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INTEGRATING VIRTUALIZED SERVERS WITH VMWARE vSTORAGE-ENABLED DELL EQUALLOGIC iSCSI SANs

A comprehensive virtualization strategy encompassing virtual servers and consolidated storage enables unprecedented gains in overall data center efficiency and flexibility. VMware® Infrastructure utilizes advanced integration available in Dell™ EqualLogic™ PS Series Internet SCSI (iSCSI) storage area network (SAN) arrays to further enhance the virtualized IT infrastructure and help simplify the management of complex data center environments.

Virtualization has had a shape-shifting effect on IT infrastructures, enabling administrators to encapsulate live, running workloads in virtual machines (VMs) and move them transparently across pooled resources without service interruption. VM encapsulation and isolation enable organizations to safely consolidate many workloads on a single physical server—helping to decrease the infrastructure cost. The operational benefits of such virtualization capabilities include the ability to dynamically spread workloads across available hardware, avoid forms of both planned and unplanned downtime, and nondisruptively expand resources on demand.

Until recently, integration of storage area networks (SANs) and virtualization platforms was restricted to basic storage protocols, limiting the coordination and intelligent use of some advanced SAN features in the virtualized environment. Consolidating servers in virtualized data centers introduced a new layer of abstraction that prevented administrators from fully incorporating many preexisting processes from their physical environments into their virtualized environments. Lack of integration between the hypervisor and the underlying storage infrastructure has typically prevented virtualized servers from taking full advantage of the data protection, backup, and performance features of enterprise-class storage.

ENGINEERING THE VIRTUAL DATA CENTER OS

Virtualizing and consolidating physical server and storage resources into a cooperative pool of well-integrated resources that can be dynamically applied to virtual workloads are key capabilities of VMware Infrastructure, the company's premier platform and an example of a Virtual Data Center Operating System (VDC-OS). A VDC-OS can help address the need for flexibility, speed, resiliency, and efficiency by transforming a data center into an elastic, self-managing, self-healing, shared infrastructure.

Dell and VMware are further advancing these capabilities through a cooperative engineering initiative designed to integrate Dell EqualLogic PS Series Internet SCSI (iSCSI) SAN arrays and storage management technologies with VMware Infrastructure. Through this collaboration, new services based on VMware vStorage application programming interfaces (APIs) are being developed by VMware to tightly integrate advanced EqualLogic PS Series capabilities (including provisioning, snapshots, replication, and thin provisioning) seamlessly into the VMware Infrastructure environment.

ADVANCING EFFICIENCY ACROSS THE VIRTUALIZED DATA CENTER

VMware Infrastructure helps create a dramatically simplified, efficient computing model that enables

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applications to safely and securely utilize shared data center resources in a dynamic and flexible manner (see Figure 1). By enabling automated management and resource allocation for VMs, it helps free administrators to focus on managing application workloads instead of contending with IT infrastructure details—helping administrators to eliminate both planned and unplanned downtime, rapidly provision new capacity, and optimize resource utilization.

The VMware VDC-OS platform contains a set of Infrastructure vServices, a hardware abstraction layer that enables efficient and flexible use of underlying physical compute, network, and storage resources. Infrastructure vServices use industry-standard server, storage, and network components to help create a unified and efficient shared platform. These services not only abstract the underlying hardware, but also aggregate this hardware into pools, which can then be logically divided into virtual components and made available to applications in a dynamic fashion based on enterprise requirements and priorities.

VMware vStorage services include a range of technologies designed for efficient usage of shared storage as well as maximum performance. VMware's Virtual Machine File System (VMFS) is designed to allow VMs to effectively share physical storage with minimal impact on performance or manageability. In this model, physical storage resources are virtualized and presented to VMs as ordinary dedicated disk devices. These disk devices are actually files stored on the VMFS volume, helping isolate administrators from storage provisioning tasks and management complexity. Optimization techniques such as thin provisioning and linked clone technology enable high consolidation of storage usage. Other vStorage capabilities provide for enhanced integration with current storage management tools, such as those for backup and array replication. vStorage offers APIs that enable VMware and storage partners such as Dell to integrate and optimize their storage technologies with VMware technologies and capabilities.

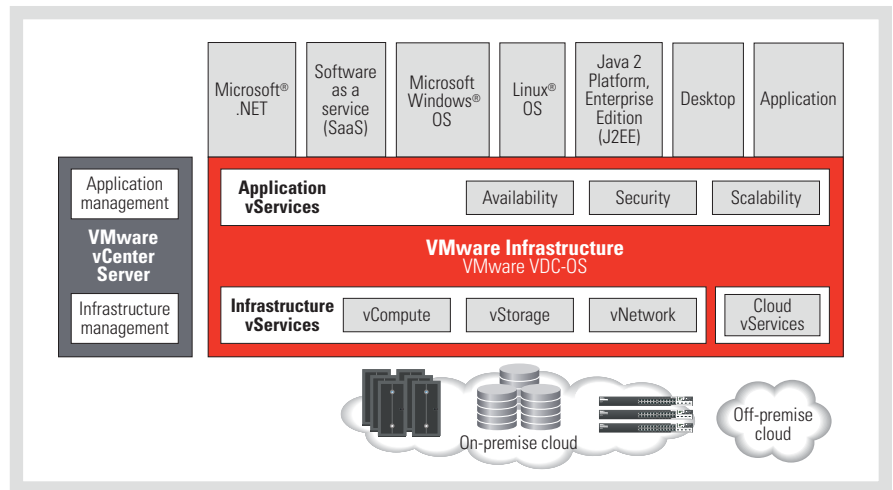


Figure 1. Forming the basis for a comprehensive virtualized environment with VMware Infrastructure

REMOVING BARRIERS WITH iSCSI SANs

Virtualizing and consolidating storage is a necessary first step toward realizing the full benefits of a virtualized data center. A virtualized SAN is pivotal for supporting 24/7 operations, enabling advanced enterprise-class functionality, and extending similar benefits of server consolidation and virtualization to storage.

All too often, storage consolidation has been a complex and expensive project requiring proprietary infrastructures and specialty skills not typically available within an IT organization. Today, iSCSI SANs are helping administrators overcome these barriers to implementing a fully virtualized data center environment. However, many iSCSI SANs require expensive add-on functionality such as comprehensive data protection and disaster recovery to make them suitable for consolidated virtualized server deployments where data is highly concentrated.

Simplified management is also critical as the virtualized infrastructure expands to encompass a comprehensive range of data center hardware and networking capabilities. Dell EqualLogic PS Series iSCSI SAN arrays help overcome these challenges with a variety of built-in features that have been widely adopted in data center consolidation scenarios. Now, Dell is using

VMware vStorage APIs to integrate these enterprise-class SAN features with the VMware Infrastructure platform.

UNDERSTANDING THE ROLE OF DELL EQUALLOGIC PS SERIES ARRAYS

A high degree of built-in intelligence and automation help make Dell EqualLogic PS Series iSCSI SANs well suited for the demands of virtualized data centers. The innovative design of the arrays enables simple, full-featured deployment with no additional license fees or software required. Arrays can be added to the SAN without service interruption, and the SAN is designed to automatically rebalance the workload to accommodate additional arrays. In many ways, EqualLogic PS Series arrays are designed to provide for storage what VMware can provide for servers: consolidation, flexibility, and high availability.

As workload demands shift or migrate between VMs and their physical host servers, the virtualized SAN can automatically apply storage resources where and when they are needed without manual intervention or tuning. Peer deployment typically enables IT staff to install, configure, and deploy EqualLogic arrays in a matter of minutes.

EqualLogic arrays are also designed to provide the reliability and uptime

required in virtualized data centers. Designed to provide greater than 99.999 percent data availability, the arrays are built with redundant, hot-swappable components. Storage volumes can automatically fail over to another disk if necessary. These features complement the high availability provided by server virtualization and consolidation.

For data protection, the EqualLogic firmware provides many standard features including snapshot, clone, and replication capabilities. Also included standard with the arrays are VMware-specific technologies, Dell EqualLogic Auto-Snapshot Manager/VMware Edition, and the VMware vCenter Site Recovery Manager (SRM) Adapter, which enable advanced automation of the data recovery process. Resource-intensive disaster recovery operations are offloaded from the hypervisor layer to the arrays to help optimize the virtualized data center.

Currently under joint development by Dell and VMware are several advanced technologies that are planned to deliver seamless integration of Dell and VMware tools with the virtualized environment: linked clone technology for minimized storage requirements, SAN data copy offload for high performance and low overhead, advanced multipathing to optimize multiple SAN connections, and thin provisioning management to help protect VMs from running out of space.

UTILIZING vSTORAGE WITH SNAPSHOTS AND DISASTER RECOVERY

In 2008, the tight engineering relationship between Dell and VMware resulted in Dell EqualLogic Auto-Snapshot Manager/VMware Edition and VMware vCenter SRM for virtualized data center protection. Both offerings take advantage of the VMware vStorage APIs and help offload performance-intensive operations from VMware Infrastructure onto the SAN.

Auto-Snapshot Manager/VMware Edition, which is bundled with EqualLogic PS Series iSCSI SANs, provides automated, consolidated VM backup and recovery in VMware environments. An easy-to-navigate graphical user interface offers SAN and VMware-centric views (see Figure 2). Auto-Snapshot Manager/VMware Edition works with VMware vCenter Server to take a snapshot of the VM and then takes an EqualLogic SAN snapshot, enabling rollback of VMs for fast recovery. Snapshots can be pre-scheduled for various time intervals, ranging from minutes to days.

This environment also offers an automated and cost-effective approach to disaster recovery using EqualLogic arrays and vCenter SRM. The arrays include auto-replication software designed to eliminate a recurring licensing expense. The arrays also include Dell EqualLogic PS Series SRM Storage Adapter software at no additional cost, which integrates the SAN auto-replication feature directly into vCenter SRM.¹

The integrated Dell and VMware environment uses the auto-replication feature in the EqualLogic arrays to make copies of data and send them to a remote location

at a safe distance from the primary data center. If the primary site goes down, the volumes are already at the recovery site, and vCenter SRM can automatically coordinate the process of bringing the environment online by running the recovery plan and starting VMs in the intended order with updated networking configurations. Administrators can monitor and pause recovery using VMware vCenter Server.

ENABLING OPPORTUNITIES FOR ENHANCED INTEGRATION

Dell and VMware continue their integration efforts to provide advanced multipathing, coordinated thin provisioning, fast and efficient data movement (including SAN-accelerated VMware Storage vMotion™ technology), and VM data de-duplication.

In future releases, connection-aware multipathing technology provided by Dell EqualLogic PS Series iSCSI SANs is planned to help optimize multiple SAN connections. Redundant connections help safeguard against network problems. Integration with VMware vStorage is expected to enable end-to-end load balancing based on optimal mapping designed to maximize the server and SAN array availability and performance.

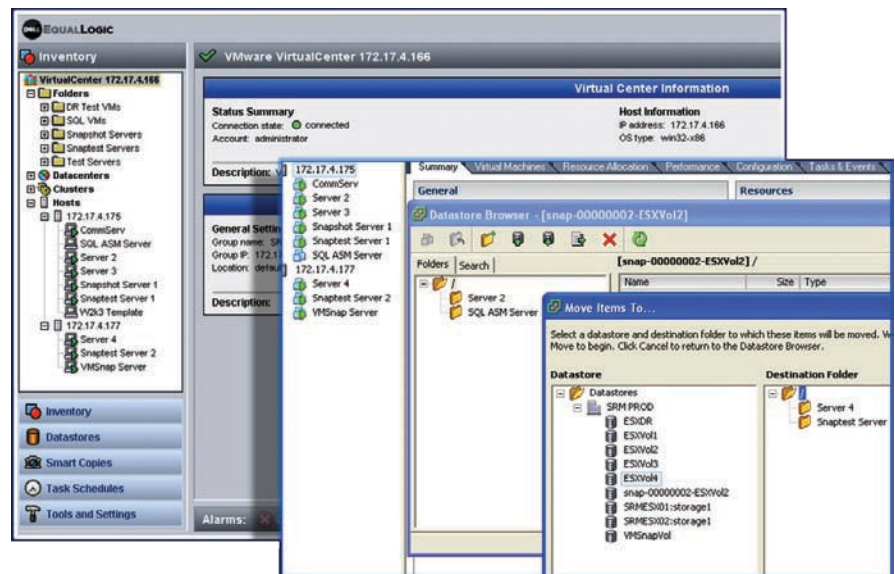


Figure 2. Navigating VM backup and recovery in Dell EqualLogic Auto-Snapshot Manager/VMware Edition

¹ For more information on protecting data with VMware software and Dell EqualLogic PS Series iSCSI SANs, see "Automated Disaster Recovery with VMware SRM and Dell EqualLogic iSCSI SANs," by Andrew Gilman and Jon Bock, in *Dell Power Solutions*, August 2008, DELL.COM/Downloads/Global/Power/ps3q08-20080395-Gilman.pdf; and "How Dell EqualLogic Auto-Snapshot Manager/VMware Edition Helps Protect Virtual Environments," by Andrew Gilman and William Urban, in *Dell Power Solutions*, November 2008, DELL.COM/Downloads/Global/Power/ps4q08-20080107-Gilman.pdf.

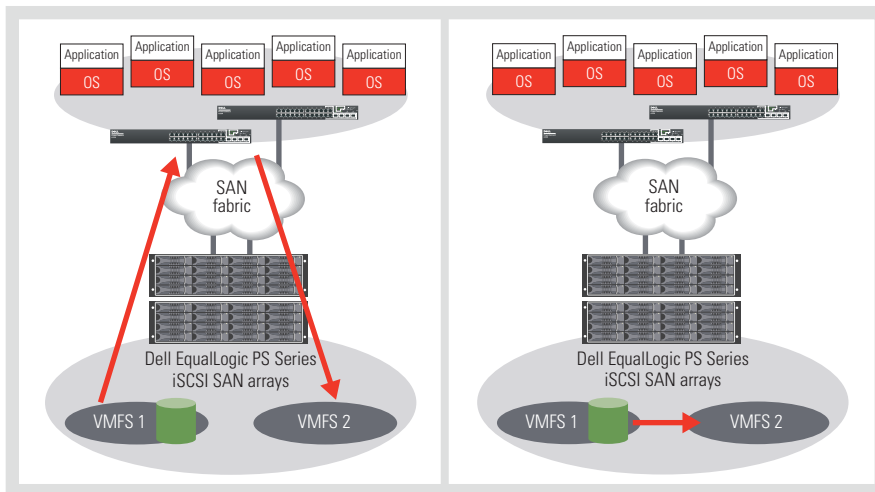


Figure 3. Copying SAN data without VMware vStorage integration (left) and with VMware vStorage integration (right)

The integrated technology is planned to automatically adapt to configuration changes on the server, network, or SAN arrays.

EqualLogic arrays include thin provisioning technology that helps relieve storage underutilization problems, allowing organizations to reduce storage purchases up-front and add capacity later as needed. This approach requires an accounting system that lets administrators monitor how much space is being used relative to the physical assets on hand. In future releases, Dell and VMware integration through vStorage is anticipated to automate this process by tying the accounting system to event-based actions and alerts. VMware Infrastructure managed through VMware vCenter Server is designed to automatically pause the VM if capacity is exceeded, notify administrators, and allow Storage vMotion to migrate files to another device before resuming operation.

Linked clone technology is also expected to help reduce VM storage requirements by enabling VMs to share common OS images on the SAN while retaining user-specific profile and application data. Each VM has its own base disk that stores writes, and patches applied to the base disk can be seen by all linked clones. The combination of virtualized storage and linked clones enhances the efficiency of storage utilization, helping


to reduce total cost of ownership by minimizing the need to provision added storage capacity.

Performance is also optimized in the integrated Dell and VMware environment by offloading many processing-intensive tasks from the server to the EqualLogic arrays. An example is the SAN data copy offload for Storage vMotion operations (see Figure 3). Without vStorage integration, data must be read from the SAN into the server and then written back to the SAN, leading to significant processor and network overhead. With vStorage integration, data can bypass the server and instead move within the SAN, which helps significantly reduce server processor and network overhead.

BENEFITING FROM A COMPREHENSIVE VIRTUALIZATION STRATEGY

Traditionally, VMs and SANs have lacked advanced integration, making ongoing management, data protection, and disaster recovery complex for organizations that have implemented server consolidation through virtualization. Dell and VMware are helping to simplify these operations for virtualized data centers by delivering advanced automation, intelligence, and integration designed to meet

the emerging requirements for a fully virtualized data center environment. By combining VMware Infrastructure and Dell EqualLogic PS Series iSCSI SANs, organizations can pave the way for a virtualized infrastructure that encompasses servers, storage, and networks.²

A fully virtualized infrastructure enables consolidation of assets, centralized management, advanced data protection, and integrated disaster recovery. By managing both virtualized servers and virtualized storage centrally as key strategic assets, enterprises can utilize storage resources efficiently, grow storage capacity seamlessly, and minimize downtime caused by storage-related problems. Ultimately, these benefits reach far beyond reductions in capital outlays and operating costs—affording fast, flexible IT response to keep pace with evolving business requirements. 

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Dell EqualLogic and VMware vStorage:
www.equallogic.com/vstorage

Dell EqualLogic PS Series:
DELL.COM/EqualLogic
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² Dell and VMware demonstrated several future vStorage technologies at VMworld 2008. For more information, visit www.equallogic.com/vstorage.