Study on Digital Campus IT infrastructure Virtualization

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***Abstract*—As Digital Campus applications gaining momentum, the complexity of IT infrastructure on campus network, resource utilization efficiency, security control and data backup impose increased difficulties. In this paper, an analysis is conducted on applications of virtualization technology including virtual server, virtual storage, and network virtualization technology for IT infrastructure to cast down maintenance costs, improve equipment efficiency, simplify IT infrastructure management, and ultimately realize the construction of a digital campus network.**

***Index Terms*— virtualization, IT infrastructure, digital campus, load**

As the construction of digital campus is advancing, application services over network increase rapidly, so do requirements on IT infrastructure. The scope of network on campus includes server, storage, network, and desktop computers, amongst, server, storage and network management are handled by the network center on campus. IT infrastructure management is facing issues in growing complexity, inefficient resource utilization, higher energy consumption, network security and data backup. The virtualization technology fits into this scope by its capability of bringing flexibility and higher efficiency for the IT infrastructure.

I. Issues in Digital campus IT Infrastructure Management

Issues in digital campus it infrastructure management include:

1) Complicated System, Difficult in Management and Maintenance: With increased application systems, requirements for operating systems and database are getting complicated. By using conventional approach of deploying standalone servers for all applications, the maintenance will demand tremendous manpower and resources.

2) Inefficient Resource Utilization: Most servers don't have high hit rate. Application systems usually only use 20% of a server's capacity but consume large volume of physical space and electricity.

3) High Operating Costs: Servers purchased by affiliated departments for their applications, which are then hosted at the data center of digital campus, don't have high utilization rate and large volume of resources stay idle, which increases operating costs.

(4) Security Concerns: Multiple applications running on the same server impose not only compatibility problems but also security concerns over security leakage of one application to other applications.

II. Virtual Technology

A. Virtual Server

Although the definition of virtual server varies with manufacturers, the core concept is the same. It is a method can provide prioritized dynamic resource allocation based on load balancing criteria to simplify management and increase efficiency. Server with higher priority and higher load during peak time will be allocated more computing resources. [1]

Through virtualization, every server can have multiple virtual machines operated under different operating systems. Every virtual machine is isolated from others. Server applied with virtualization can host multiple virtual machines for different applications, resulting in less physical servers required, while, reducing energy consumption of power supply to servers and cooling system.

B. Virtual Storage

Virtual storage technology provides a shield from servers of characteristics of low-level physical storage devices from diverse manufacturers while an abstraction of logical characteristics used for the realization of centralized, uniform, and efficient management. [2]

Storage virtualization can integrate entire or portion of storage resources into a logical storage farm with an access interface for multiple servers.

C. Virtual Network

Two approaches are used by data centers dependent on different needs -- longitudinal division and crosswise conformity. The longitudinal division provides functional division between organizations, while facilitates access within its own organization, i.e. a logical vertical division of physical network by function. Crosswise conformity is to integrate multiple physical network nodes into logical equipment, which can improve the network usability and simplify network architecture.

III. IT Infrastructure Virtualization

A. Virtual Server Solution

Sponsored By: Research Grant awarded by Department of Education of Guangxi Province (201012ms136)
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By using VMWare Server or Hyper-V virtualization software, applications deployed originally on a physical server can be separately installed on several logical servers with no functional deterioration.

Both VMWare Server and Hyper-V are suitable for virtual servers less than 50 per server. Hyper-V must be used with Windows Server 2008 and for non-Windows operating systems, VMWare Server is recommended, as illustrated in Figure 1, multiple virtual servers are configured on one physical server.

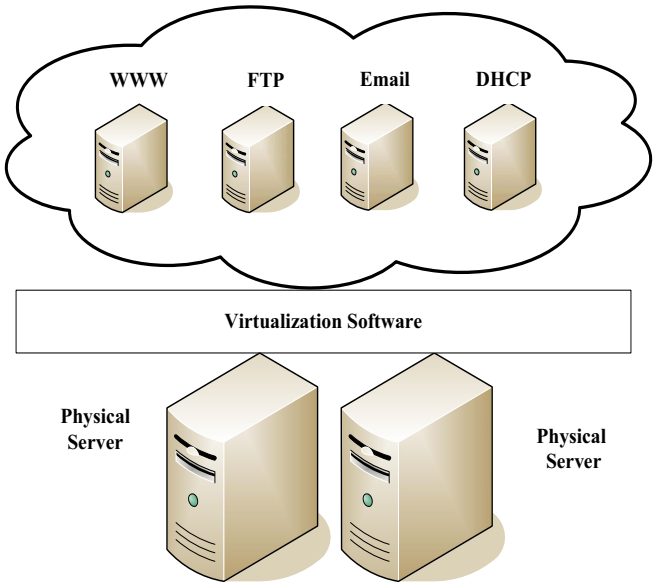

Figure 1 Virtual Server

Many problems encountered on digital campus can be solved with server virtualization. Deploying applications on virtual servers can reduce number of physical servers needed for schools so as the costs and energy consumption. Affiliated departments can save server purchasing expenses and hosting costs by leasing just virtual host in information center.

Information center can arrange server spaces by missions and schedule so guarantee computing resource availability. When a virtual server is overloaded with applications, by configuring CPU cores, memory, and hard drives, virtual server's capacity can be upgraded to meet application requirements. For example, course registration service usually requiring only 2GB during normal time can be configured with dynamic resources allocation with 8GB available during registration to maintain the same performance for high hit rate and load. It can provide better resource management by configuring idle resources to services with higher demands and increase efficiency of computing recourses utilization.

Virtual segmentation provides security to application systems by isolating virtual servers. In dealing hardware malfunctions. Virtual server giving even more flexibility of relocation and reconfiguration can greatly boost application system's reliability.

B. Virtual Storage Solution

Storage is transparent to users under virtual storage environment, regardless of performance, capacity, equipment and manufacturers, all devices are managed uniformly. At present, major IT hardware manufacturers all have their own virtual storage products.

The embedded data management engine in virtual storage with uniform interface can centralize storage management of diverse storage structure and provide optimized space utilization rate.

In the data center of digital campus, virtual storage technology can integrate all storage devices into one logical storage farm to provide storage space. In this study, virtual data management engine NeoStor, which is embedded in Neocean IV5000 from H3C, is used to integrate SATA RAID, SAS RAID, and FC RAID into a logical storage available to application servers through SAN and NAS with additional capabilities of providing snapshots, mirroring, and replication related services. The virtual storage structure is given in Figure 2.

The virtual storage technology provides great cost-effective solution of storage with less physical hard drive requirement. Resources in the storage pool are available and sharable by multiple application servers, which dramatically increase the utilization rate of storage resources. Moreover, the service is extended to affiliated departments through leasing instead of purchasing additional storage devices. This saves costs. The virtualized storage solution can realize a uniform storage farm for digital campus yet with sufficient analysis and backup facilities, which enhance data security tremendously.

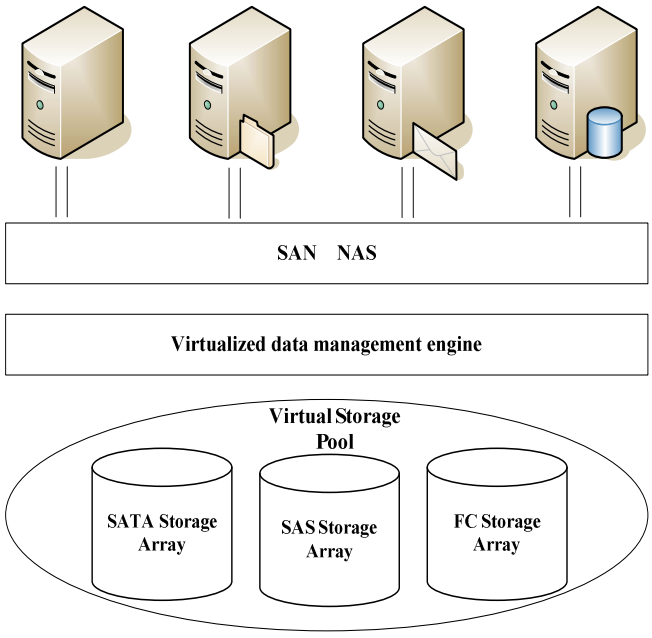

Figure 2 Virtual Storage Architecture

C. Virtual Network Solution

As applications of digital campus are getting diversified, operational requirements become increasingly dynamic. To satisfy the growing pressure in management and maintenance,

the infrastructure has to be flexible enough to be easily configurable and expandable. The network virtualization technology can integrate physical networks or divide it into separate virtual networks as needed.

VLAN segmentation can group physical network nodes into virtual networks without changing the original physical network structure. In Figure 3, VLANS of Finance and Campus Security Video are grouped from physical network nodes into separate sub-networks virtually isolated from other nodes in the digital campus network by using network virtualization.

Physical connections in a digital campus network can be virtualized and grouped together traverse into a logical channel, which simplifies the network configuration and betters the reliability.

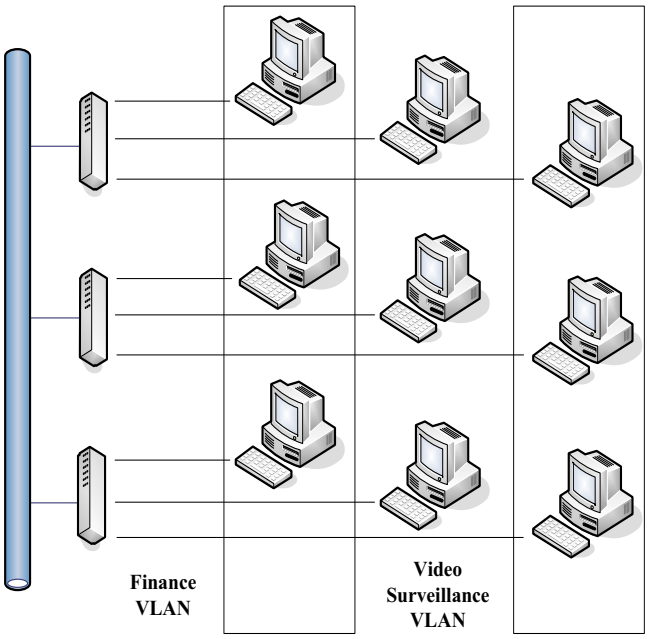

Figure 3 VLAN Segmentation

IV. Summary

It is demonstrated that by using virtualization technology on server, data storage and network, the utilization efficiency of IT infrastructure on digital campus is being improved and feasible to facilitate the management and maintenance of equipment. As the progressing of virtual technology becoming a key element in the implementation of cloud computing, it also continuously plays a vital role in digital campus establishment.

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