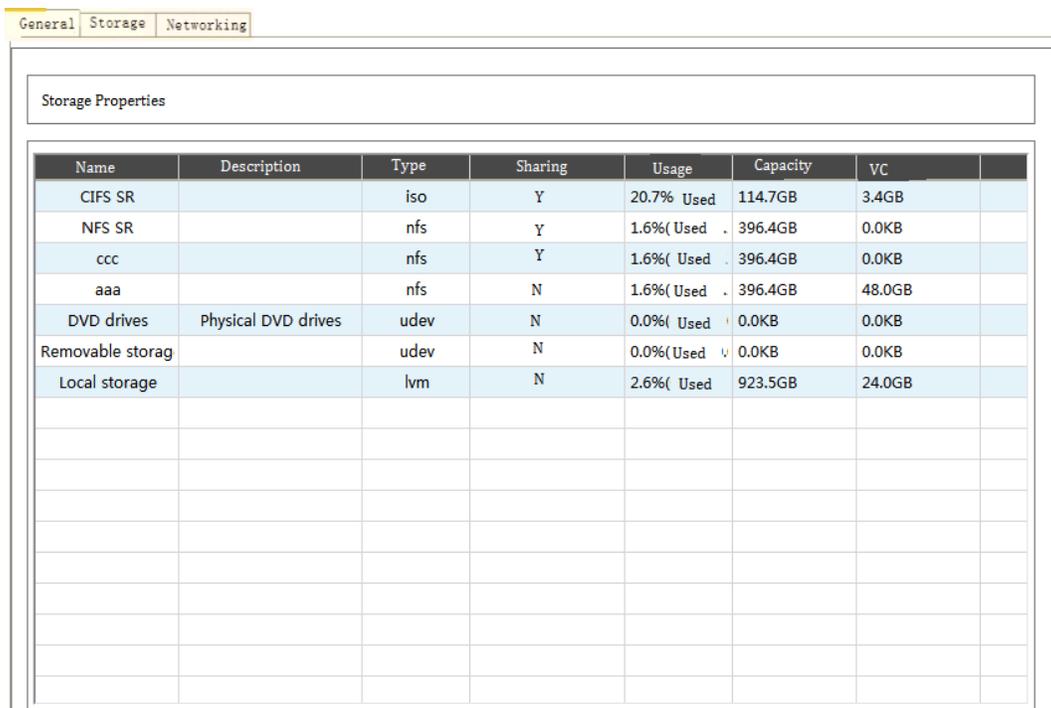


Fig. 5: Storage properties

When the user clicks "storage" in cloud pool properties tab, the system will display name, description, type, sharing, usage, size, virtual size and other related properties of the cloud pool, as shown in Fig. 5.

**Host management:** After the user successfully logs into the system, click on the corresponding host node in

the tree menu, the right side view of the interface is shown in Fig. 6.

**Host properties:** Users can view general, storage, network card, CPU, memory, performance and other related attribute of existing host; when the user clicks "general" in the host properties tab, the system will display the host name, description, IP address and other

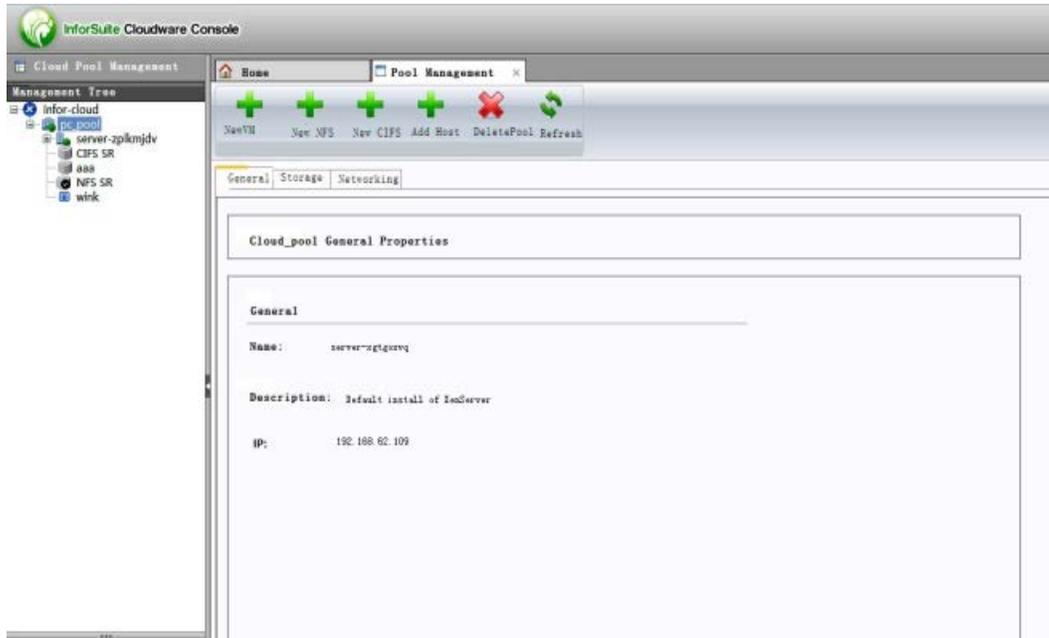


Fig. 6: Host management

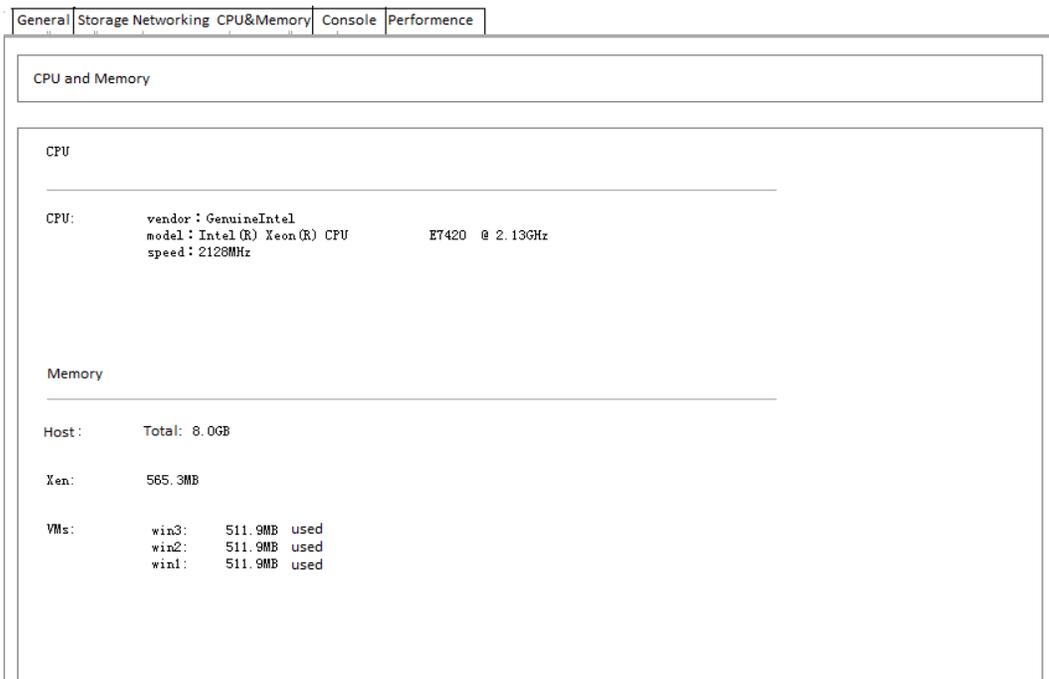


Fig. 7: Host properties management

related properties; when the user clicks "storage" in the host properties tab, the system will display all the storage name, description, type, sharing, utilization rate, size, virtual distribution and other related properties of the host; when the user clicks "network card" in the host property tab, the system will display all the network card speed, duplex, vendors, device, PCI bus and other related properties of the host; when the user

clicks "CPU and memory" in the host properties tab, the system will display CPU information, memory size, Xen, memory used by running virtual machines and other related information of the host, as shown in Fig. 7.

We can also monitor the status of our cloud management platform in real time. The system performance status is shown in Fig. 8.

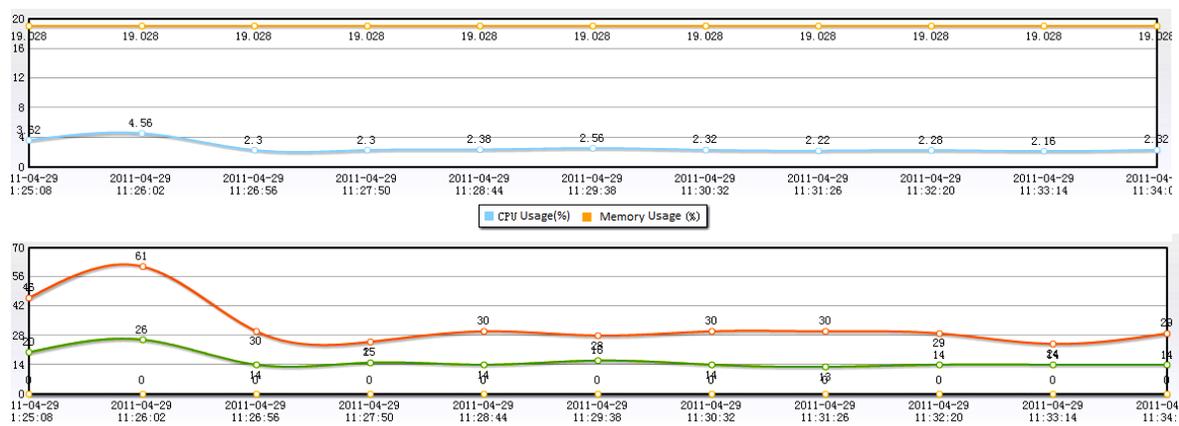


Fig. 8: System performance monitoring

**Application results in real world:** For the requirements of China Telecom "Star Cloud plan", Jiangxi Telecom IDC built a cloud computing platform of a 20U rack by InforSuite platform with cloud computing, the integrative management of infrastructure resources and middleware resource is implemented on cloud platform, that is, Jiangxi hotline, information and security scanning systems are deployed on InforSuite Cloudware.

After several months' operation, various application systems deployed on InforSuite platform operated stably and reliably, the performance requirements of running on a physical host are totally reached. To take information and security scanning system for an example, it needs to take rack space of 9U before, 9 physical hosts are occupied exclusive, while InforSuite platform used as supporting and just less than 1U of rack space is occupied and computing resources is less than a physical host.

Meanwhile, applications system can be defined as a cloud application by InforSuite, unified management, flexible computing, disaster recovery and other policy configuration are implemented. When system resource is insufficient, computing resource is allocated automatically by the configured flexible strategy; the phenomenon of suspended animation in system running can be effectively eliminated by configured disaster recovery strategy.

Moreover, according to the Jiangxi Telecom's security test results, system security is scanned by IBM Rational AppScan 7.8.0.2, no safety problems are found in systems supported by InforSuite; and if running on another similar middleware products, 87 security issues are found by the same scan, obviously, security has been substantially upgraded.

The security of cloud computing platform based on InforSuite is highly appreciated by customer of Jiangxi Telecom. The system runs on InforSuite platform of CVIC Inc., the platform is an advanced, highly secure cloud computing product that can effectively improve the utilization of IT infrastructure, reduce energy consumption, green, high security data center.

In next step, we plan to expand the support for application frameworks and large scale data as well as other clouds.

## CONCLUSION

IDC based on InforSuite is oriented to business, feature supporting of self-management, intelligent, which can provide high disaster recovery and flexibility. And the new generation of IT infrastructure is composed of infrastructure resource architecture platform, middleware supporting operating platform, value-added service platform, operation and maintenance management platform and user self-service platform.

In terms of improving the cloud middleware capabilities, we expand the support for heterogeneous set of compute resources and provide cloud security service and security protection using InforSuite Cloudware platform. And, it can effectively resist attacks from outside the cloud and achieve some good results in real world.

## ACKNOWLEDGMENT

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