Field Audit

Report

BLADE Switch

Enterprise Network Switching Devices (Customer Use Case Evaluation)

By Judson Zhou, Sino-bridges Analyst

February, 2011

Table of Contents

Introduction

Blade Network Technologies (BLADE), which was acquired by IBM in 2010, is a supplier of top of rack and bladed Ethernet network infrastructure solutions for the data center. The high density, low latency, low power consumption and virtual machine awareness of BLADE Ethernet switches are ideally suited for virtualization and consolidation within the growing number of organizations considering the benefits of cloud computing. This report documents how Beijing-based Skycloud Technology Co., Ltd. has deployed BLADE switches in a private cloud infrastructure that's being used to serve the needs of Chinese enterprises including a division of State Grid, a key state-owned supplier of electricity.

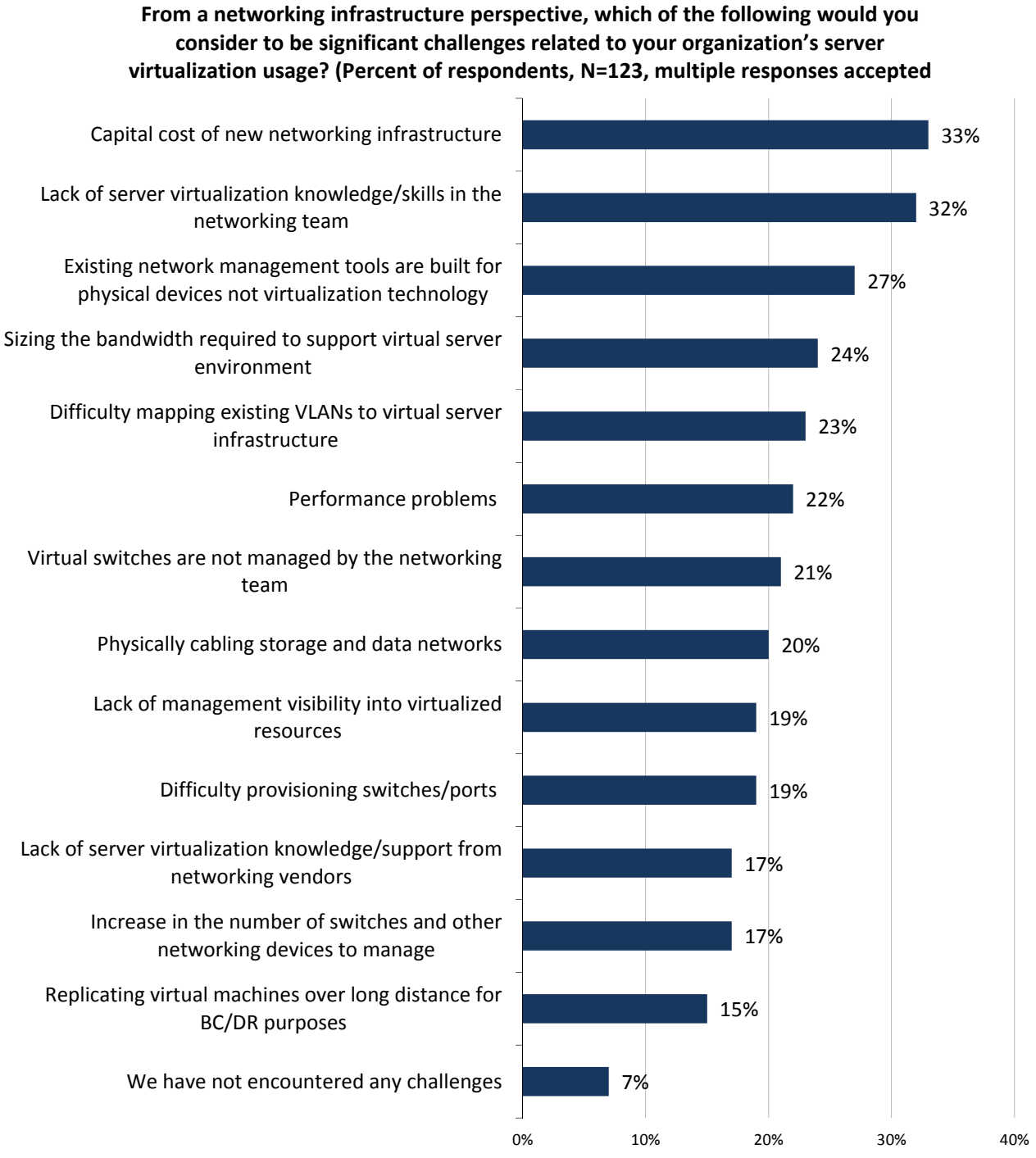
Background

Nowadays, people have realized that many of their systems are idle most of the time and that a large number of resources in their data centers are not fully utilized. In addition, as server and storage virtualization is deployed and available space, power, and air conditioning capability in the data center continue to reach their limits, many enterprises are deploying network virtualization technology. Network virtualization technology makes it possible to fully consolidate infrastructure in the data center. Network virtualization brings many benefits, including increasing utilization; reducing demands for physical facilities to lower procurement costs; reducing maintenance and operating expenses; reducing energy consumption and cooling demands; and ensuring more flexible and dynamic support for users' computing environments.

Figure 1 shows the results of a recent SINO-BRIDGES survey[1] which explored the challenges for network infrastructure in a virtual server environment. As shown, the cost of new network infrastructure tops the list of challenges reported by network managers in a virtual server environment. Increasing performance and bandwidth requirements and a lack of server virtualization training and integrated tools were also identified as major challenges. To meet the increased performance and bandwidth needs in a consolidated virtual server environment, IT managers often add ports or switches to avoid a potential bottleneck; adding additional infrastructure increases costs and defeats the goal of reducing cost and complexity with consolidation. In addition, it increases complexity, reduces utilization, and ultimately lowers the return on investment.

[1] Source: SINO-BRIDGES Research Report, *The Evolution of Server Virtualization*, November 2010.

Figure 1. Networking Infrastructure Challenges Related to Server Virtualization Usage



Source: Enterprise Strategy Group, 2011

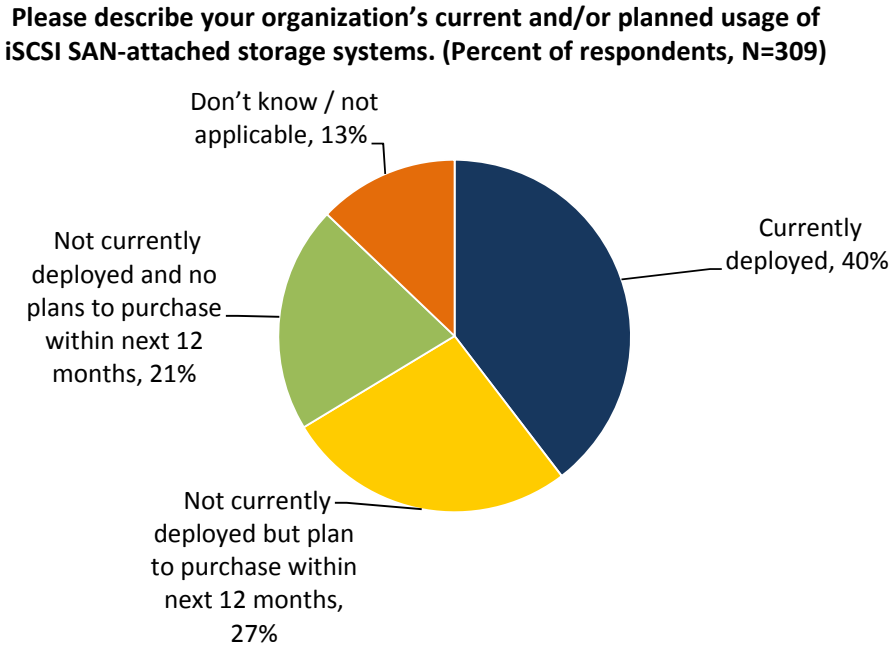
The development of cloud computing technology and its market adoption has been a gradual process. Initially, most organizations used server virtualization to consolidate physical servers in order to lower capital and operating costs. In addition, server virtualization and storage networks have been used to bring other benefits, including enhanced mobility, flexibility, high availability, and fault tolerance.

Two kinds of technology are typically used to provide storage networking connectivity in the data center: Fibre Channel (FC) and iSCSI. iSCSI has been growing in popularity in recent years, especially in virtual server environments. The main reasons that ISCSI technology has seen rapid development and wide adoption are as follows:

- iSCSI leverages industry standard Ethernet technology which reduces complexity and substantially reduces costs compared to traditional Fibre Channel technology.
- iSCSI-based technology has continued to mature. The selection, support, functionality, stability, and interoperability of iSCSI products have been validated and accepted in the market.
- iSCSI technology has been used in production environments and the experience of current users has led to increased awareness of the benefits of using iSCSI, fueling rapid and wide adoption.
- Up to now, there has been no market resistance or downside associated with iSCSI; many users feel satisfied with iSCSI SAN solutions.
- Microsoft has been a key proponent of iSCSI, which is one of the main reasons that a lot of customers use iSCSI technology based on the Windows operating system.
- In addition, VMware's support has become another major factor promoting iSCSI usage.

SINO-BRIDGES research[2] indicates that a growing number of large organizations have adopted, or plan on adopting, storage systems that leverage iSCSI SAN technology. As shown in Figure 2, 40% report that they have already deployed iSCSI storage systems and 27% plan on doing so in the next 12 months. Clearly, iSCSI SANs are growing in popularity and have excellent momentum.

Figure 2. iSCSI SAN Adoption



Source: Enterprise Strategy Group, 2008

A mature cloud architecture includes server virtualization, network virtualization, storage virtualization, and desktop virtualization—which all depend on a stable, reliable, and scalable platform that can readily respond to new business needs. A 10 Gb Ethernet device with high throughput and multi-core CPU architecture allows a single physical machine to utilize greater bandwidth to run more workloads. Server virtualization applications such as migration of virtual machines and adoption of storage virtualization require network connection devices with high

[2] Source: SINO-BRIDGES Research, *SINO-BRIDGES 2008 Enterprise Storage Systems Survey*, November 2008.

bandwidth and high performance. As this new phenomenon of "moving" virtual machines occurs increasingly frequently, network technology needs to adapt to these dynamic changes. VMready software developed by BLADE is one of the examples validating this trend.

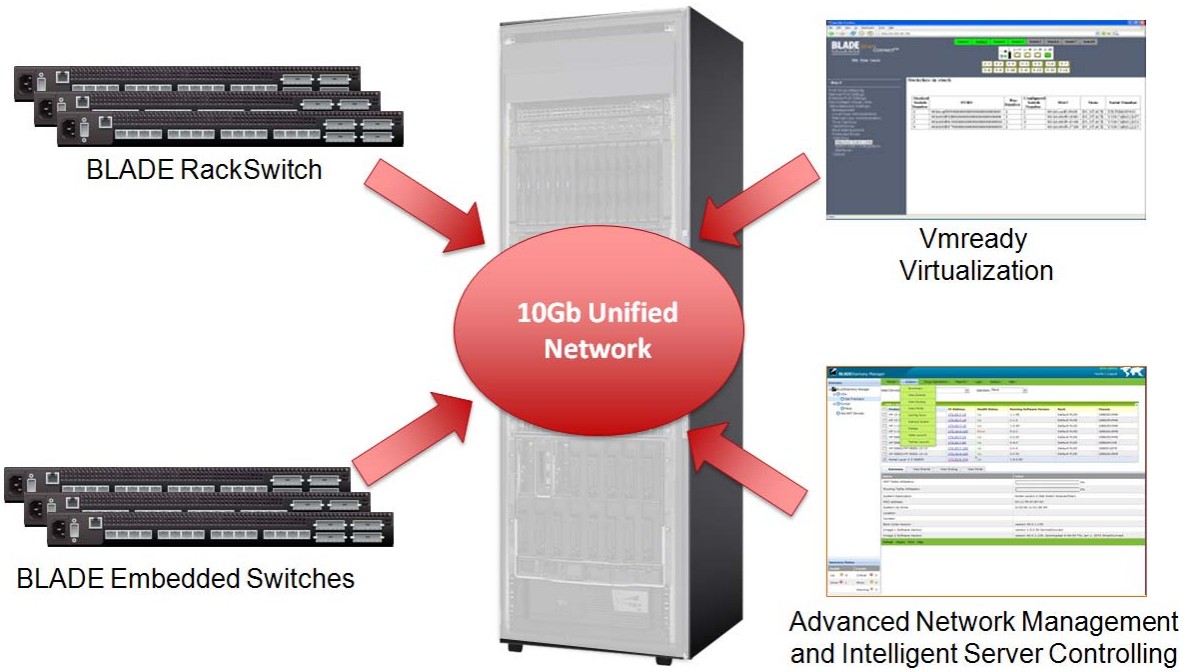
The development of server virtualization, storage virtualization, network virtualization, and data center consolidation has increased the market applications of 10 Gb Ethernet core switches. Today, more and more customers use the Gigabit (10 Gb) Ethernet network, which has become a major dynamic in the field of networking equipment. In China, the cloud is a huge potential market. The integration of telecommunications networks, cable TV networks, and the Internet (triple integration); the Internet; government and medical care digitization of information; and a large number of fast-growing small and medium enterprises constitute strong market drivers for cloud computing in China. On the one hand, China has a large group of fast growing small to medium-sized enterprises (SMEs) who see the investment needed to ensure that their own data centers will meet the demands of their fast-growing businesses as cost-prohibitive and difficult to justify in terms of expense. Cloud provides a more economic and efficient solution for them by virtue of allowing them to customize their environments or rent on demand only the resources that they will need. On the other hand, a lot of vendors providing servers, storage hardware, and software are looking to promote their products to the SMEs through a cloud platform so as to gain more market opportunities in the future. Third, the "Twelve Five" plan (the Chinese government's five-year strategic guideline plan focusing on key investing initiatives), which has just been released, also shows the government's supportive attitude towards high-tech industries.

These problems and opportunities in the market help to bring about a situation in which service interruption and security risks caused by incorrect network configurations have kept virtualization from growing into its full potential in the cloud data center. In addition, ensuring network performance and security in the movement of virtual machines are additional operational issues which will have to be tackled for virtualization to reach its full potential. In order to support a dynamic data center environment, one which provides for the movement of virtual machines, an intelligent network is required, which accordingly demands that network vendors provide products which have the following features:

1. Support for virtual machines.
2. Support for network configuration at the virtual port (V-Port) level (not just the physical port level).
3. Migration tracking of VMs within the data center.
4. Network configuration that automatically re-sets with the migration of VMs.
5. Scalability at the data center and "cloud" levels.

To solve these problems, BLADE provides network switching equipment with VMready software, which enables ease of use, centralized management, enterprise-class performance, reliability, and low latency. These properties make it suitable for a cloud environment: rapid installation, simple management, seamless upgrade expansion, high performance, low latency, and virtual machine awareness. BLADE enables the data center for cloud computing through a Gigabit network, providing the solution shown in Figure 3.

Figure 3. BLADE Network Equipment Solution



VMready technology is based on the ability to identify and monitor virtual machines in the physical hosts connected to the switch. It can identify virtual machines according to the properties unique to them in the switches, which enables administrators to implement the same strategy in the switches as in the server environment. Greater network flexibility and control are provided by allowing administrators to set network parameters for each VM in the network switches. Once set, those VMs' network settings will move with the VM in the VMready domain without an administrator's intervention. At the same time, VMready enables the network administrator to see deep into the structure of the virtual environment beyond the boundaries of physical servers, allowing for easier and more efficient configuration and monitoring of SLAs. Each VM is identified according to its own virtual NIC (vNIC), and the corresponding actions are taken in accordance with the MAC addresses and destinations of these vNICs. In VMready network environments, when the VMs migrate across physical hosts, their network properties migrate along with them—ACL, QoS, and VLAN attributes can remain unchanged when virtual machines are added, moved, and removed.

The cloud service provider SINO-BRIDGES interviewed has deployed the cloud solution interconnected through BLADE switching equipment. This report explores the customer's actual use of BLADE switch products, the problems they solved, and a general evaluation of the product.

Customer (Skycloud)

SINO-BRIDGES interviewed Beijing Skycloud Technology Co., Ltd. (referred to as "Skycloud Technology"), a cloud service provider whose core advantages in its cloud service center are large-scale job scheduling and clustered management. Skycloud Technology specializes in the underlying cloud architecture, building cloud platforms, and providing a variety of cloud services around them. It has a considerable professional team in charge of R&D, marketing, customer service, and the service network. Today, Skycloud itself has stored all its own business data in its cloud data center. Skycloud has completely replaced its original PCs with thin clients, allowing its operation to fully shift to a desktop virtualization platform.

Environment and Form

During the interview, the director responsible for the management of the Skycloud computing center said: "We are a domestic organization focusing on the field of cloud, so our entire network architecture solution in our data center is oriented toward cloud computing. Our data center is the company's private cloud as well as the environment for Skycloud to research, develop, and test cloud and its services, which makes it an incubator for Skycloud strategic services and products. Today, our data centers have deployed a large number of applications, including application systems providing cloud service and self-management, such as YoYo applications, Skycloud trend, and cloud based MIS systems, which have all been already deployed in the virtual environment. Capital and operating costs have been reduced by consolidating the whole data center using server, storage, network, and desktop virtualization. One of our goals is to enhance the mobility of virtual servers with network virtualization. We're also focusing on how we can keep costs down as we increase the scalability, manageability, and reliability of our growing private cloud infrastructure."

BLADE networking products are used to simultaneously support a variety of major virtualization technologies including VMware, Citrix XEN, the Tcloud server virtualization platform (developed by Skycloud), and the YOYO XEN server virtualization platform developed by YOYO. For this, Skycloud has deployed 20 VMware server virtualization platforms, 40 TCloud server virtualization platforms, 4 Citrix XEN server virtualization platforms, and more than 100 YOYO XEN server virtualization platforms. These server virtualization platforms have been running a large number of virtual machines and applications. For instance, the VMware virtualization platform has been running more than 100 virtual machines. As Skycloud's virtual server environments have grown, network performance monitoring and management capabilities at the virtual machine level have become critical. Server virtualization enables it to use desktop virtualization, reducing management cost. Currently, it has already used more than 100 thin clients.

Why Choose BLADE Switches?

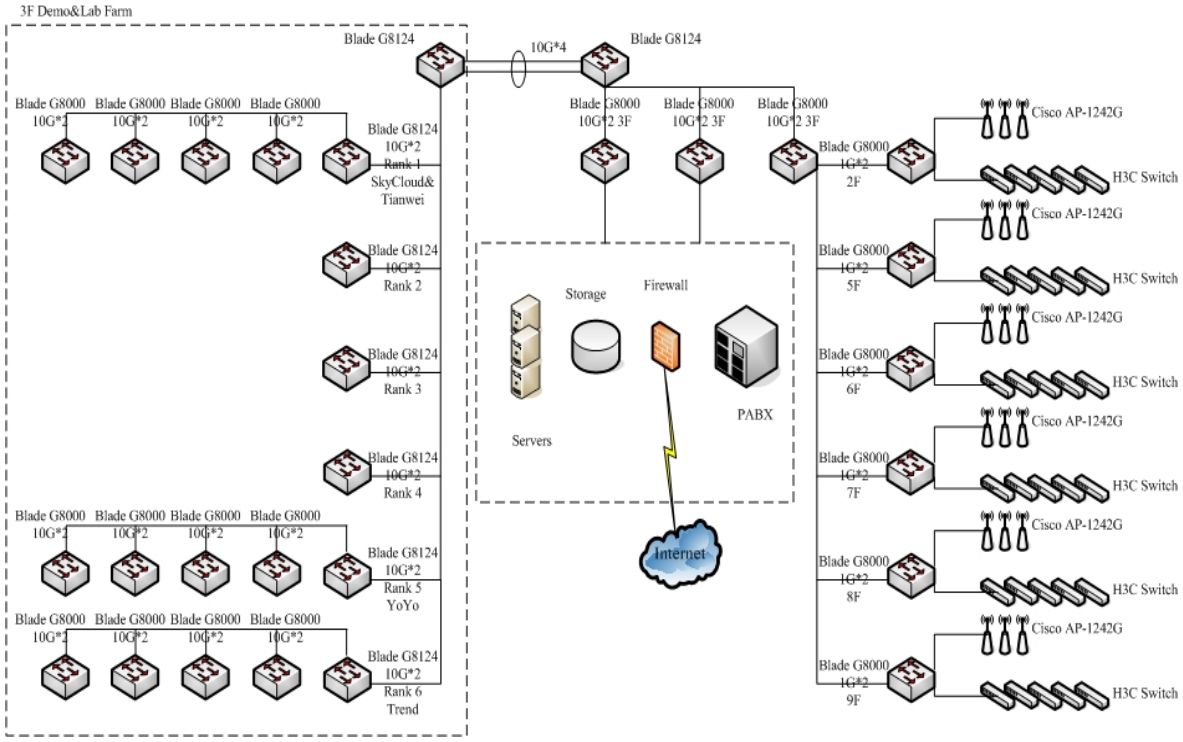
Traditional switches and routers' restrictions on throughput, port density, and support for virtualization technology can limit their usefulness in the cloud. As Ethernet technology has rapidly evolved in recent years, its use in switches' application in server virtualization is also rapidly growing. For the deployment of a variety of Ethernet, 1 Gb Ethernet, and 10 Gb Ethernet switching equipment in the network, Skycloud needs to ensure the interoperability of these switches, especially for the network interconnection involved in implementing a large number of virtualized servers so that it can maintain the functions of the network.

The rapidly rising energy consumption and heat dissipation in cloud computing centers is a factor Skycloud has to consider in the selection of products. BLADE switches have been designed specifically for the data center in terms of airflow—thus Skycloud no longer have to add extra cooling equipment for them, effectively saving costs. It also achieves the aggregation of servers through the integration of multiple 1G connections into two 10 G uplinks. With BLADE switches, Skycloud enables network virtualization for its own data center network, reduces costs, and improves efficiency by combining the benefits of different Ethernet networks.

It is very important to monitor, configure, and manage each virtual network's performance for Skycloud's users and cloud service providers. By using VMready to achieve network virtualization, Skycloud provides users with more capabilities and flexibility in managing the virtual network. Managers can use the BLADE management interface to manage each virtualized network, and configuration parameters and indicators are more transparent as compared to VMware management. At present, most users are managing servers and networks independently, but with this flexible management, they can achieve unified management without changing the existing separation between server and network management.

Figure 4 is the Skycloud IT architecture diagram. In its framework, a large number of BLADE switches are deployed, including G8000 and G8124. As is seen in the diagram, it has deployed 8 G8124 switches and 21 G8000 switches which constitute a large switching network that is the backbone of its cloud system.

Figure 4. Skycloud IT Architecture



Results

When deploying BLADE's switches in its network architecture, Skycloud was very satisfied with the simple installation, configuration, and ease of use. After it ran in the manufacturing operation environment for six months, Skycloud was also pleased with the benefits that the Blade switches provided, such as the stack of virtual machines, low power, high performance, VMready software, and cooling capabilities, while also validating that the migration of virtual machines could complete within a few seconds using BLADE switches. Figure 4 shows how Skycloud cloud center meets its requirements—especially, how BLADE deploys applications in the cloud center.

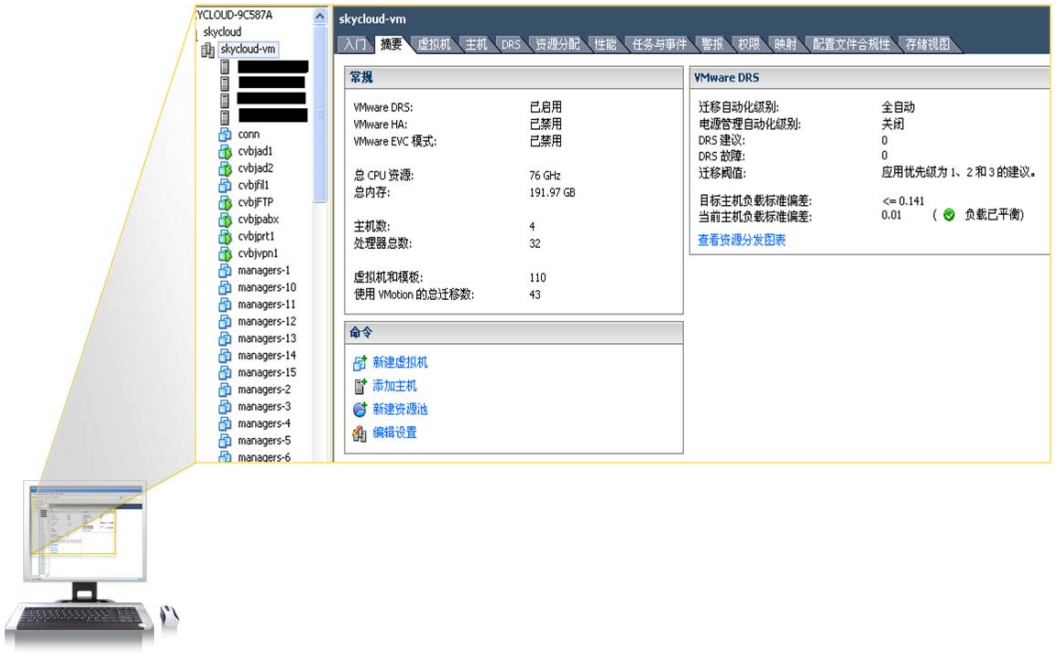
Server Virtualization Platforms in the Cloud Computing Center

We have already mentioned that there are four kinds of server virtualization platforms in Skycloud's cloud data center, each running a large number of virtual machines. For actual deployments, the quantity of virtual machines can quickly increase to a few thousands. Traditional switches are restricted by the management of physical ports and would fail to support such a large virtual deployment. Running many virtual machines on BLADE switches validates that BLADE switches provide quite good performance. Only switches with high performance are suitable

for a cloud environment. In addition, BLADE's API function can be used to integrate BLADE Network management into Skycloud's customized virtual management platform. BLADE's impressive network performance, high scalability, support for multi virtual platforms, and VMready functions make it a good choice for a cloud environment. The following screenshot shows the server virtualization platforms of VMware, Citrix XEN, Tcloud, and YOYO XEN in turn.

Figure 5 shows the management interface of the VMware virtualization platform. The screenshot shows the general information, VMware DRS information, and operational commands provided for users under the summary tab bar. General information covers VMware DRS status information, VMware HA status information, VMware EVC mode setting information, the total number of CPU resources, the total memory, number of hosts, the total number of processors, virtual machines and templates, and the total migration through VMotion. We can see that the total CPU resource in the current system is 76GHz, the total memory is 191.97 GB, there are 4 hosts, 32 processors, 110 virtual machines and templates, and the total number of VMotion migrations is 43. Network equipment with very high performance is required to support so many virtual machines and their operations. As shown, BLADE switches can support the operation of virtual machines in the environment.

Figure 5. vSphere Client Summary

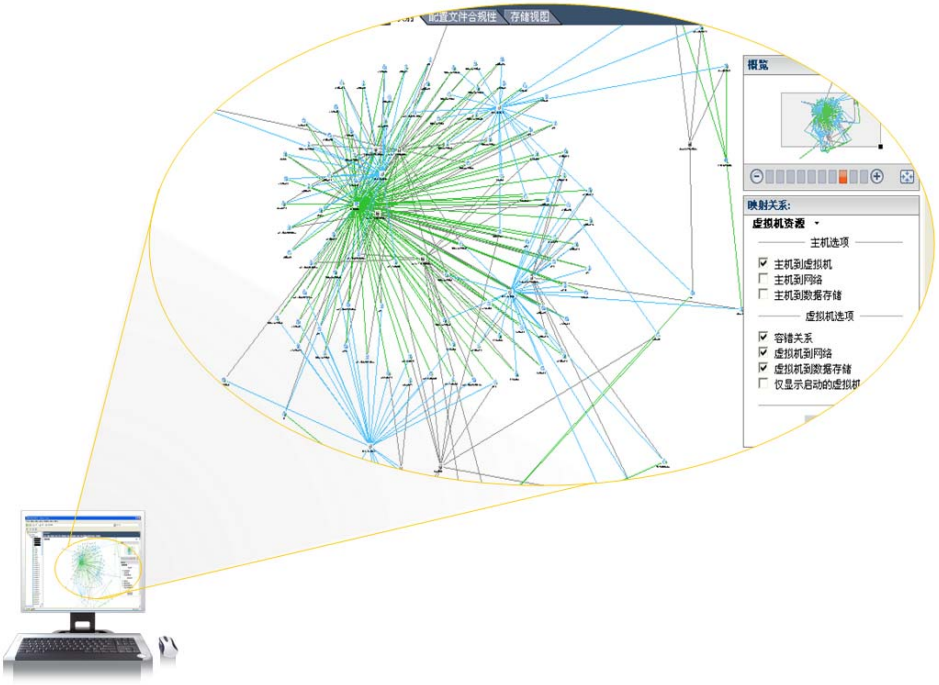


We have already mentioned that Skycloud has deployed more than 100 virtual machines on the VMware platform to run various business applications. Figure 6 is a screenshot of the virtual machines on VMware, mapping relationships between virtual machines. You can first easily click the zone you want to view in the outline box on the right and the selected zone will be magnified in the center figure. In the following mapping relationship, the information you want to display can be selected by choosing from the offered host and virtual machine options. As shown, a considerable number of virtual machines are currently running in VMware, but each virtual machine can function properly without any impact on performance, which indicates that BLADE switches perform well with low latency.

The BLADE Ethernet switch management platform and VMware Management Interface enable transparent management. The virtual network configuration achieved through the BLADE management platform can be automatically reflected in the VMware Management Interface, providing unified management. For many users, VMware is part of server management while BLADE switches are part of network management. BLADE

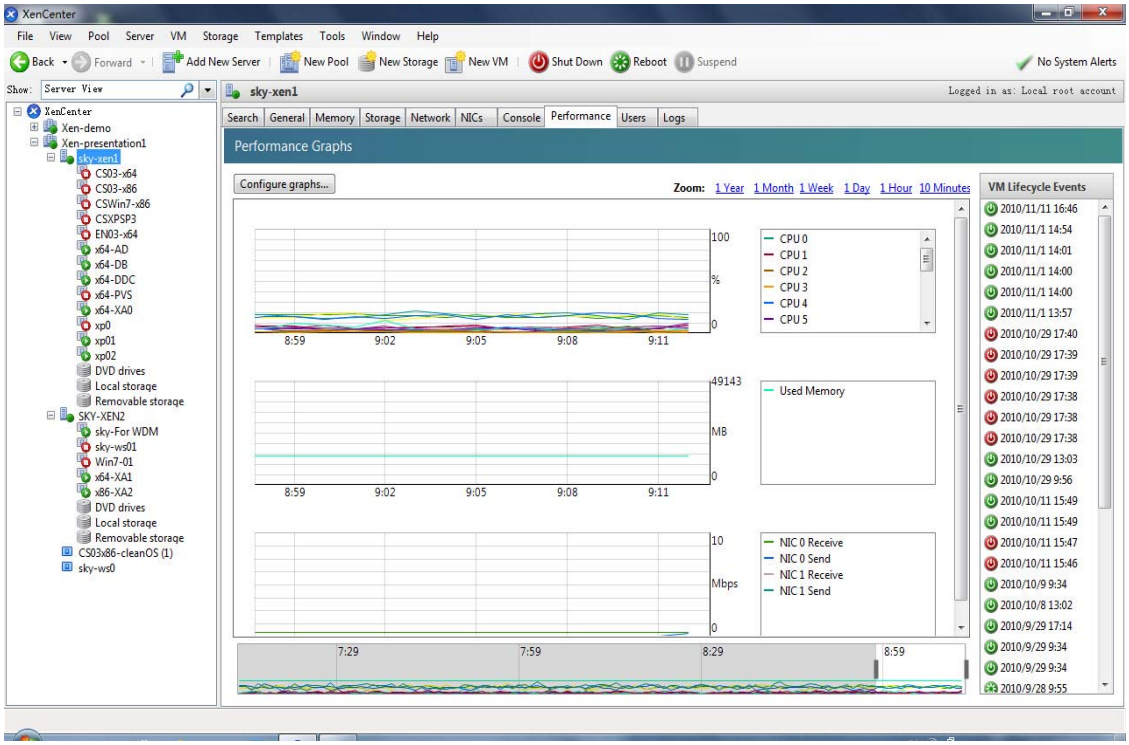
management parameter indicators are more transparent compared to the VMware Management Interface, which solves this conflict.

Figure 6. Virtual Machines on VMware



In addition to the VMware platform, Skycloud has also deployed the Citrix XEN virtualization platform. Figure 7 shows the Citrix XEN virtualization platform management interface. From the figure, we can observe the following: the first graph shows the performance state of the virtual machines. It records the running state of the virtual machine for the period selected (the states of six virtual machines can be shown at the same time). The second graph shows memory usage and the third graph records the state of the NICs. At the same time, the VM Lifecycle events on the right record the states of virtual machines (normal or default) at specific points in time, which is convenient for administrators to quickly learn about the operation of virtual machines within the system. It can be seen from the figure that the performance of the virtual platform has been very stable. To leverage the BLADE API, BLADE network management functions can be integrated into the Citrix XEN management platform. Customers have the choice to either manage network resources through BLADE or via Citrix XEN management, providing management flexibility and support for unified management goals.

Figure 7. Citrix Panel

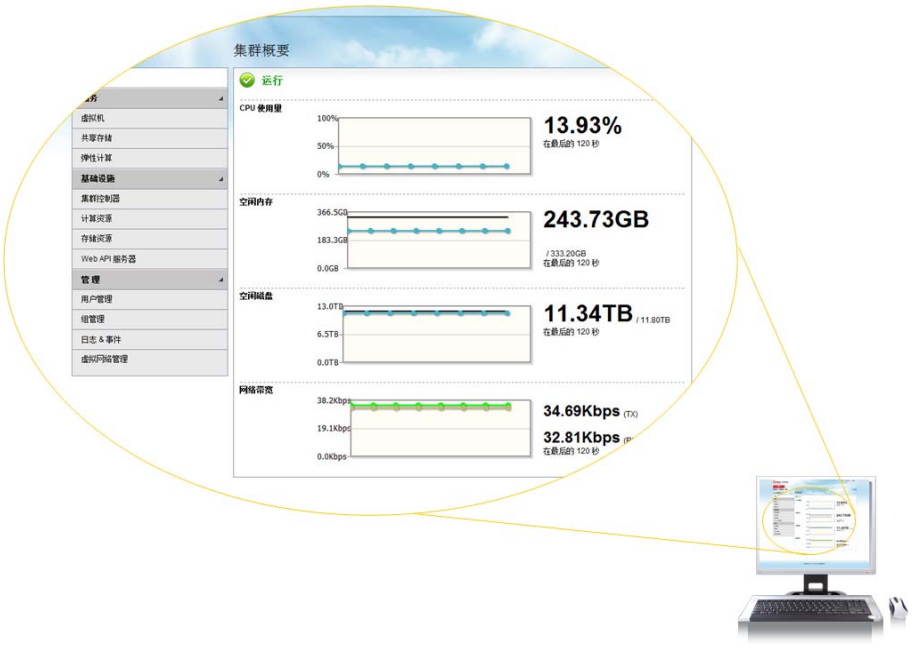


TCloud, a server virtualization platform Skycloud itself developed, has been widely deployed in Skycloud's data center. Figure 8 shows the virtual machine panel of the TCloud platform. You can see that the interface provides three optional information items: virtual machine instances, templates, and resilient group. The interface clearly shows the number of instances of virtual machines in the current environment and a description of each one. In addition, here you can also control the operating system running on each virtual machine and their current running state. Meanwhile, managers can also operate the virtual machines in the current environment by closing the isolation command of the virtual machine and importing the virtual machine command. A large number of virtual machines are also installed in the TCloud platform. For an environment with a large amount of VMs, BLADE's high performance management interface integration ability is important.

Figure 8. TCloud Virtual Machine Panel

Figure 9 shows the TCloud performance interface. From this interface, administrators can clearly monitor information on CPU utilization, free memory, free disk capacity, and network utilization. From the indicators shown in the figure (13.93% of CPU utilization, idle memory of 243.73 GB, free disk capacity of 11.34 TB and network utilization of 34 Kbps), you can see that the server virtualization infrastructure is not consuming an excessive amount of resources. The performance of the virtual platform is closely related to the performance of the network devices and storage equipment.

Figure 9. TCloud Performance



Cloud Application System Run by Skycloud

We have already mentioned that Skycloud deploys all application systems in a virtualized environment, including the cloud application system and internal application system. The following is a screenshot of part of the cloud application system to verify the actual usage of the application system.

Figure 10 shows the cloud analysis system interface. This interface provides several ways for the administrator to view data, including real-time state diagrams, statistical analysis diagrams, comparative analysis diagrams, and consolidated statements. These methods enable administrators to clearly focus on the real-time state of the system. In addition, the system's massive data mining capability can be utilized to run useful information through statistical and comparative analysis, providing the basis for decision-making.

Figure 10. Cloud Analysis System

Figure 11 shows the YoYo network computing demonstration interface. In the YoYo system network computing engine demonstration interface, three tab options are provided, including Monitoring Management console, GAP console, and DataCell console. Meanwhile, this screenshot clearly and concisely shows the running state of the system cluster in the form of a chart, providing a macro-control for managers. On the right side, the interface also provides basic information about the cluster, including the total CPU number, the total number of machines, the number of machines that have failed, average load time, and local time. As you can see in the figure, there are 16 CPUs in this system and the machines are running normally.

BLADE's management reinforces YoYo's ability to virtualize network resources. YoYo's customers can either manage VM networks through BLADE's management interface or through YoYo's management platform.

Figure 11. Demonstration of YoYo Network Computing

Figure 12 shows the YoYo application interface, which includes five functions: knowledgebase, document management, document search, statistics information, and system management.

Figure 12. Application of YoYo

BLADE Switch Management

As previously mentioned, some of the characteristics of the BLADE switch include the following:

- Easy to install, deploy, and manage.
- Virtualization-awareness: In keeping with a basic network virtualization strategy, the VMready functionality built into the BLADE switch can automatically migrate with virtual machines to maintain application performance, availability, and security in the virtual data center.
- Enterprise-class data center performance: The BLADE switch provides non-blocking throughput, low latency, and a large number of Layer 3 features, including OSPF, VRRP, and active multi-pathing which can create a massively scalable flat network.
- Enables the Converged Network: The BLADE switch works with the Converged Enhanced Ethernet (CEE) to provide a top-of-rack switch with high performance for an emerging FCoE environment and an IP storage environment that can leverage either iSCSI or NAS.

The following screenshots fully and clearly demonstrate the management simplicity of the BLADE switch.

Figure 13 shows the BNT G8124 switch panel interface, which clearly and simply provides detailed information on switches, including name, model, MAC address, IP address, software version, and more.

Figure 13. BNT G8124 Switch's Panel

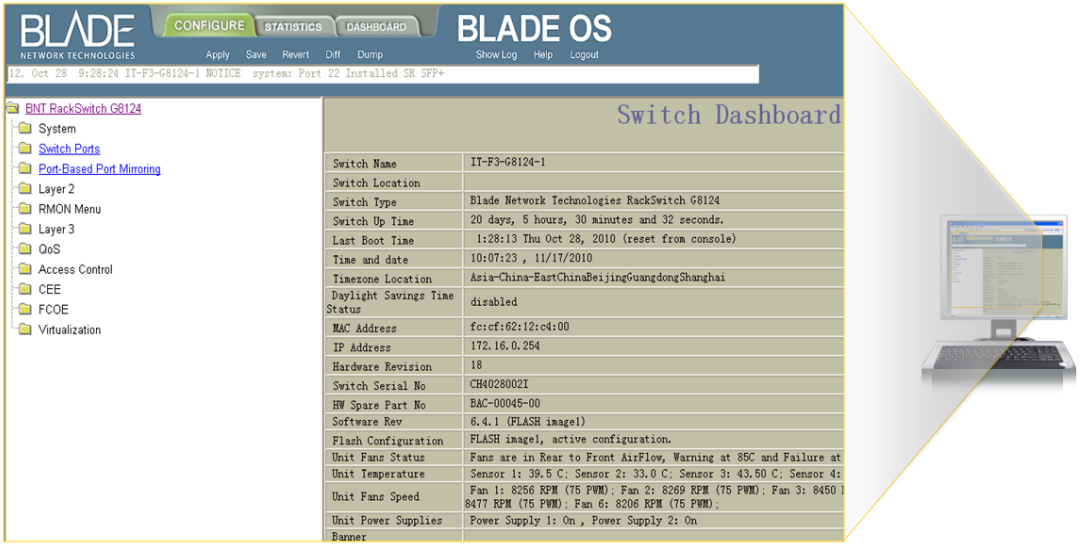


Figure 14 shows the BNT G8124 configuration interface. The configuration options for the switch management process can be seen, including the switch's IP address and mask address.

Figure 14. Configuration of BNT G8124

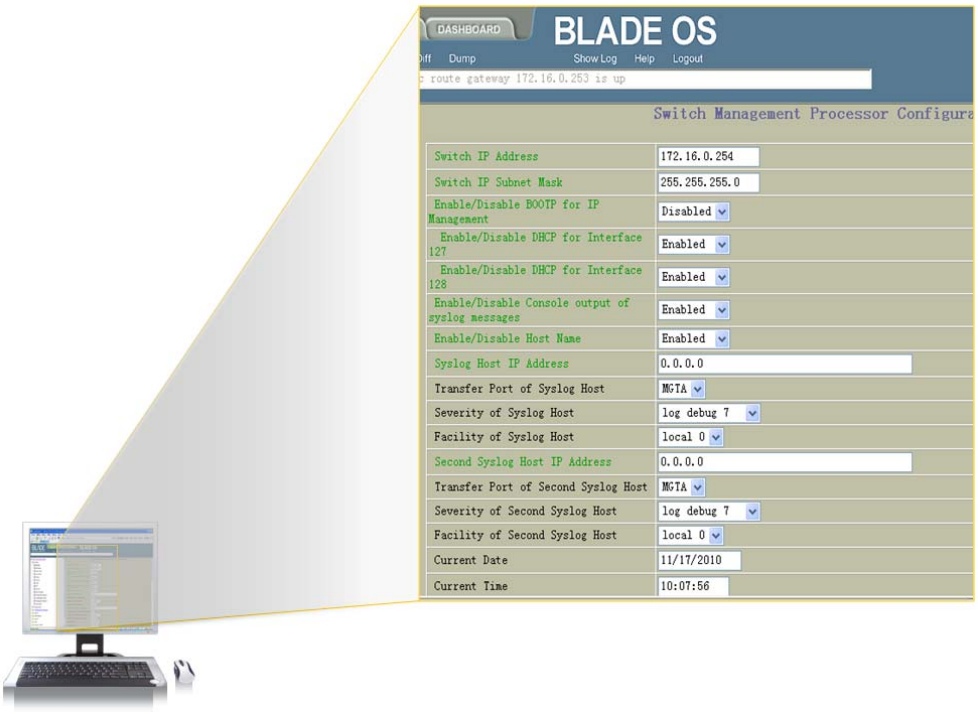


Figure 15 shows the BNT G8124routing configuration. Through this interface, administrators can set or clear all of the relevant network parameters, including the IP static route, destination IP, subnet mask, gateway IP, and search operation selection. The table shown lists the static route information which has been configured in the current environment.

Figure 15. BNT G8124 Routing Configuration

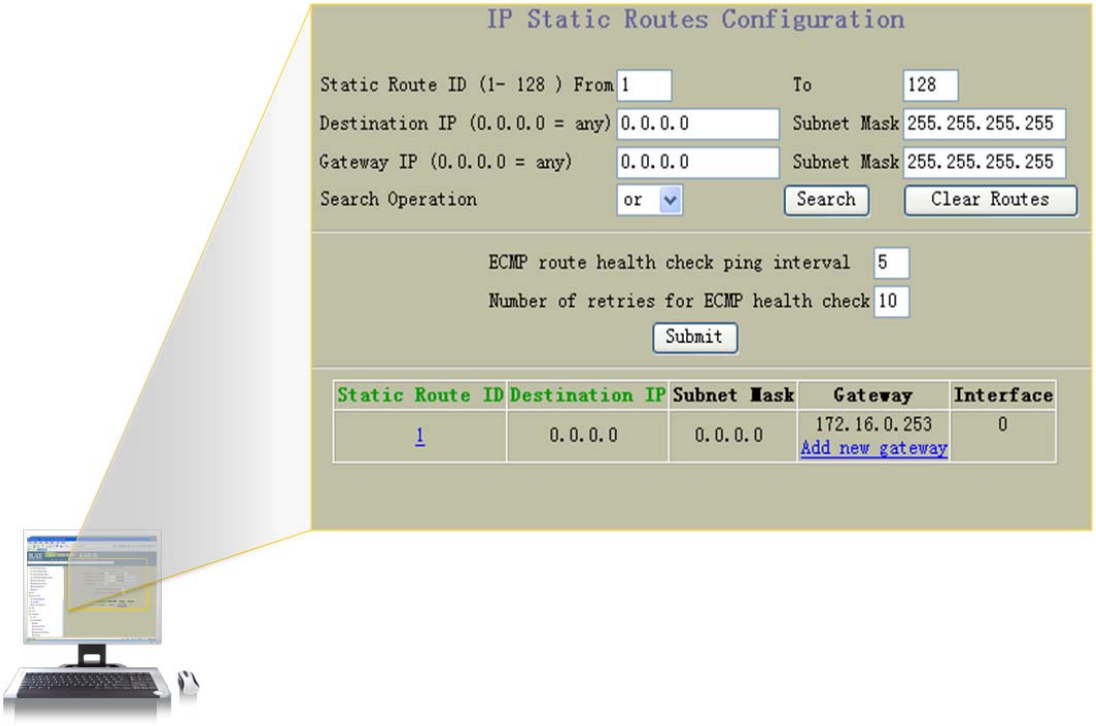


Figure 16 shows the detailed information which the BNT G8124 panel presents to the administrator's switch panel, including the switch name, model, date and time, MAC address, IP address, hardware version, serial number of the switch, and software version.

Figure 16. BNT G8124 Panel

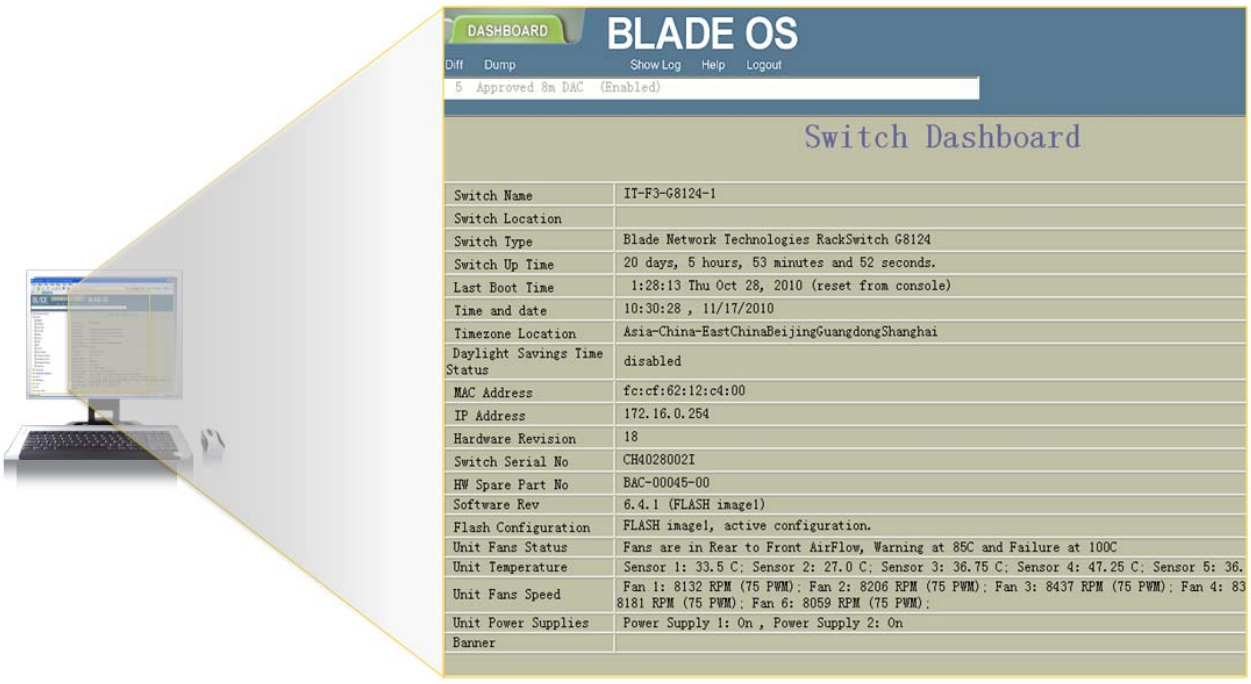
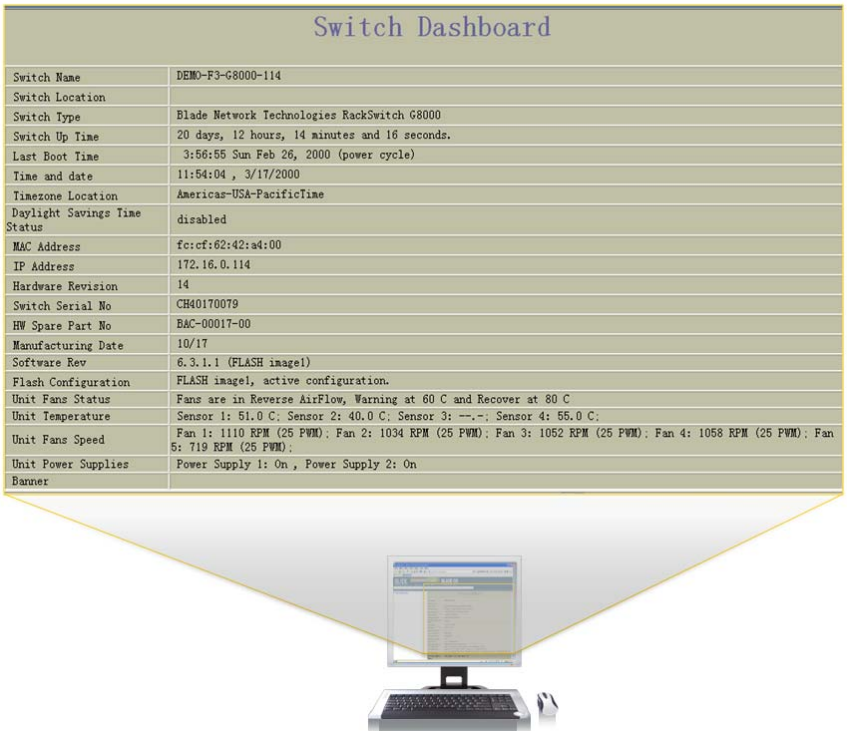


Figure 17 shows the BNT G8000 panel, which displays basic information about the switch, including name, model, time of last start-up, MAC address, and IP address to allow managers comprehensive understanding.

Figure 17. BNT G8000 Panel



VMready

To support a basic network strategy, VMready functions built in the BLADE switch can automatically migrate with virtual machines to maintain application performance, availability, and security in the virtual data center. The following screenshot shows the results of using VMready.

Figure 18 shows the configuration interface of the VMready CLI. Administrators can use this interface to view information about the switch or manage its operations through the command lines.

Figure 18. Configuration of VMready CLI

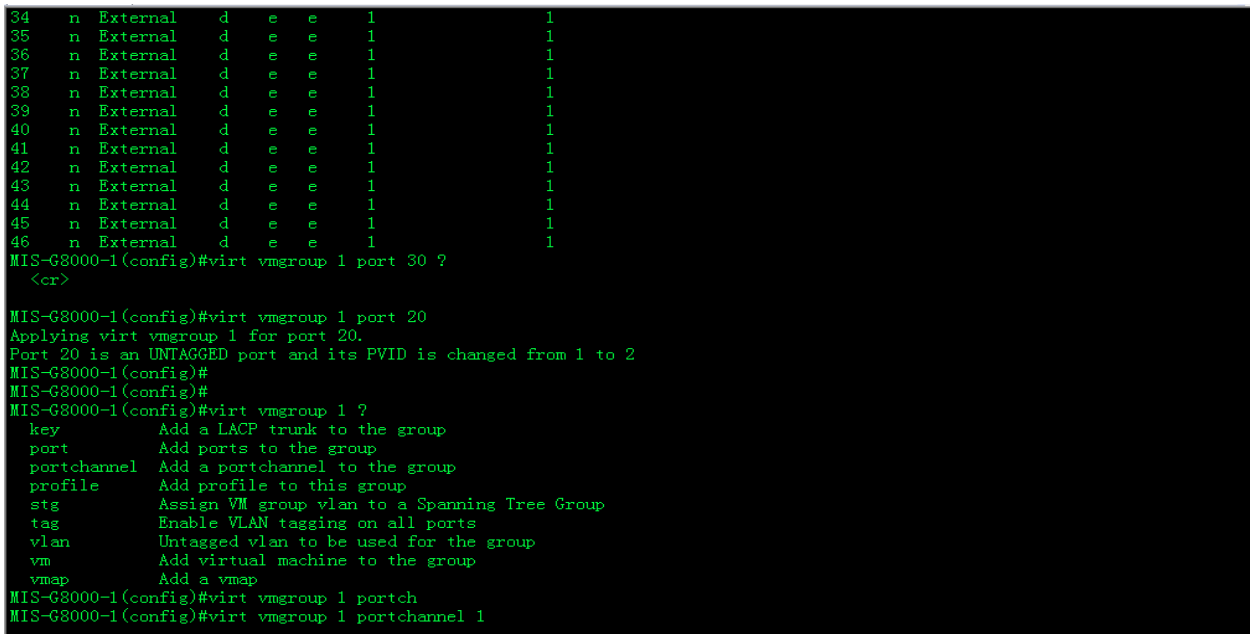


Figure 19 shows the BNT G8000 VMready panel, which provides information on the virtual machine group, including VLAN ID, its affiliated group, current status, and properties. VM Group brings a group of target sites, representing one or more virtual machines (and their vNICs), together so that the switches on the second layer running VMready forward data packets to it. You can see that the information from almost 21 groups is currently being displayed and that the only group available is Group 1, which displays the VLAN ID “50,” which means it is “available.”

Figure 19. BNT G8000 VMready Panel

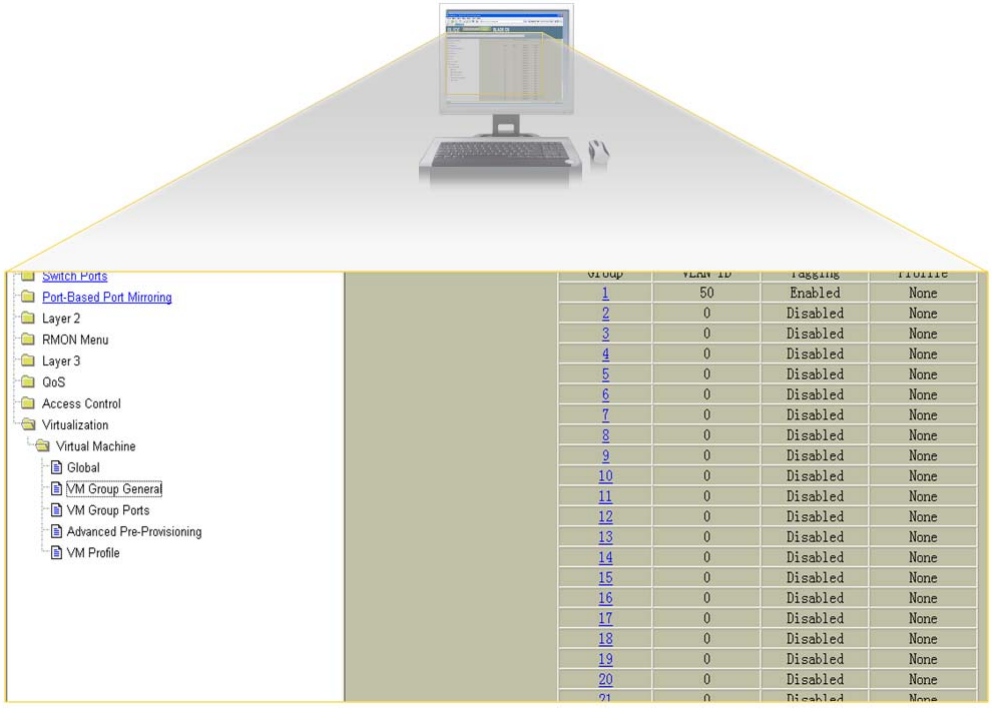


Figure 20 shows the BLADE VMready group interface, which clearly and simply provides support information for virtualized environments.

Figure 20. BNT G8000 VMready Group Information Panel

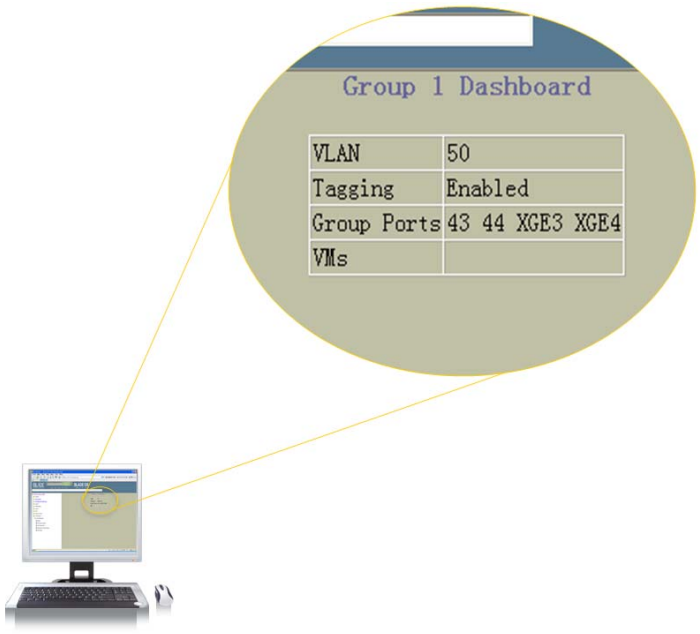


Figure 21 shows the BNT VMready CLI interface, which can show query information through a few simple commands.

Figure 21. BNT VMready CLI

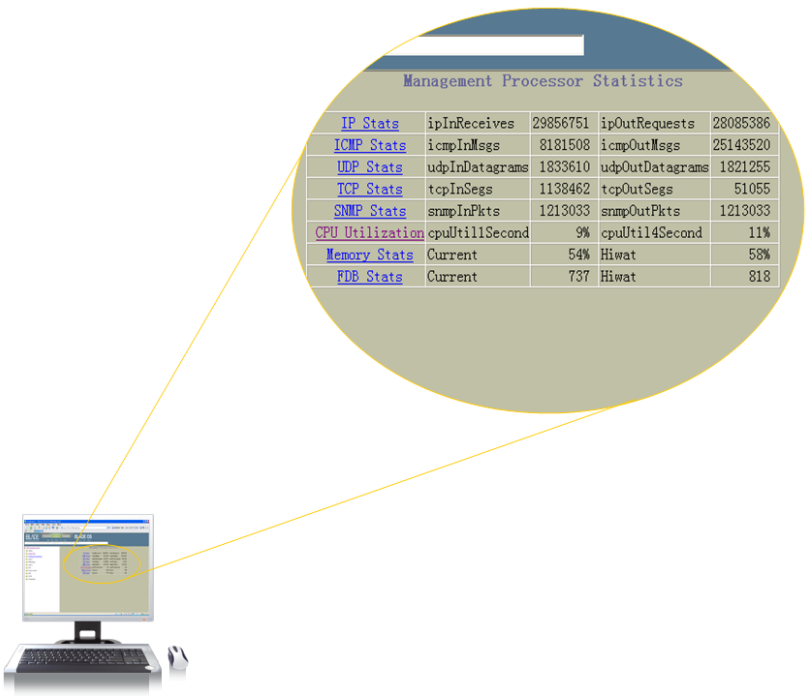
```
!
vlan 39
        enable
        name "VLAN 39"
        member XGE3-XGE4
!
vlan 1001
        enable
        name "Icloud-test"
        member 1-12
!
virt enable
virt vmware vcspec 172.16.201.53 administrator noauth a6a5a433a025a022bfaee7f2639503d0fa216f271b4c8e2f80d3595b81a31ae261272953a555d0
62b613f71c70cf6712b115d8f56fac67be2285b3f1cc2e2730
!
virt vmgroup 1 vlan 50
virt vmgroup 1 tag
virt vmgroup 1 port 43
virt vmgroup 1 port 44
virt vmgroup 1 port XGE3
virt vmgroup 1 port XGE4
!
portchannel 1 port XGE3
portchannel 1 port XGE4
portchannel 1 enable
!
!
no spanning-tree stp 1 enable
spanning-tree stp 1 vlan 1
spanning-tree stp 1 vlan 10
spanning-tree stp 1 vlan 31
spanning-tree stp 1 vlan 37
spanning-tree stp 1 vlan 38
spanning-tree stp 1 vlan 39
spanning-tree stp 1 vlan 50
spanning-tree stp 1 vlan 1001

!
!
--More--
```

Statistical Performance Parameters

Figure 22 shows the performance parameters of the BLADE switch, including IP state, ICMP state, UDP state, TCP state, SNMP state, CPU utilization, memory state, and FDB state.

Figure 22. Performance of BNT Switch



Thin Client

In short, desktop virtualization refers to technology which provides support for enterprises to achieve remote dynamic access between desktops and the unified hosting of the data center. Let's make a vivid analogy: today, we can all access our e-mail systems that live on a network or network drive from anywhere at any time by any device; using desktop virtualization, in the future, we will be able to access our desktops from anywhere at any time by any device.

Desktop virtualization provides the following benefits:

1. Flexibility of access and usage. Users' access to desktops will not be limited to specific devices, locations, and times.
2. More extensive and simplified support for endpoint devices. Desktop virtualization is just another way of saying cloud computing. Since all the computing takes place on the servers, the requirements on terminal equipment will be greatly reduced, meaning that smart phones, netbooks, and even televisions may become methods for accessing desktops. This is precisely the soul of cloud computing.
3. Lower cost. Since all the processing occurs in the data center, pressure on client devices will be significantly reduced, meaning that a user can choose from a wider array of simpler and cheaper devices that support a different set of application requirements.
4. Centralized management, unified configuration, and secure usage.
5. Decreased power consumption and environmental impact.

It should be stressed that the advantages of desktop virtualization come with the typical "size effect." That is, the more terminals that utilize virtualized resources, the more benefits and advantages that can be realized. The following figure shows a thin client device Skycloud has already deployed using desktop virtualization technology.

Figure 23. Thin Client

Skycloud's Customer (A Power Company)

Skycloud, as a cloud service provider, not only deploys its own internal cloud, it also provides private cloud deployment services for some important domestic customers who use the BLADE switch for all network connection devices. The following is a brief introduction to one customer's cloud deployment.

As one of the key state-owned enterprises closely related to the national energy, security, and economic lifeline, the customer operates business in 26 provinces, autonomous regions, and municipalities covering more than 88% of the land area of China.

Figure 24 shows a diagram of the customer's IT architecture. From the figure, we can see that the core network in the data center is divided into three VLANs. The thin client server is deployed for VLAN 1, the IaaS server for VLAN2, and the SaaS server for VLAN3. These VLANs use 1 Gb Ethernet switches for interconnectivity and are connected to two BLADE switches (Switch A and Switch B). These two switches are connected through 10 Gb Ethernet and a

BLADE switch (Switch C) in DemoCenter. For VLAN1 in DemoCenter, servers with thin clients are deployed, which are connected to Switch C through a 1 mbps NIC.

Figure 24. IT Architecture of a Power Company of China

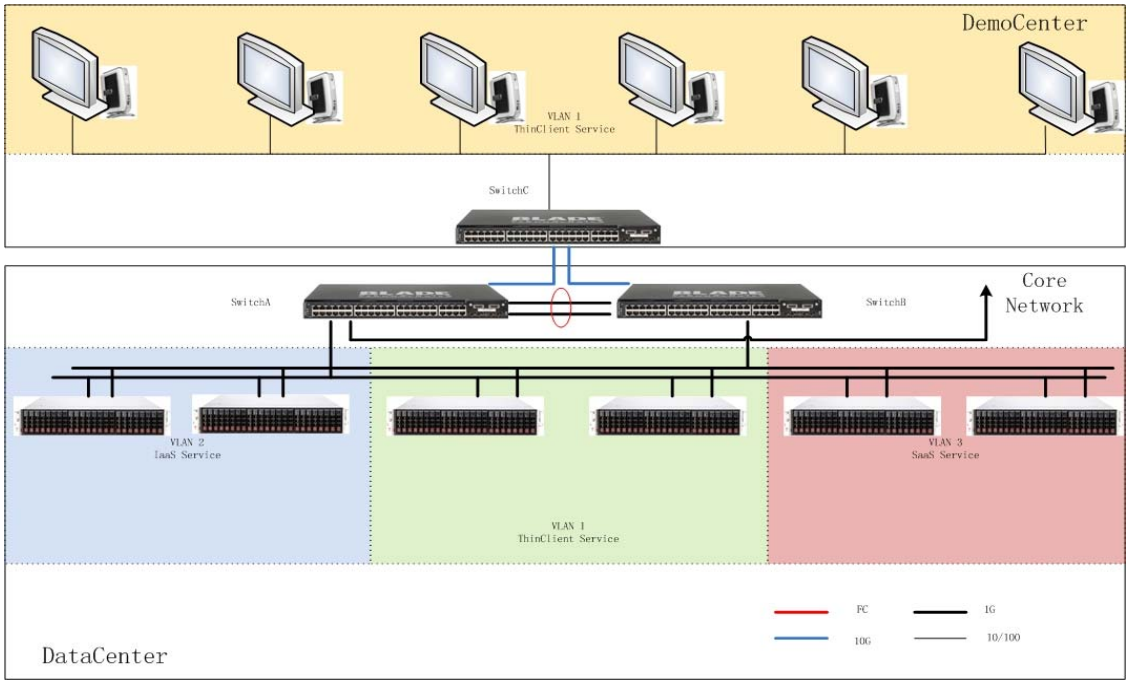


Figure 25 shows a diagram of the architecture of this customer's cloud application deployment. As you can see in the figure, the entire environment operates around the "Power Cloud." Four functional modules, including massive data processing, information security interaction, efficient parallel computing, and real-time alarm, transmit data into the "Power Cloud," which will store or return processed data to these four modules to be transmitted to the other four modules (including intelligent power utilization, intelligent power generation, "Power Cloud" knowledge management, and intelligent power transformation/distribution/scheduling) for power control and information dissemination.

Figure 25. Customer's Cloud Architecture

In the power scheme, the BLADE Ethernet switch is the only switch product. BLADE switches provide high performance, low latency, and high scalability for virtual environments, which can meet the demands of the intelligent grid. In addition, BLADE switches provide flexible management that allows power user network managers to independently configure and manage virtual networks through the BLADE management interface. Also, virtual network performance indicators can be integrated into a unified management platform as a parameter of application management. BLADE products support multiple virtualization technologies (whether they are mainstream or prototypes still under research and development), of which the VMready function requiring virtual network's high performance and security and BLADE VMReady3.0 supporting virtual migration across data center enable BLADE Ethernet switches to have a unique advantage in the grid as a kind of large-scale "cloud" application. Currently, the power pilot project has been released for production. In general, the customer is very satisfied with the capabilities of the BNT switch after working with it, such as its easy management and deployment, high performance, low latency, and the VMready software.

SINO-BRIDGES's View

As heterogeneous network and connectivity environments are eliminated from data centers through the integration of networking with IO, cloud computing centers require optimized, simplified cabling and network environments as well as a high-speed network. As Ethernet technology continues its rapid development, 10 GbE technology is increasingly used in today's data centers. With the continued deployment and maturity of server and storage virtualization, data center infrastructure virtualization needs to be consolidated and integrated. Network virtualization must provide the ability to dynamically add and reduce bandwidth resources on demand; low latency and high performance for transmitting data between the storage network, data center, and LAN; the ability to support automatic migration of virtual machines (VMs) while maintaining security and network performance; and extensibility of management functions to the management platforms of enterprises and service providers, all while providing consistent visibility into a changing environment.

SINO-BRIDGES-Sino has verified that BLADE networks switches achieve high performance through 10 GbE and meet the requirements for complete network virtualization. In addition, the VMready software in BLADE products satisfies the requirements of server virtualization with low latency and easy management. On the whole, BLADE switches provide compatibility, high performance, low latency, virtual-awareness, and open network convergence, making them very suitable for cloud computing environments.

SINO-BRIDGES Lab's Validation

SINO-BRIDGES Lab performed extensive evaluation of BLADE's switches from the following perspectives specifically:

Operational Efficiency

Top-of-rack design is a "route once, and forget it" design. The configuration and routing of LANs and SANs can be completed in a centralized way, manually through the console, or, more typically, as part of an integrated virtual set of products (such as VMware, Microsoft Hyper-V, or Citrix Xen). In fact, the more functions of "virtualization awareness" implemented in the network, the higher the degree of automation server configuration can achieve. For example, BLADE's VMready can perceive virtual machines between servers—when this happens, virtualization management and networks can work together to maintain some attributes, such as VLAN or 802.1p tags. With this intelligent virtualization, large enterprises can take advantage of the flexibility and mobility of server virtualization without damaging the network architecture or opening security holes.

Economic Factors

Top-of-rack convergence is designed to allow the server's rack load and storage in the modern enterprise data center to scale out. When each new rack is in place, a group of small uplinks (usually in a fan-out ratio of 5:1—that is, five top-of-rack ports in each uplink port) will be connected to the ends of switches in each line. When BLADE infrastructure is used, significant network economic savings can be achieved.

As we all know, it is difficult to make an accurate comparison due to frequent fluctuations in cost. So in some way, many of the items in Table 1 (adapters and switches) will change over time and differ based on changes in regional and market conditions. In fact, the difference in wiring costs between similar components varies widely, but the top-of-rack design only requires a relatively small component. In addition, if large enterprises use more top-of-rack switches (fewer ports for each switch), they can achieve significant savings in capacity without an investment in expensive core switches with excessive capacity/ports.

Table 1. Cost Model (100 servers, 5 racks, and a Typical Deployment of 4 LANs, 2 SANs, 2 top-of-rack CEE)

Capital cost	Traditional design	Top-of-rack convergence	Savings
Adapter	$219,000	$142,900	35%
Switch	$203,960	$124,000	39%
Terminal board and cable	$283,600	$24,000	92%
Total	$706,560	$291,000	59%

The Value Growth of the Virtual Machine is in Direct Proportion to its Mobility

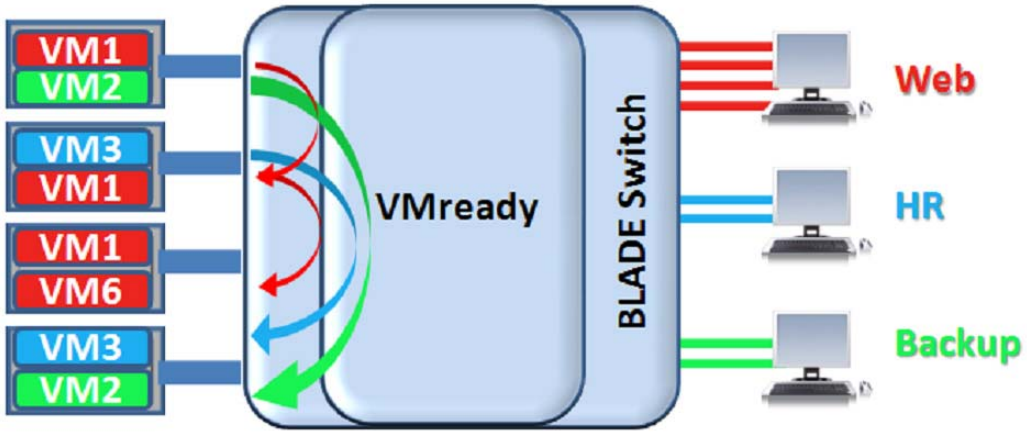
The key to being able to automate network functions is to ensure that the basic network infrastructure has the capability of virtual-awareness and can respond rapidly while the virtual machine moves in the resource pool. If enterprises are forced to continue to rely on manual intervention, they will not be able to fully realize all the benefits of server virtualization technology. At the same time, it remains difficult to maintain reliable service levels with manual processes. The solutions BLADE provides can help enterprises overcome these network problems, allowing users to enable the full value of server virtualization.

To fully realize the advantages of a virtual server environment, seamless migration of virtual machines in the resource pool must be ensured while application performance and security are fully maintained. The mobility of virtual machines will provide tremendous value, allowing enterprises to achieve the following goals:

- Rapid scaling of new applications: the creation of a “golden copy” of a virtual machine enables enterprises to add new applications to the resource pool in very short order, shortening the time it takes to put new applications into use.
- Load balancing: the dynamic adjustment of loads in the resource pool enables enterprises to optimize performance and minimize power consumption and cooling costs after work hours through the mobility of virtual machines.
- High availability: even if physical infrastructure fails, applications can still quickly move to another physical resource in the pool, significantly reducing downtime while eliminating the demands for dedicated redundant infrastructure.

Figure 26 shows the ability of a virtual machine to shift from one physical host to another. VMready enables the automatic transfer of network settings along with dynamic migration of virtual machines, ensuring that applications will always be protected and provide a more satisfactory level of performance.

Figure 26. SINO-BRIDGES’s Certification



As described earlier in this paper, SINO-BRIDGES's research shows that server virtualization plays an increasingly prominent role in production environments and that it is critical to provide adequate network throughput for multiple virtual machines to share physical resources. In many cases, network performance demands a range from 1 Gb to 10 Gb Ethernet. BLADE reduces the financial burden of the transition to 10 Gb Ethernet, which is considered to be a valuable leader in this field. Currently, BLADE's pricing on 10 Gb Ethernet ports makes it possible for more companies to afford to upgrade their network infrastructures to support virtual server environments.

The Bigger Truth

Cloud computing is designed to create a mobile pool of resources shared between services and data centers, enabling users to store data and run applications on demand. Therefore, there are two tasks for the network in the data center: first, transform the pool of resources into a virtual resource, and then connect users from anywhere to these resources. Today, over-purchasing of switching equipment can create a lot of unwanted side effects. Most networks were originally designed only for older generation switches and routers with limited throughput, port density, and client-server applications as their model. By carefully evaluating the selection of switches for next generation cloud computing-enabled data centers, enterprises can achieve significant reduction in costs and increase operating flexibility and efficiency.

SINO-BRIDGES-Sino audited the BLADE switch architecture and deployment at Skycloud for a division of State Grid. Through evaluation of customers' actual usage of their cloud computing environments, SINO-BRIDGES-Sino discovered that the BLADE switch offers high performance, low power consumption, extremely low latency, and a design specifically targeted at virtualized environments utilizing an open standard. SINO-BRIDGES-Sino believes that IT managers that are beginning to design network architectures for public or private cloud computing should seriously consider the benefits of cloud-ready switches from BNT.

Room 1605, MEN Finance & Trade Center Tower Plaza A, No.26 of Chaowai Avenue, Chaoyang dist, Beijing 100020, PRC

8610 85655510 |www.Sino-Bridges.com|contact@sino-bridges.com