



NETAPP WHITE PAPER

USING A NETWORK APPLIANCE SAN WITH VMWARE INFRASTRUCTURE 3 TO FACILITATE SERVER AND STORAGE CONSOLIDATION

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1 INTRODUCTION

Many companies are experiencing a rapid proliferation of commodity Intel® and AMD® x86 servers. These systems are typically equipped with a small amount of internal or direct-attached disk storage. As server numbers grow into the hundreds, the management complexity for both servers and storage increases exponentially, putting a strain on limited administrator resources and IT budgets.

Server and storage consolidation using VMware® Infrastructure 3 (VI3) software and Network Appliance™ storage systems significantly reduces these problems. The benefits of VMware are uniquely complemented by Network Appliance storage solutions. Using NetApp technology, storage can be consolidated onto one or a few storage systems accessed across Fibre Channel SANs or regular IP networks. This dramatically simplifies storage provisioning, increases asset utilization, and allows a company to take advantage of NetApp data protection and disaster recovery functionality.

VMware allows multiple operating system instances to run on a single physical machine and does not require changes to existing application software. Server consolidation with VMware results in significant savings on hardware purchases, because the yearly requirement for new hardware is reduced dramatically. Hardware savings can be determined by comparing the number of servers purchased per year with and without virtualization. The difference in the amount of dollars spent on hardware purchases represents the TCO reduction from using VMware. Dividing this number by the years of server useful life provides the annual savings. Last but not least is the savings in overall power consumption. VMware Infrastructure 3 helps conserve energy by utilizing a smaller number of servers compared to non-virtualized server environments.

Server and storage consolidations have demonstrated that it is possible to reduce the number of deployed Intel and AMD-based servers by 50% or more while achieving the following benefits:

- 60% to 80% utilization rates (up from typical rates of <15% at the server level and <35% at the storage level*)
- Application provisioning time measured in seconds, not days
- Response times for change requests measured in minutes
- Zero-downtime hardware maintenance

* These results are typical, actual results may vary.

This paper describes the real-world experiences of a customer that reduced its x86 server count by 60% and decreased overall operating costs.

Customer Challenges

- Server proliferation results in rising complexity and costs
- Low asset utilization
- Rising infrastructure costs such as power
- Managing more physical servers

VMware and Network Appliance Value Proposition

- Simplified management for both servers and storage
- Reduced operating costs
- Increased business flexibility
- Advanced data protection and disaster recovery

Deployment Results

- Servers reduced >50%
- Application recovery reduced from hours to minutes
- Centralized backup architecture
- Ability to migrate a live OS
- Ability to pool server resources (CPU, memory, etc.)
- Server management cut 20%
- Tapeless backup for rapid recovery
- Bare metal recovery in 30 minutes
- Disaster recovery for all critical business applications
- Dramatically increased IT flexibility

2 BACKGROUND

Like many organizations, the Intel-based server environment of this worldwide auto parts distribution company has grown exponentially over the years to support additional business requirements and applications. Prior to consolidation, the company relied on over 100 servers, many of them several years old. Supporting these end-of-life servers was one of many hurdles the company faced. Servers were provisioned every time an additional application was needed. Server provisioning took weeks and sometimes months, when considering budgets constraints. Storage was both internal and direct attached, so that no two servers could share that resource, which would have helped to lower the overall cost of ownership. Additionally, the company faced an exponential rise in management costs for both servers and their data stores. When several weeks of internal studies against similar companies in the same industry showed that the number of servers was significantly above average for the number of users supported, the company launched an initiative to lower operating costs by reducing servers and also to reduce overall storage management.

In 2006 the company selected VMware as an enabling technology to replace physical servers with virtual hardware instances running on powerful multiprocessor systems (typically two- to four-processor servers).

VI3 is supported with either internal direct-attached storage, network-attached storage (NFS-based), or SAN-based (FC or iSCSI) disk storage. However, NAS and SAN storage (such as NetApp Network Storage) enables many high availability (HA), disaster recovery (DR), and quality of service (QoS) features in VI3. The company chose both NAS and Fibre Channel SAN to allow storage to be consolidated onto the existing NetApp storage systems. Although building a new Fibre Channel infrastructure can be expensive, the VMware/Network Appliance server to storage consolidation project server count was cut dramatically and overall expenditures were significantly reduced. Further reductions were made possible by utilizing NAS for many of applications that required fewer resources to function. Costs were also offset by the advantages of consolidated storage and the advanced data management capabilities offered by the NetApp platform.

3 ORIGINAL INFRASTRUCTURE

The company's storage infrastructure utilized both internal disks and direct-attached disks via SCSI cables to external disk shelves. Applications included mail servers, Web servers, file servers, and database servers. Servers were typically one- or two-CPU servers with dual Ethernet ports and dual internal drives, set as mirrored for redundancy. The network was Gigabit Ethernet. Overall CPU utilization was around 15% to 27%. Out of the box server deployment took as long as 2 months and as little as 3 weeks, depending on budgets and complexity. Storage provisioning was accomplished relatively quickly; however, many times an additional server was brought online due to running out of storage space. Managing the network infrastructure became increasingly complex as more and more servers were brought on line. The current data center at headquarters could house a maximum of 120 servers, a number projected to be outgrown in two months. Data replication was 15 to 24 months away. A total of four employees ran the data center, two server administrators and two storage administrators.

4 NEW INFRASTRUCTURE

Five four-processor Xeon servers and five two-processor servers had been configured with VMware ESX software. These servers were configured to access LUNs on the NetApp system in the primary data center.

LUNs are provisioned in their own qtrees. In accordance with NetApp best practices (<http://www.netapp.com/news/techontap/3248.pdf>), each virtualized server is allocated a qtree in a SAN_vmware volume on the NetApp storage system. In addition, each VMware LUN is formatted as a VMFS-3 volume. This allows the VMware Virtual Center to be used to migrate a virtual machine from one VMware ESX host to another while the server is live (using VMotion™). Additionally, the customer now has localized disaster recovery with the high-availability (HA) feature in VI3. The HA feature allows virtual machines (VMs) on a single ESX server to be started on another ESX server within the resource pool (which is managed by Virtual Center). If a server fails completely, all of its VMs start on another ESX server within minutes. This reduces the overall provisioning of servers to minutes instead of days. Along with VMotion and HA, the customer also utilized the Distributed Resource Scheduler, which allows the balancing of virtual machines across a defined set of computing resources such as CPU and memory.

5 CONFIGURING A NETAPP FIBRE CHANNEL SAN WITH VMWARE

Once the appropriate software is installed, configuring VMware ESX to access NetApp storage via Fibre Channel Protocol (FCP) and NAS (NFS) is simple. VMware allows the administrator to map LUNs to the virtual SCSI disks used by each virtual machine instance. Provisioning LUNs on the NetApp storage systems requires the following steps:

1. Decide the size of the LUN, the LUN ID number, and where it will reside on the storage system (use VMware as the host OS type).
2. If it is not already present, create an initiator group for the host.
3. Run LUN setup on the NetApp storage system via the command line, or use the LUN Wizard tool in NetApp FilerView®.

After the LUN is created, use the VMware administrative interface to map the LUN from the storage system to the specific virtual server.

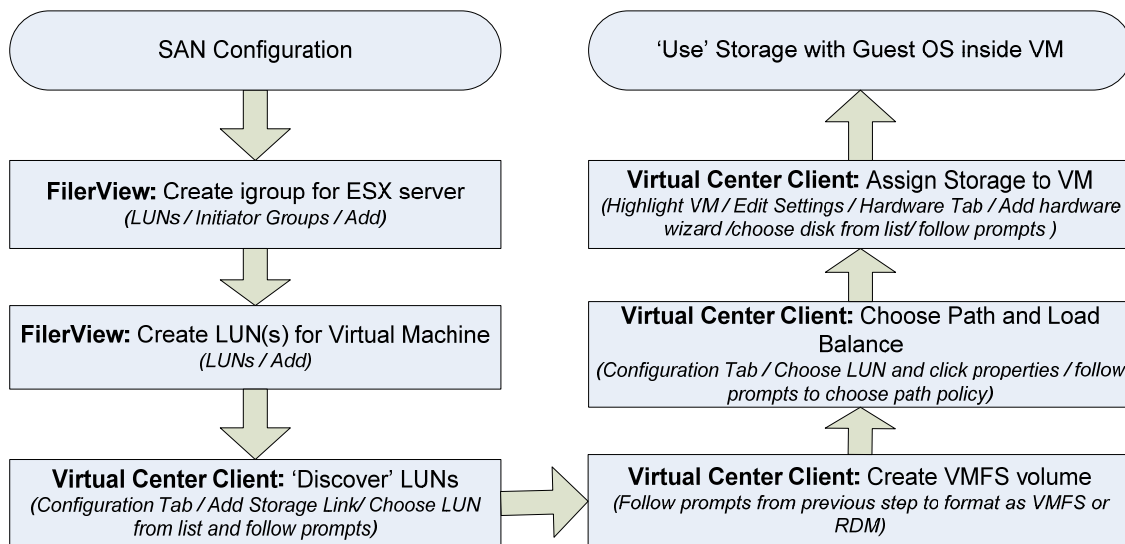


Figure 1) NetApp Fibre Channel SAN configuration with VMware software.

In sizing the LUN for VMware, it is necessary to increase the size slightly to account for VMware administrative space. VMware uses this space to accommodate information about the instance, and to store the memory contents of the virtual server when it is suspended. The company created LUNs that were 2GB larger than the storage requirement to accommodate VMware.

After the company created its LUNs and virtual servers, the LUNs were mapped to individual virtual servers and the instances started. A migration tool from VMware called VMware Converter was used to move data from existing physical servers to VMware virtual machines. After a period of testing and a brief outage for each, the physical servers were retired or provisioned for testing applications.

6 NETAPP AND VMWARE IMPACT

When the project began, the company relied on more than 100 servers in their main data center. The environment supported Web servers, mail servers, print and file servers, and database servers. By simplifying its IT infrastructure with VMware and NetApp storage, the company was able to reduce the number of deployed physical servers to fewer than 15—a reduction of more than 50%—without eliminating any services.

This effort significantly simplified the company's IT infrastructure while making it easier to provide appropriate protection and disaster recovery capabilities for critical applications. As a result, the headcount directly responsible for storage and server management functions was reduced by 25%.

Consolidating server storage on NetApp storage systems has given the company much greater control over its data. In the past, server and storage provisioning took as long as 3 months. Application restore time was reduced from days to minutes by using a two-tiered approach (VMware template deployments and restoring with NetApp Snapshot™ copies). By utilizing the template feature in VMware Virtual Center, provisioning VMs took a matter of minutes, including the applications that were configured as a part of the template creation process. Therefore the customer decided to have gold configurations based on the multitude of various application types.

For individual file restores, the company has completely eliminated a previous service-level agreement of 4 hours. The metric is no longer needed because restores occur in minutes.

In addition, the previous tape environment had a much higher risk of losing data, and bare metal recovery of a failed server could take from 8 to 12 hours for critical servers. Using the HA feature in the Virtual Center allowed the server and application to restart in minutes. Improved disaster recovery (DR) is another major advantage. NetApp Snapshot technology and SnapMirror® software have replaced tape backups with a completely tapeless solution. In the past, the company provided disaster recovery for only a small part of its overall environment. With NetApp and SnapMirror as well as VMware HA, the company provides DR for all of its critical applications and can rapidly add DR capability for any application that requires it.

The company has also found that resource usage is very efficient in its VMware environment. VMware efficiently shares processor and memory resources between instances of the same OS, so fewer processors and less memory are needed than originally anticipated, and end users report that application performance has actually increased noticeably. In addition, the company utilized the ability to pool ESX servers to create resource pools and carve up CPU as well as memory space to a granular level (per VM). This is a key feature in VMware Virtual Center 2.0.

VMware enables the company to quickly implement new servers for proofs of concept or new projects. The company no longer has to budget immediately for new hardware and software; it can simply configure a new virtual machine with any instance of OS supported by VMware. NetApp and SAN technology complement this capability. Today, the company makes changes to its storage environment four or five times a week with no disruption to users.

Network Appliance has unified storage with access via FCP, iSCSI, and NAS (CIFS/NFS). The company also utilized both NFS and FCP to deploy their environment, resulting in an overall better ROI and TCO from both the server and storage architecture.

Customer benefits:

- Operational savings in managing, provisioning, and restoring servers
- Environmental savings in power, AC, and data center space
- Reduced hardware costs
- Ability to deploy applications based on resource pools
- Data center DR availability with VMware high availability
- Disaster avoidance with VMware Distributed Resource Scheduler
- Simple management with zero downtime using VMware VMotion
- Lower cost with NFS

7 CONCLUSION

VMware allowed the company to reduce server counts by 50% or more without major application changes, while making it possible to adapt much more rapidly to support new projects and new applications.

NetApp solutions simplified the company's overall storage infrastructure, creating a storage system that adapts rapidly to changing needs while improving data protection and disaster recovery—often by reducing or eliminating the need for tape-based solutions.

The combination of VMware software and NetApp storage solutions offered significant advantages for the company's consolidating servers and storage to reduce costs and increase operational efficiency

8 ADDITIONAL RESOURCES

"Network Appliance and VMware ESX Server 3.0 Storage Best Practices," January 2007.

<http://www.netapp.com/news/techontap/3248.pdf>

"Network Appliance and VMware ESX Server 3.0: Building a Virtual Infrastructure from Server to Storage," October 2006.

<http://www.netapp.com/library/tr/3515.pdf>

"Server Consolidation and Containment with VMware Virtual Infrastructure 3."

http://www.vmware.com/pdf/server_consolidation.pdf

