ENABLING THE VIRTUAL DATA CENTER:

SIMPLE, AFFORDABLE VIRTUALIZED iSCSI STORAGE FOR MICROSOFT WINDOWS SERVER 2008 HYPER-V ENVIRONMENTS

Virtualization has become an essential data center technology, allowing IT administrators to consolidate server infrastructure and reduce costs while enhancing service levels. Today, many organizations are advancing toward the next step, which is to couple storage virtualization with server virtualization in a highly available, scalable, and manageable environment. Building the foundation for these next-generation data center infrastructures requires well-integrated server and storage virtualization platforms.

This white paper describes a virtualized infrastructure that applies storage and server virtualization technologies to cost-effectively achieve a flexible, high-performance, dynamic IT infrastructure that is simple to deploy, manage and scale.

SERVER VIRTUALIZATION

Server virtualization is currently one of the most significant technology trends in IT. Managing server hardware and software as separate infrastructure components can make it possible to significantly improve data center operating efficiencies. Consolidation and containment solutions implemented with Microsoft® Windows® Server 2008 Hyper-V™ meet the challenges of server sprawl and underutilization by reducing hardware and operating costs. A virtualized infrastructure can also simplify server deployment and resource management to optimize capacity and infrastructure management. Microsoft Hyper-V server virtualization technology makes it possible to package a complete x86 server—hardware, operating system, applications, and configurations—into a portable virtual machine package.

Given sufficient processor, memory and disk storage, a single hardware system running server virtualization software can support many guest virtual machines. Applications and data are processed in exactly the same way as in the physical environment, using the same operating system facilities for making system requests. The only difference is that the operating system is now a virtualized guest running in a virtual system environment.
Virtual machine files can be transparently migrated from one server hardware platform to another, giving administrators the ability to allocate and shift physical server resources in response to changes in application workloads. A scalable, highly resilient, flexible server environment is created, resulting in greater resource utilization, greater IT flexibility, and lower operating costs.

**STORAGE VIRTUALIZATION**

Most IT professionals define storage virtualization as a technology that allows discrete storage systems to operate as a single resource. In light of recent advancements in server virtualization, the concept of storage virtualization is being further refined as a way to create an abstraction layer between the storage hardware and logical data volumes. Given sufficient protocol support (as with iSCSI), virtual storage products are now being designed that can allow data volumes to be located and striped across multiple (and diverse) physical storage resources, including storage systems, RAID groups, disk types, and controllers. Not only can this provide higher performance and scalability, it also can allow data volumes to be transparently moved from one set of resources to another without disruption to the operating systems and applications that are utilizing data. A scalable, highly resilient, flexible storage environment is formed, resulting in better storage utilization rates and reduced operating costs.

**REQUIREMENT FOR NETWORKED ENTERPRISE STORAGE IN A HYPER-V ENVIRONMENT**

Hyper-V, Microsoft's hypervisor-based server virtualization technology, is enabled as a role within Windows® Server 2008 that provides a simplified, reliable, and optimized virtualization solution, designed to help enable improved server utilization and reduced costs. With Hyper-V, you are able to make the best use of your server hardware investments by consolidating multiple server roles as separate virtual machines (VMs) running on a single physical machine. Hyper-V enables consolidation of a broad range of services, from resource-intensive services like Microsoft SQL Server™ to third-party applications running on previous versions of Windows or Linux. In addition to reducing the cost of buying or leasing server hardware, virtualization can reduce costs associated with managing server power and cooling, physical space, and maintenance.

In a Hyper-V virtual environment, a parent partition (host server) is created that, in addition to the host OS, includes device drivers and the virtual hard disks (vhd) for the VMs. Child partitions (VMs) reside on the host server and support a broad range of operating systems and applications without modifying the host server. As the need arises, additional server resources can be non-disruptively added, and current workloads can be quickly migrated to take advantage of the newly available resources.

Microsoft Hyper-V enables more than server consolidation. It also improves network reliability, scalability, security, and flexibility. Servers that slow down due to peak usage at the start of the workday,
for example, can offload some of their workloads to
other servers, which increase their capabilities, or
move to more powerful servers, improving network
availability. Virtual machines are also able to simply take
advantage of the greater performance capabilities of
new generations of server hardware. Server software
designed for other operating systems like Linux can run
on the same hardware as Windows solutions, and take
advantage of centralized management using industry-
standard tools, making Microsoft Hyper-V, a flexible
alternative to dedicating separate servers to a single
type of architecture or operating system with disparate
management tools.

Effective Hyper-V deployments depend on shared
access to storage — in other words, a SAN. SANs
help to ensure that each Hyper-V server has access
to any virtual machine’s data sets, enabling simple
re-hosting of the virtual machine. This eliminates the
unacceptable and time-consuming necessity of copying
virtual machine files, applications, and data from one
server to another. SANs can support powerful features
within Windows 2008 Hyper-V — these include Quick
Migration, the ability to quickly move virtual machines;
and Microsoft’s High Availability feature, based on
Microsoft Cluster Shared Volumes (CSV), which
monitors the proper functioning of a virtual machine
and, in case of a failure, rehosts and restarts the virtual
machines affected by the failure on another Hyper-V
Server. With the availability of Windows Server 2008
R2, Cluster Shared Volumes (CSV), a distributed-
access file system optimized for Hyper-V, is supported,
enabling Live Migration of individual virtual machines
from one physical server to another.

In addition to the requirement for networked storage, a
virtualized environment can heighten the need for high
performance, highly available, resilient storage to meet
the needs of the aggregation of workloads. As more
critical applications, production workloads, and data
assets are consolidated into fewer resources, greater
is the need for high-performance, non-disruptive
scalability, and continuous availability of the storage
assets. Enterprise-class storage designed for mission-
critical deployments is a basic requirement when
building a virtualized IT infrastructure.

In particular, purpose-built storage architectures should
be deployed that include mirrored memory write caches,
fully-redundant hot-pluggable components, online hot
spare disks, environmental monitoring, and enterprise-
class disk drives with RAID protection. Furthermore,
advanced availability features, including storage
controller and I/O path failover, are required to guarantee
data access even in the case of component failure.

Consideration should also be taken to evaluate the
data protection software features enabled within the
storage system. Storage consolidation within a SAN can
enable the consistent application of data protection and
disaster recovery, assuming the basic SAN-based tools
are available and enabled. Space-efficient, non-intrusive
snapshot-based point-in-time copies as well as efficient
array-based replication tools should be considered as
basic requirements of the storage infrastructure for a
virtualized environment. Multiple use cases exist for the
application of these tools in virtualized environments
— including disaster recovery, online backup and quick
recovery of virtual machines, simple extraction of lost or
corrupted data files, rapid virtual machine and data set
DELL EQUALLOGIC ™ VIRTUALIZED ISCSI SAN

The foundation of an EqualLogic virtualized iSCSI SAN is the PS Series storage array. Each array is fully-redundant, containing disks, multiple high-performance network interfaces, redundant controllers with mirrored battery-backed caches, and other advanced features. The disks are automatically protected with RAID (RAID 10, RAID 50, RAID 5 or RAID 6) and hot spares. Multiple models of arrays exist, leveraging high performance SSD drives, 10K and 15K RPM SAS drives or more cost-effective, higher-density SATA-II drives.

A PS Series storage group can be comprised of a single PS Series array or multiple arrays. A group is a virtualized resource that offers network storage access to a single large pool of storage—a storage area network (SAN) composed of a single, virtually scalable, high-performance storage system. Unlike a conventional SAN, in which multiple controllers appear as independently managed islands of storage, each group member in an EqualLogic SAN “cooperates” with other members to automate resource provisioning and performance optimization.

AUTOMATIC LOAD BALANCING

Volumes are distributed among the group’s member arrays, with data placement and access continually adjusted for optimal performance as resources are added or workloads change. When an array is added as a group member, its disk space is added to the group’s storage pool. Volumes are automatically re-striped and distributed across all the members of the storage pool. Controller resources are also dynamically adjusted based on the workloads being generated by the attached Hyper-V servers. Data and network I/O to the group are automatically load balanced across the group members’ resources.

As capacity and performance requirements increase, a group can be scaled linearly in both capacity and performance — all while online. New members “learn” configuration and performance information from the group — with no manual intervention. Data and client connection load-balancing occur automatically as the group scales. I/O activity is monitored, and data and network connections are adjusted as needed.

NON-DISRUPTIVE SCALABILITY

The scalability model allows for automated, online expansion in all storage dimensions, and the PS Series architecture nearly eliminates downtime caused by expanding or managing a storage system. Because capacity can be added so easily, IT managers need to buy only the storage necessary for current applications, easing budget constraints caused by excessive purchases. Additional benefits of the virtualized SAN environment include the transparent application of storage tiers. EqualLogic storage groups can use multiple storage tiers contained within the storage pool and automatically optimize data placement based on workload. Alternatively, storage tiers may be segmented into independent resource pools to guarantee specific resources to specific workloads, concurrently maintaining the flexibility to migrate volumes online from one tier to another, fully transparent to the Hyper-V Server.

QUICK, INTELLIGENT PROVISIONING

Within the EqualLogic environment, storage can be quickly provisioned simply and easily with the click of a button. The key functions needed to configure, manage and scale storage are automated, cutting administration tasks for volume and capacity growth. Given the intelligence built into the PS Series software, decisions with respect to RAID type and data layout are made automatically at the time of provisioning, and optimized as workload patterns for the newly provisioned storage evolve. As new resources become available, the resources are automatically applied where and when needed.

By eliminating complex tasks and enabling fast and flexible storage provisioning, PS Series solutions help to dramatically reduce acquisition and ongoing operational costs, and make enterprise-class shared-block storage practical for the mid-range storage market.

AUTOMATED MANAGEMENT

The PS Series architecture is designed to simplify storage management in several ways. RAID configuration and hot sparing are automated, and dynamic storage and network I/O load balancing occurs automatically, as resources and performance metrics change. No longer must administrators manually map application data to specific physical devices and controllers.

A primary benefit of this automated, virtual storage system is that storage administration remains stable as the group is expanded. All administration is performed at the group level, through the Dell EqualLogic Group Manager, an intuitive, single-pane administrative console. Because the group is managed as a single logical system, the ongoing operational costs of storage management remain fixed even as storage grows.
provisioning using snapshots and clones for production and temporary use, as well as server-less tape- and disk-based backup and recovery of the organization’s data assets.

A thorough evaluation of the storage platform should be undertaken prior to deployment, considering not only-the robustness and feature set, but also the total cost of ownership over its useful life, with particular consideration of the required system growth in terms of performance, capacity, and software features.

**HOW ISCSI ENABLES VIRTUALIZED SANS**

Storage virtualization can simplify provisioning and ongoing management, increase storage utilization, provide unlimited scalability in capacity and performance, and enable online migration of data sets among controllers and storage tiers. By consolidating network-based storage into a simple, flexible, consolidated pool of storage that can grow in capacity and performance on demand (as can the Dell EqualLogic environment), storage virtualization is a key enabler for simplifying a virtualized IT infrastructure.

Historically, the adoption of storage virtualization technologies in SAN environments has been limited, primarily to enterprise data centers needing a tool for online data migration between heterogeneous storage environments. This add-on design allows for heterogeneous storage and data movement, but does not simplify management of the configuration. Most of these designs have been implemented as external appliances sitting within the storage area network. These devices generally add more complexity to an already complex environment – introducing additional points of management within the SAN, masking value-added features of the attached arrays, and limiting performance and scalability of the consolidated SAN storage pool to a single gateway hosting the backend storage. In the iSCSI realm, simple design alternatives make the promises of storage virtualization easy to achieve.

The most advanced storage virtualization technologies offer the ability to virtualize storage at the storage device level. This approach achieves scalable performance and capacity and reduces overall management by aggregating multiple controllers into a cooperating set of resources, i.e., virtualizing volumes not only across disks within a controller but also across storage systems in a SAN. Dell EqualLogic PS Series storage arrays are an excellent example of such a “scale-out” architectural design. Ironically, despite their elegant simplicity, such designs are virtually non-existent in the Fibre Channel SAN world, primarily due to architectural constraints inherent in Fibre Channel network deployments.

Devices in a Fibre Channel SAN are attached to the network via a World Wide Name (WWN), a physical port address specifically assigned and encoded within the device hardware/firmware. World Wide Names are assigned for all devices within the SAN, including each physical port within each host server and each physical port within the storage controllers. Furthermore, data paths between the hosts and the storage array are statically set when the host is added to the SAN.

Herein lies the inflexibility of Fibre Channel SANS. The topology of the SAN is intrinsically hard coded into the environment, typically making changes within the infrastructure burdensome, time consuming, and error-prone. Expansion of resources in the host, fabric, or storage layer propagates changes throughout the infrastructure, causing intrusive downtime to the applications and infrastructure.

In contrast, TCP/IP networks support virtual addressing and dynamic routing, whereby paths through the network are not statically defined. With DHCP, addresses can be dynamically assigned, or through address proxying, physical addresses can be virtualized, making it possible for devices in the network to transparently act on the behalf of other devices on the network. If the IP address of the resource being accessed is known from within the network, the entity (such as a SAN initiator) requesting access can find the resource dynamically without prior knowledge of the paths or the resource’s physical address.

IP address proxying fully virtualizes storage access across multiple EqualLogic storage controllers. In an EqualLogic group, for example, each PS6000 member array has 4 active physical gigabit Ethernet ports. A 4-member group has a total of 16 active Ethernet ports, providing 16 Gb/second of peak bandwidth. Each of these Ethernet ports...
is assigned an IP address. The members within the group are aware of and coordinate use of these multiple IP addresses and the underlying physical resources. External connections to the group by all hosts within the SAN is exclusively via the group IP address, a unique IP address that transcends all the underlying member IP addresses. Through standard iSCSI commands, the EqualLogic group instructs the hosts to connect via an alternative IP address, thus distributing host workloads across all Ethernet ports in the SAN.

Shielding host systems within the SAN from being aware of the physical topology of the storage serving its data is vitally important, particularly in a virtualized server environment. By virtualizing all physical I/O ports, a flexible storage utility is created. Pooling storage assets within the SAN is now possible, enabling a rich set of features to maximize storage utilization and effectiveness, extending beyond the limitations of a single, physical end-to-end connection to a single storage controller.

Data is accessed by the host without intimate knowledge of where in the storage utility the data is stored, providing the opportunity for data volumes to span controller boundaries and exploit the combined resources of multiple controllers. Controllers coordinate among themselves to balance workloads and optimize storage resource utilization.

Changes in storage infrastructure can be achieved seamlessly, without impacting host connectivity or data access. The iSCSI-based infrastructure can be scaled non-disruptively, automatically applying the resources of the additional controllers and disks to extend performance and capacity. Multiple tiers of storage can be seamlessly integrated in the utility, providing for automatic placement of data within a volume to the appropriate tier based on the volume’s access patterns.

A flexible storage architecture, as described above, is particularly appealing in a virtualized server environment as the “scale out” architectures of both server and storage infrastructures uniquely complement each other, providing an end-to-end virtualized infrastructure.

Deployed together, IT managers achieve an infrastructure that is particularly adaptable to changing business requirements by providing workload migration across all physical resources (both storage and server resources) as well as online resource expansion.

A FLEXIBLE, SCALABLE, VIRTUALIZED ENVIRONMENT FOR SERVERS AND STORAGE

iSCSI is a key technology enabling scalable, cost-effective, high performance virtualized SAN environments, a perfect complement to a virtualized server environment.

ADVANCED INTEGRATION OF DELL EQUALLOGIC IN MICROSOFT HYPER-V ENVIRONMENTS

Dell EqualLogic PS Series iSCSI SAN arrays are designed to provide the elements required for an enterprise-class virtualized server and storage environment based on Microsoft Windows Server 2008 Hyper-V. The EqualLogic PS Series product family has been certified for Windows Server 2008 x64 Editions by Microsoft, indicating that it meets Microsoft standards for compatibility and best practices. In addition, the EqualLogic PS Series has received the Microsoft Simple SAN designation, indicating that it has met specific ease-of-use, ease-of-installation, and ease-of-management criteria.

EqualLogic PS Series arrays are designed to deliver enterprise-class reliability in Microsoft Hyper-V environments. The arrays function as peers, working together to share resources, evenly distribute workloads, and enable comprehensive data protection for the VMs in a Hyper-V environment. Power supplies, controllers, enclosures, and disk drives are fully redundant and hot-swappable. If a failure does occur, failover to a redundant component helps keep operations up and running.

Microsoft Hyper-V enables organizations to dynamically scale VMs on physical servers, and EqualLogic PS Series arrays help extend that same dynamic scalability to storage. Administrators can expand SAN resources online and even move running workloads, all without disrupting services. Newly added arrays adopt the configuration from currently deployed arrays, and the new arrays are included automatically in the available storage pool.
Enterprise-level management capabilities are provided in the EqualLogic PS Series arrays with no added licensing fees, including role-based management, historical performance trending, and reporting. Storage pooling and tiering are automated, helping save administrative time and costs. Cloning and replication capabilities are also included in the firmware of EqualLogic PS Series arrays, offering advanced data protection for Microsoft Hyper-V environments.

Dell and Microsoft have a long standing cooperative relationship to enhance the integration of the Dell EqualLogic PS Series with Windows operating systems. Advanced integrated features, including the Dell EqualLogic MPIO DSM, Remote Setup Wizard and Auto-Snapshot Manager/Microsoft Edition are easy to install as part of the Host Integration Tool Kit. The Host Integration Tool Kit is included with the purchase of a Dell EqualLogic PS Series array or downloadable from support.dell.com/EqualLogic at no extra cost.

**ADVANCED I/O MULTIPATHING**

In a Hyper-V virtualized environment, virtual machine operating system images and datasets are stored on volumes that reside on the PS Series SAN. The Hyper-V host connects to the volumes using the built-in Microsoft iSCSI software initiator or through 3rd party iSCSI host bus adapters.

High availability of data is a requirement to ensure protection against system/device faults as well as increasing performance for workload demands. Achieving this level of availability is sometimes a challenging and daunting task for server and storage administrators. Redundant hardware and RAID technologies help but the paths between the servers and the storage are vital for data transfer and availability. Microsoft provides a software infrastructure to support multiple I/O paths to SAN storage called Multipath I/O. MPIO (Multi-path Input/Output) provides multiple path connections from servers to SAN, providing increased resiliency and redundancy. In the event of path congestion or failure, traffic is rerouted through the network assuring maximum performance of the server and storage infrastructure.

Using Microsoft MPIO, users can configure each server network port to connect to the SAN one at a time. With many servers and multiple NICs per server, this process can be tedious job. To simplify this process, Dell has developed a Dell EqualLogic PS Series Device Specific Module (DSM) to leverage and enhance Microsoft’s native MPIO capabilities when deployed with a PS Series array. The Dell EqualLogic MPIO DSM is designed to take the confusion out of connecting all available I/O paths from the server to the storage and automatically connects these paths based on designated subnets. The Dell EqualLogic MPIO DSM delivers:

- Automatic connection management
- Automatic failure detection and failover
- Automatic load balancing across paths
- Increased I/O bandwidth
- Increased volume bandwidth
- Reduced network latency
- Easy installation and management

The Dell EqualLogic MPIO DSM consists of two components, a pluggable software component that integrates directly with the Microsoft MPIO driver to route I/O to the desired path, and a service that manages connections. The connection manager automatically makes the appropriate connections to the target volume when an initial connection is made. Together, these services allow administrators to easily install and configure multipath I/O for iSCSI networks. Connection management is integrated with the Remote Setup Wizard, a Windows-based utility for PS Series arrays that provides a simple interface for installing Dell EqualLogic systems.
INTEGRATED DATA PROTECTION FOR MICROSOFT HYPER-V ENVIRONMENTS

Auto-Snapshot Manager/Microsoft Edition (ASM/ME) is a unique and innovative bundled data protection feature of the Dell EqualLogic PS Series iSCSI SAN that enables fast online backups and quick restores of Hyper-V virtual machines (VMs). Through an easy-to-use graphical interface, ASM/ME coordinates the creation, recovery and scheduling of VSS-compliant Dell EqualLogic SAN-based snapshots of Hyper-V virtual machines helping enhance protection, storage utilization, and performance.

In a Hyper-V environment, ASM/ME installs in the host Windows operating system of the parent partition of the Hyper-V Server, and automatically discovers the Hyper-V Server and associated child partitions (VM). ASM/ME is fully integrated with Microsoft® Volume Shadow Copy Services (VSS) framework providing application-consistent SAN-based snapshots. In a matter of minutes, IT administrators can create VSS-compliant SAN-based snapshots (Smart Copies) of virtual machines and their associated data sets (.vhd files). In the event of an outage, Smart Copy Snapshots can provide quick recovery of the VMs. Using the built-in scheduler, Smart Copy Snapshots can be scheduled for ongoing protection as frequently as needed while minimizing required disk space and maximizing the overall efficiency of the Hyper-V virtual environment.

ADVANCED PROTECTION FOR MICROSOFT SQL SERVER AND EXCHANGE

Many organizations are looking to deploy mission-critical transactional database applications such as Microsoft Exchange and SQL Server in virtual machines. EqualLogic PS Series arrays enable excellent performance with these applications.

Protecting transactional database applications in a virtualized environment can present challenges. Database protection is among the top concerns for administrators. Requirements for reducing database backup windows and restore times continue to mount as demands for continuous database and e-mail uptime increase. Because these applications are characterized by high I/O and constantly changing information, making consistent volume copies for backup and disaster recovery purposes can be difficult.

Auto-Snapshot Manager/Microsoft Edition automates these activities as well. With ASM/ME, administrators can attach data volumes directly to the iSCSI software initiator within the virtual machine, to easily create clean, consistent, SAN-based snapshots of application datasets, quickly recoverable to prior points in time. ASM/ME also integrates with standard backup software using the Microsoft VSS framework, enabling you to integrate into your standard backup processes and confidently deploy and protect transactional database applications in a virtualized IT environment.

ASM/ME extends the use of SAN copy facilities beyond storage administrators, to server and database administrators. This raises the productivity of the server and database administrators, allowing them to leverage efficient SAN copy facilities without requiring SAN privileges. By automating these data protection operations, the time-consuming operations of managing and maintaining database uptime are minimized and data availability is increased.
The storage virtualization achieved in the advanced iSCSI-based design of the Dell EqualLogic PS Series enables great performance, scalability, ease of use, and flexibility. As a result, both server and storage assets become fully virtualized, abstracted from the physical hardware upon which they reside. Virtualized server assets utilize a pooled set of physical server resources. Similarly, virtualized storage volumes utilize a pooled set of physical storage resources. By combining virtualized server and virtualized storage technology, a simple, flexible IT infrastructure can be created, resulting in a comprehensive solution with a common set of benefits, resulting in increased IT flexibility, lower total cost of ownership and reduced complexity. These benefits include:

- Aggregation of Virtualized Assets on Consolidated Hardware – Operational procedures and best practices can be standardized and consistently applied to both storage and server assets (both physical and virtual) resulting in a more resilient infrastructure with greater resource utilization, higher levels of service, and enhanced protection of information assets.
- Simple, Centralized Management – Greater management efficiencies can be achieved by centralizing management through intuitive, graphical management tools accessible from anywhere on the network, providing a comprehensive view to provision, monitor, and manage the entire virtualized infrastructure.
- Flexible and Quick Deployment of Virtualized Resources – Organizations can quickly adapt to changing and growing business needs by reducing the time to provision and deploy new applications via quick provisioning methods available for both servers and storage.
- Resource Re-allocation and Expansion – As workflows and business priorities change, both storage and server resources can be simply re-allocated. In addition, physical resources can be easily expanded online, without downtime.
- Common IP Network-based Infrastructure – The IT environment can be simplified by basing all operations on IP networking, including the interconnect for client access, inter-server communication, storage access, and off-site data replication. The organization’s inherent IP networking expertise is leveraged, resulting in lower training and ongoing management costs.
- Enterprise-Class Resiliency – With redundancy built into the physical server, network, and storage architecture, as well as component failure detection and failover software implemented within each layer of the infrastructure, overall reliability, availability, and service levels are enhanced.
- Advanced Data Management and Disaster Recovery – A rich set of server and SAN-based data protection tools ensure the organization’s critical assets are protected and immediately recoverable at the local or a remote site.

SUMMARY

Virtualized iSCSI SANs are changing customer experiences of how simple an enterprise storage infrastructure can be to deploy, manage, and grow. They are uniquely positioned to enable broad adoption of virtualized server technologies by reducing technical complexity and cost barriers imposed by classic storage area network architectures, without compromising the performance, scalability, and resiliency requirements of a virtualized IT infrastructure. As a result, organizations of all sizes are now deploying EqualLogic PS Series virtualized iSCSI SANs as the backbone of their virtualized infrastructure.

Characteristically, both server and storage virtualization provide key features for reducing complexity and increasing flexibility, including virtualized asset management, incremental online growth, and workload migration. The complementary effects of EqualLogic virtualized iSCSI SANs and virtualized server technologies enable a simple, cost-effective, and dynamic enterprise-class IT environment.

For more information on EqualLogic solutions in a Hyper-V environment, visit [www.dell.com/PSseries/Hyper-V](http://www.dell.com/PSseries/Hyper-V).
