



DEPLOYING MICROSOFT WINDOWS STORAGE SERVER 2003 WITH A PS SERIES iSCSI SAN

ABSTRACT

This Technical Report describes how to use PS Series storage in a Microsoft Windows Storage Server environment. With PS Series storage arrays, you can deploy file serving with a scalable, fault-tolerant iSCSI SAN increasing data availability and flexibility.



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PS Series Firmware Version 3.2 or later.

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REVISION INFORMATION

The following table describes the release history of this Technical Report.

Report	Date	Document Revision
1.0	January 2008	Initial Release

The following table shows the software and firmware used for the preparation of this Technical Report.

Vendor	Model	Software Revision
Microsoft®	Windows Storage Server 2003 R2	
Microsoft	iSCSI Software Initiator	Version 2.05
Dell®	Host Integration Tools for Microsoft Windows	Version 3.0.1
Dell	PS Series Firmware	Version 3.2.4

The following table lists the documents referred to in this Technical Report. All PS Series Technical Reports are available on the Customer Support site at: <https://www.equallogic.com/support/>

Vendor	Document Title
Dell	Storage Array Network Performance Guidelines Technical Report
Dell	Deploying Microsoft Windows Server 2003 MPIO in an iSCSI SAN Technical Report
Dell	Deploying Microsoft Windows Clustering in an iSCSI SAN Technical Report
Dell	Aligning Disk Sectors for Optimal Performance Technical Report
Dell	Host Integration Tools for Microsoft Windows User Guide and Release Notes
Dell	Deploying Microsoft System Center DPM 2006 in an iSCSI SAN Technical Report
Dell	Expanding Basic Disk Volumes Technical Report
Dell	Deploying Pools and Tiered Storage in a PS Series SAN Technical Report
Dell	Deploying Microsoft Multipath I/O in an iSCSI SAN Technical Report
Dell	CLI Reference

INTRODUCTION

Microsoft is a leader in file serving technology with Windows Server and Windows Storage Server 2003 R2 platforms. File serving and file storage is the maintaining of a wide range of file types including work processing documents, spreadsheets, PDFs, presentations, pictures, scanned images, development code, medical images, computer aided design, various audio, video, and photograph images, and other types unstructured data. As organizations grow, and data needs increase, storage needs, data integrity, availability, and ease of file access become critical IT points to consider. A Windows Storage Server is a dedicated, file and print server providing a shared access storage space in a diverse environment.

Together, Microsoft and Dell make it possible for businesses of all sizes to leverage their knowledge of Microsoft environments with the ease-of-use, scalability, and performance of Dell EqualLogic PS Series iSCSI storage. To obtain the benefits of consolidated storage, customers no longer have to invest in complicated network hardware and software—not to mention personnel training costs—keeping expenses down and reducing the total cost of ownership.

Grouping together one or more PS Series storage arrays enables you to design an intelligent storage area network (SAN) that provides highly-available and scalable storage and is inherently able to protect its own data using state-of-the-art snapshot and replication technology. In addition, multiple arrays in a SAN allow for storage tiering and RAID-level optimization of storage to deliver the best performance from the storage subsystem.

In addition, the Dell EqualLogic Host Integration Tools kit includes a multipath I/O Device Specific Module, MPIO DSM to increase performance and availability to PS Series SAN volumes. Also included with the Host Integration Tools kit is a VSS provider and Auto-Snapshot Manager for Windows which acts as a VSS requestor for VSS enabled applications. Auto-Snapshot Manager interacts with PS Series storage and Microsoft Windows Storage Server 2003 to dramatically improve backup operations by creating flexible, space-efficient point-in-time copies of data (snapshots), called Smart Copies or shadow copies.

FILE SERVING AND NETWORK ATTACHED STORAGE (NAS) OPTIONS

All file servers and NAS gateways solve a common need – centralized file level sharing and storage. Data is stored in a centralized location to take advantage of a greater level of fault tolerance, backup, sharing, and access controls. Files servers differ at a high level based on Operating System (OS) and file system protocol, and differ even further when one looks at usability, user interface, and client side usability.

Though there are many file system protocols, the two most prominent used today are CIFS and NFS.

- **Network File System (NFS)** – NFS is a network file system protocol originally developed by Sun Microsystems in 1984. NFS allows a user on a client computer to access files over a network as easily as if the network devices were attached to its local disks. NFS is specified in various RFCs and, although traditionally a UNIX based protocol is widely used on Windows systems as well as Mac OS, Novell Netware, and many Linux offerings.
- **Common Internet File System (CIFS)** – CIFS is a protocol used for file and device sharing across a network and is the default protocol used for sharing in a Windows environment. Although it was originally developed by many organizations under as the SMB protocol, Microsoft has brought the protocol to a new level and is commonly thought of as the Microsoft method of file sharing. CIFS can also be available by other third party implementations.
- **Others.** There are other, less commonly used, file system protocols as well. Some examples include Samba, FTP, Netware Core Protocol, and AFP (Apple Filing Protocol).

As there are many different Operating Systems, there are many methods of file serving. As technologies are maturing, many OS's are supporting a variety of file system protocols. Here are a few operating systems that support file serving:

- **Windows Server** – Windows Server is a suite of servers from Microsoft (including Windows Storage Server). The file serving features of Windows includes many features and functionality further described in this technical report.
- **UNIX** – UNIX file servers and NAS appliances typically use the NFS protocol although support other protocols as well such as CIFS and FTP.
- **Linux** – Linux comes in many different varieties, and when being used as a file server will commonly use NFS, although there are many third party CIFS implementations available for Linux.
- **Others** – There are many different OS's used for file serving from NetWare and Mac OS to a large list of proprietary systems.

It is the combination of the OS, and other software on the file server that provide the full functionality of file serving. For example, Windows Storage Server and FreeNAS support both CIFS and NFS. However, the additional software on Windows along with the strong client affinity with a Windows desktop creates an environment with many more advantages beyond simple file level access and sharing. CIFS on a Linux system can “look” very different from CIFS on the Windows system.

WINDOWS STORAGE SERVER 2003 – FILE SERVING

Windows Storage Server 2003 R2 is a dedicated file and print server based on Windows Server™ 2003 that is designed for dependability, seamless integration, and best value in networked storage. Windows Storage Server 2003 R2 integrates with existing infrastructures and supports heterogeneous file serving as well as backup and replication of stored data.

Windows Storage Server is an ideal solution for consolidating multiple file servers into a single solution that enables cost reduction and policy-based management of storage resources. Working in conjunction with PS Series SANs organizations achieve fully functional file services for users with the ease of use, scalability, and performance sought by IT managers.

Windows Storage Server 2003 R2 includes advanced features such as snapshots (past versions), VSS integration, Distributed File System (DFS), and incorporates well with additional software such as Data Protection Manager (DPM). Windows Storage Server 2003 R2, being optimized for file serving, also includes great usability features such as Single Instance Storage (SIS), File Server Resource Manager (FSRM), and works with many third party backup and antivirus software keeping consistency throughout your infrastructure. Many of these additional features bring greater end-user satisfaction due to the client/server affinity. Functionality such as offline file access and the ability to access past versions of files are available because the Windows clients are in-tune with Windows file serving.

Windows Storage Server 2003 R2 integrates with existing infrastructures – both physical and virtual. Organizations can use existing knowledge and skills making use of existing Windows environments and Active Directory® services.

Windows Server vs. Windows Storage Server

Although Windows Storage Server 2003 R2 is based on Windows Server™ 2003, there are distinguishing features that give advantages to a particular server based on needs of the organization. These solutions all have integrated storage features to aide in storage consolidation such as the Microsoft iSCSI initiator, Volume Shadow Copy Service (VSS) and the Virtual Disk Service (VDS), and could all be virtualized if necessary. They differ in terms of use optimization. For example, Windows Storage Server is optimized for file and print management and is estimated to perform 15% better for file serving. Features such as Single Instance Storage (SIS), and file and text indexing allow the server to utilize less storage space and enhances end user searching and usability. Windows Unified Data Storage Server has additional share management and wizard features enhancing the Storage Server's usability. Windows Server 2003 has many uses and supports other server applications such as Microsoft SQL Server, and Microsoft Exchange. The following chart provides a quick feature comparison.

Technology Description	Windows Server 2003 R2	Windows Storage Server 2003 R2	Windows Unified Data Storage Server (WUDSS)
Run Applications (e.g. Database, Business Applications)	X		
Multi-Purpose Server (E.g. File & E-mail Server)	X		
Commitment to DAS Architecture	X		
Team Collaboration (E.g. Windows Sharepoint Services)	X	X	X
Distributed File System Replication	X	X	X
File Server Resource Manager	X	X	X
Multi-Path IO	X	X	X
Remote Differential Compression	X	X	X
Storage Manager for SANs	X	X	X
Pre-configure File and Print Server		X	X
Dedicated file & Print server for datacenter		X	X
Branch Office file & Print Server		X	X
NAS Gateway for SAN		X	X
Single Instance Storage		X	X
Performance optimization for File serving		X	X
Full Text Search & Indexing		X	X
Out of box Experience for configuring storage Server role			X
Unified share and Storage Management Console			X
End-to-End Storage and share provisioning wizards			X
Remote administration from non-Microsoft clients thro' Java applet			X

Windows Storage Server File Serving Features

Windows Storage Server 2003 R2 offers many features to optimize the server for file and print sharing and administration. These features include:

- **Single Instance Storage (SIS)** – Single Instance Storage (SIS) recovers disk space by reducing the amount of redundant data stored on a volume by identifying identical files, storing only a single copy of the file in the SIS common store and replacing the files with pointers to the file in the SIS common store. Consider the following scenario:
 1. Two users receive the same e-mail with an attachment. They both save the attachment to their home folder. SIS runs in the background and detects the two identical files on the volume and moves one of the copies into the SIS common store and replaces both files with a pointer to the file in the SIS common store.
 2. One of the users makes a change to the file. SIS immediately detects that an update is pending for the file, removes the pointer in the user's home folder and replaces it with a copy of the file in the SIS common store. The updates are then applied to a fresh copy of the original file. This is completely transparent to the application.
 3. The other user's file remains in the SIS common store with a pointer in the user's home folder, even if there is only one pointer to the file. When the second user updates the file (assuming there are no other pointers) the pointer is deleted and replaced with a copy of the original file and the file in the SIS common store is deleted.

4. SIS works automatically without any end user involvement. The administrator can enable SIS on a per volume basis, and for best results the administrator should use a backup application that supports SIS.

- **Full Indexed Text Search** – Indexing extracts the information from a set of documents and organizes it in a way that makes it quick and easy to access that information through a Windows client's search function. This information can include text from within a document, or the document's name or properties.
- **Distributed File System (DFS)** – The DFS solution in Windows Storage Server 2003 R2 helps administrators make files available to users on many distributed servers. All this is done with a single namespace removing the complexity from the end user. A user only has to work with one server, not many. DFS namespaces and DFS replication, used together, provide simplified, fault-tolerant access to files, and load sharing.
- **Efficient Storage Management** – Windows Storage Server 2003 R2 includes new management tools providing a centralized view of storage to simplify provisioning, maintenance, and improve monitoring and reporting. Tools such as Storage Server Management Console include a quota manager, policy manager, and file server resource manager that enable administrators to more efficiently manage storage across IT resources.

File serving is more than computing hardware that supports CIFS and NFS. There are management features (described earlier) and HA features (described later in this document) that define the servers usability. The aspect that will have the greatest organization impact however is the client/server affinity. Although most CIFS clients can connect to most CIFS servers, usability features can greatly differ. In a Microsoft environment, a Windows client can take advantage of usability features supported by the Windows Storage Server. Some of these features include:

- **Shadow Copies** – Shadow Copies provide point-in-time copies of files that are located on the file server. With Shadow Copies, a user can view files and folders (stored on the server) as they existed at points of time in the past. This gives the client the ability to recover a file that has been deleted, corrupted, or the user simply needs to view a previous versions.
- **Offline File Access** – With Offline Files, a user can continue to work with a stored document when the network is not accessible. The user can select the folders where they may need offline access and still hold the same access permissions to those files and folders as you would have if you were connected to the network. When access is restored, any changes made while working offline are updated to the server through automatic synchronization.

BENEFITS OF DEPLOYING WINDOWS STORAGE SERVER WITH PS SERIES STORAGE

Traditionally, many servers use direct attached storage (DAS) that is difficult to provision and scale. As IT needs grow along with server proliferation, storage becomes increasingly difficult to manage. SAN configurations can improve storage flexibility by providing the ability to connect multiple server nodes to storage. However, typical Fibre Channel-based SAN configurations are complex, expensive to deploy and manage and require special switches, in addition to special controllers.

PS Series storage solutions rise above the limitations of DAS and traditional SANs by enabling you to set up and connect servers to an iSCSI SAN. Based on the iSCSI protocol, PS Series storage utilizes familiar SCSI and IP technologies to deliver an affordable and easy-to-manage consolidated storage solution.

The basis of a PS Series iSCSI SAN is the PS Series storage array, a fully redundant storage device. Combining reliability and scalability with an easy-to-use management interface, PS Series storage provides virtualization and high-end features in a single offering—there is no extra software needed and no hidden charges.

PS Series storage arrays are Microsoft Simple SAN for Windows Server certified, ensuring full compatibility with Windows Server platforms. Volume Shadow Copy Service (VSS), Virtual Disk Service (VDS), and Multi-Path Input/Output (MPIO) are fully supported in all PS Series SANs.

Some of the benefits of deploying Windows Server 2003 in a PS Series SAN are:

- **Rapid deployment and configuration of Windows Storage Server 2003 storage** – In very little time, a PS Series SAN can be operating and providing storage for Windows Storage Servers. A simple setup utility lets you quickly configure an array on the network and create a PS Series group. Automation of complex tasks like RAID configuration, disk sparing, data provisioning, and load balancing means that even the inexperienced can effectively manage the SAN.
- **Excellent Performance and Scalability** – Intelligent PS Series storage arrays are self-scaling, with I/O performance that increases as the number of arrays in the SAN increases. When a new array is added, its resources are integrated into the SAN and immediately available to the virtualized storage pool. In addition to its storage capacity, the new array's disk spindles, controller cache, and GB Ethernet ports provide enhanced performance.
- **Thin Provisioning** – Thin provisioning is a storage virtualization and provisioning feature that allows administrators to logically allocate large addressable storage space to a volume, yet not physically commit storage resources to this space until it is used by an application. For example, using thin provisioning you can create a volume that an application views as 3 TB, while only allocating 300 GB of physical storage to it. As the operating system writes to the volume, physical disk space is allocated to the volume by the storage array. This physical disk space is taken from the available free space in the pool automatically and transparently. As a result, less physical storage is needed over time, and the stranded storage problem is eliminated.
- **Redundant hardware and hot serviceable configuration** – PS Series storage arrays are fully redundant with dual controllers, power supplies, and fans—all of which can be serviced online, without disrupting applications. In addition, support for multipath I/O provides end-to-end redundancy for Windows storage, ensuring maximum reliability and availability.
- **Data protection.** All data is protected with RAID and spare disks. Complete hardware redundancy and hot-service capabilities assure uninterrupted operation.
- **Simple and immediate Windows Storage Server 2003 storage expansion** – With modular PS Series storage arrays, as the Windows file servers grow and need more capacity, you can increase SAN storage capacity and performance online, without server or application disruption.
- **SAN boot capability** – Using iSCSI host bus adapters (HBAs or supported NICs) and PXE (Preboot eXecution Environment) boot technology provide the ability to install and boot the Windows operating system from a PS Series SAN volume, increasing disaster tolerance. When server hardware fails, the unit can be quickly removed and replaced with a similarly-configured spare hardware platform. This new platform can be directed to the SAN boot volume and, in minutes, resume providing application services. Other benefits of SAN boot include centralized storage management and reliable and highly available storage resources that eliminate the need for mirrored boot volumes.
- **Network path protection and load balancing** – Using multiple NICs or iSCSI HBAs with the Microsoft iSCSI Software Initiator Version 2.0 (or greater), you can configure multipath I/O and increase the reliability and performance of Windows Server 2003. Also known as MPIO, multipath I/O enables the dynamic load balancing of iSCSI SAN traffic across redundant paths between the Windows Server 2003 and the PS Series SAN.
- **Advanced management features.** PS Series storage comes standard with a comprehensive set of features including:
 - Automatic load balancing

- Virtual volume management
 - Space-efficient snapshots for instant backup and restore
 - Volume cloning for rapid server provisioning
 - Multipath I/O (MPIO) support
 - Cluster support
 - Auto-replication for a comprehensive disaster recovery solution.
 - Storage pools creating a “SAN within a SAN”
 - Member-by-member RAID level control
- **VSS-based backups** – The Dell EqualLogic Host Integration Tools kit includes a VSS provider, called Auto-Snapshot Manager for Windows, that interacts with the PS Series storage, the Windows Server 2003 VSS writer, and a VSS requestor backup application to dramatically improve backup operations by creating flexible, space-efficient, point-in-time-copies of data called snapshots or shadow copies.
 - **Remote site volume replication** – With the PS Series auto-replication capability, Windows Server 2003 data can be automatically transferred to remote data centers, protecting the data from serious failures ranging from the destruction of the volume to a complete site disaster—with no impact on data availability or performance.

PLANNING AND DESIGN CONSIDERATIONS

This section covers issues that you need to consider when planning to deploy Windows Storage Server 2003 as a NAS gateway with a PS Series SAN. With these considerations, the PS Series SAN maintains very high levels of availability and fault tolerance achieving data integrity, while Windows Storage Server manages file level access and control.

High-Level Considerations

When designing a Windows Server 2003 environment, you should understand these general challenges:

- Reliability, Availability, and Serviceability
- Performance
- Scalability
- Management and Disaster Recoverability
- Usability

It is critical to focus on these challenges *before* you begin the initial installation. The following sections describe planning factors for a Windows Storage Server 2003 environment using PS Series storage to overcome many of the challenges facing IT managers.

Reliability, Availability, and Serviceability

The environment must be robust, resilient, and easily repaired by hot swapping components while the system remains available. In a SAN configuration, the server, network, and storage arrays should all have a robust level of fault tolerance to avoid costly downtime and allow scheduled maintenance to take place without service disruption.

You can easily build fault tolerance into your file server environment by using PS Series storage arrays, which provide high availability and scalability, in addition to hot-swappable hardware and MPIO support. Not only does PS Series storage have a low initial cost, the benefits increase as your environment grows.

Performance

The environment must optimize application performance and response time. Data access is a large and important part of day-to-day operations for most companies, and under-performing servers can have a devastating effect on overall productivity. In addition, network issues and switch configuration can affect performance.

You can easily distribute data in a way that takes optimum advantage of PS Series storage capabilities to maximize application performance.

Scalability

As your workload grows and storage capacity needs increase, the environment must accommodate changes without affecting users. Storage used in a Windows Server 2003 environment must be highly scalable to accommodate changes in the workload, including additional users, increased capacity needs, and an overall increase in SAN activity.

Modular PS Series storage arrays provide easy, online scalability.

Management and Disaster Recoverability

It must be possible to recover from situations that can cause data loss, ranging in scale from a corrupted or infected file to the loss of an entire data center due to hostile action or act of nature.

PS Series storage arrays deliver snapshots and auto-replication technology as standard features, enabling automatic backup and disaster recovery capabilities for your critical data.

Setup and configuration, backup and recovery, and day-to-day administration should be handled easily and have minimal impact on operations and users. PS Series storage automates complex tasks like RAID configuration and load balancing, and provides both graphical and command line user interfaces for easy and intuitive storage management.

Usability

It is important for IT administrators to contemplate storage management tasks from installation and configuration to day to day tasks. The PS Series Group Manager takes the complexity out of SAN management. All functions are intuitive and easy to use. Advanced features are always available without the need to pay for costly host licenses or software keys.

Disk Storage Considerations

There are a variety of storage considerations when deploying Windows Server 2003. Key disk storage considerations include:

- Using highly-available disk storage
- Ensuring data reliability and performance with RAID technology
- Choosing the optimal RAID level for each member
- Optimally distributing I/O across disk devices
- Providing scalability
- Consider storage tiering for applications

Using Highly Available Disk Storage

For fault tolerance and redundancy, the primary focal point is the disk subsystem where the file server's data is located. Storing data in a PS Series group (SAN)—one or more PS Series storage arrays connected to a standard IP network—ensures both reliability and availability.

Each PS Series storage array is hot serviceable and fully redundant, with dual power supplies, fans, and control modules, in addition to multiple Gigabit (Gb) Ethernet interfaces. Automatic RAID protection and disk sparing protects data from disk failures.

With no-single-point-of-failure PS Series storage arrays, you can set up a SAN that can survive hardware failures and be serviced online, thus avoiding unplanned downtime and service “brown-outs.”

Ensure Data Reliability and Performance with RAID Technology

RAID (redundant array of independent disks) is a technology that protects data from disk failures. The PS Series storage arrays in a SAN can be configured with RAID 5, RAID 10, or RAID 50. Based on the RAID policy you select, each array automatically configures its own RAID subsystem, eliminating the need for complex and error-prone manual procedures. In addition, each array automatically configures spare disks and uses them in the event of a disk failure.

Choose the Optimal RAID Level

Before creating a PS Series group, you should determine which RAID level to configure on each of the group members (storage arrays). The ability to set the RAID level for each member of each pool gives you great flexibility in designing this aspect of your Windows Server 2003 installation.

For more information on RAID levels in a PS Series group, see the *Choosing a Member RAID Policy* Technical Report on the Dell EqualLogic Customer Support website (<https://www.equallogic.com/support/>).

Optimally Distribute I/O across Disk Devices

Where data is written and the storage subsystem configuration can have a huge impact on performance. Manual provisioning can be a time-consuming, complex, and error-prone task. In contrast, PS Series storage automates storage provisioning and RAID configuration, providing optimal performance without user interaction.

Note: When the SAN contains multiple storage pools, each pool acts independently within the SAN, with performance optimization occurring within each pool.

For the best performance, I/O should be distributed across multiple disk drives (spindles) and multiple drive controllers to balance read and write requests. In most DAS and SAN configurations (other than PS Series), the IT administrator is responsible for the specific data layout on storage-related hardware, including disks, controllers, and network links. The administrator must understand effective capacity utilization, as well as performance balancing across controllers, spindles, and controller ports.

When using PS Series storage, there is no need to manually provision data, because each pool in the group automatically distributes I/O across all its constituent storage arrays—with no interruption in data availability. This process includes data distribution not only across spindles, but also across controllers and network ports. In addition, volumes can be expanded on demand. There is no manual tuning or management and no downtime for storage reconfiguration.

To facilitate these automatic processes, PS Series best practices call for the creation of a small number of volumes (when practical) to contain application data. In the Exchange example above, you might create one volume to hold the logs, and another to hold the message database.

Scalability

You may need to expand the storage supporting your Windows Server 2003 environment if:

- New servers require new volumes.
- Existing server volumes grow beyond the space available within their pools.
- Performance and response time needs improvement.

When using DAS, adding usable storage to an existing configuration usually requires a full backup, the installation of a new and bigger storage subsystem, and then a full restore—resulting in long downtime and many hours of work.

In contrast, by simply adding arrays to the affected pools (and creating additional volumes when needed), you can seamlessly increase the capacity of a PS Series SAN—on demand and without affecting availability. Expanding the SAN also can improve fault tolerance and increase performance. As network interfaces, controllers, and arrays are added, performance scales linearly, and the load balancing of data and network I/O occurs automatically.

Consider Tiering

Unless all the applications stored on the SAN have the same performance and availability requirements, along with the same service level agreements, consider implementing tiered storage architecture. Dividing applications into tiers and adjusting the characteristics of the storage assigned to each tier optimizes both performance and capacity.

When using a SAN built from PS Series storage arrays, storage pools provide a method for implementing tiers. Within each pool, individual PS Series arrays can be configured to best support the needs of each tier, thereby optimizing storage performance for the tier.

See the *Deploying Tiered Storage in a PS Series SAN* Technical Report on the Dell EqualLogic Customer Support website (<https://www.equallogic.com/support/>) for more information on application tiering and pools.

Network Considerations

The key network issues to consider when deploying Windows Server 2003 are described below. These are:

- Setting up redundant network paths
- Optimally configuring the network and switches
- Optimizing server iSCSI connectivity

Set Up Redundant Network Paths and MPIO

As a best practice for availability and performance, you should provide at least two paths for each type of network traffic. For example, you should configure separate server interfaces to provide multiple paths for the following:

- LAN traffic between the users and the Windows server.
- SAN traffic between the Windows server and the PS Series storage arrays.

The server network interfaces that are connected to the user network (LAN) should consist of two or more network interface cards (NICs). Optimally, you should use dedicated switch hardware to isolate the SAN traffic from the LAN traffic. Otherwise, it is recommended that you configure VLANs on the switches and place the LAN and SAN on separate subnets.

For the LAN traffic, NIC teaming (bonding) can be used on the servers, depending on the network topology employed.

To handle SAN traffic, each PS Series storage array has three pairs of 1 Gb Ethernet interfaces, providing up to six high-performance network connections. We recommend that you configure at least two network interfaces on each array and connect the interfaces to separate Gb Ethernet switches to improve traffic distribution and increase redundancy.

To ensure that there is an available path between each Windows server and the PS Series group, we recommend that you configure multiple interfaces on the server for SAN traffic (either Gb Ethernet interfaces or iSCSI HBAs) and then configure multipath I/O (MPIO) on the interfaces.

For more information on implementing multipath I/O, see the *Deploying Microsoft Windows Server 2003 MPIO® in an iSCSI SAN* Technical Report located on the Customer Support website at: <https://www.equallogic.com/support/>

Optimally Configure the Network and Switches

Implementing the correct networking infrastructure is crucial to trouble-free server operation. We recommend that the SAN is configured in a redundant fashion. The benefit of this configuration is that no single point of failure exists. This configuration would include multiple network switches configured such that each network can operate (and fail) independently.

For more information on configuring the network and switches, consult the *Storage Array Network Performance Guidelines* Technical Report on the Customer Support website (<https://www.equallogic.com/support/>).

Optimize Server iSCSI Connectivity

PS Series volumes appear on the network as iSCSI targets. To connect a Windows Storage Server 2003 to a PS Series volume, you can use Microsoft's iSCSI initiator. You can use an iSCSI software initiator and NIC combination for the server's I/O configuration, or you can use iSCSI HBAs.

Using a NIC with an iSCSI software initiator will provide good performance in most installations. However, an iSCSI HBA may improve performance by offloading CPU processing.

Another factor to consider is the placement of these devices on the server I/O buses. It can be helpful to install your interface in a PCI-X slot to benefit from the higher clock speed (133 MHz). Some servers have multiple PCI-X buses, and in cases where there are two or more HBAs or NICs configured for MPIO, it can be beneficial to install these PCI-X devices on separate PCI-X buses.

Server Considerations

Important server-side deployment considerations include:

- Using multipath I/O (MPIO)
- Using clustering services and DFS
- Aligning disk sectors
- Formatting volumes as basic disks

Use Multipath I/O

Multipath I/O (or MPIO) is the ability to use more than one physical path to a storage device, improving server reliability and availability through path redundancy and I/O traffic load balancing. MPIO can be implemented using standard network interfaces with the Microsoft iSCSI Software Initiator or third-party HBAs combined with the Microsoft iSCSI Software Initiator.

For more information, see the *Deploying Microsoft Windows Server 2003 MPIO® in an iSCSI SAN* Technical Report located on the Customer Support website (<https://www.equallogic.com/support/>).

Figure 1 shows a typical recommended network path topology for a Windows Storage Server installation.

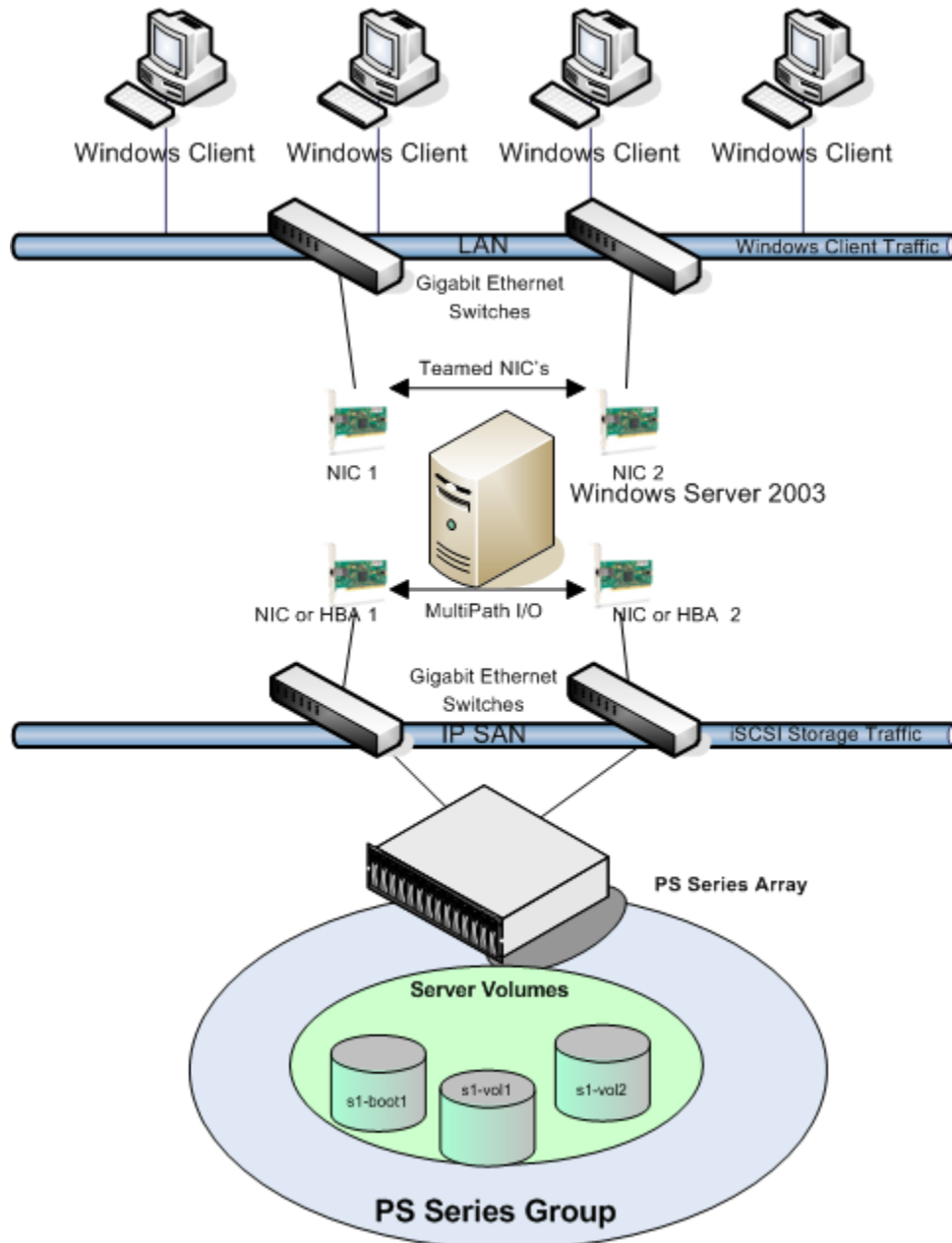


Figure 1: Windows Server 2003 Network Redundancy

Use Clustering Services and DFS

Windows Storage Server clusters are based on Microsoft Cluster Service (MSCS) and provide high availability through failover. In a server cluster configuration, if the hardware or software fails and causes a service failure, the cluster will automatically restart the failed service on a functional cluster node. This service failover capability ensures that no data is lost, and there is little disruption to users. When the problem is corrected, the cluster can re-balance the services across all functional nodes.

For more information on clustering, consult the *Deploying Microsoft Windows Clustering in an iSCSI SAN* Technical Report on the Customer Support website (<https://www.equallogic.com/support/>).

The DFS solution in Windows Storage Server 2003 R2 helps administrators make files available to users on more than one distributed servers. All this is done with a single namespace removing the complexity from the end user. A user only has to work with one server, not many. DFS namespaces and DFS replication, used together, provide simplified, fault-tolerant access to files, and load sharing.

Align Disk Sectors

For optimal performance, PS Series best practice calls for aligning the disk sectors so that they match the PS Series storage array RAID stripe segment size, thereby improving I/O performance, especially with applications that have random I/O workloads, such as Microsoft Exchange and SQL Server.

For more information, see the *Aligning Disk Sectors for Optimal Performance* Technical Report on the Customer Support website (<https://www.equallogic.com/support/>).

Format Volumes as Basic Disks

After a file server connects to a PS Series volume, it appears as a local disk. By default, the disk will be formatted as a basic disk. Do *not* convert the disk to a dynamic disk.

There are several reasons why you must use basic disks:

- The utilities used to align disk sectors, can only be used with basic disks.
- The Microsoft iSCSI Software Initiator currently does not support dynamic disks. It has been observed that there are timing issues that may prevent a dynamic disk volume on an iSCSI disk from being reactivated at system startup.
- Microsoft Windows clustering currently does not support dynamic disks.

Management and Disaster Recovery Considerations

Volume storage used in a Windows Storage Server environment must be easy to manage, while the data must be protected and quickly recoverable when needed. Disasters can be everything from a lost or corrupt file to an inaccessible datacenter. The following sections describe various ways to improve administration for backup and restore operations, including:

- Using snapshots and VSS shadow copies
- Backing up data to disk media
- Using near-continuous backup and archiving
- Using PS Series auto-replication technology

Using Snapshots and VSS Shadow Copies

A PS Series SAN provides the ability to create snapshots which are point-in-time copies of data. Snapshots enable you to quickly copy data at the disk (PS Series volume) level without disrupting access to the volume. This stable copy of the data can then be used as the source for backup and disaster recovery operations.

For example, creating a snapshot prior to installing a patch or performing an upgrade makes it possible to quickly recover if that change fails for some reason.

A snapshot is created nearly instantaneously (usually within a few seconds) and stored in the same group as the original volume, providing both high performance and low disk space utilization. By recording only the changes that have occurred since its creation, the snapshot occupies only a fraction of the space that a full backup requires.

Microsoft created a technology in Windows Server 2003 family called Volume Shadow Copy Services (VSS). VSS provides a framework that integrates VSS-aware storage hardware and applications with operating system drivers to create coordinated point-in-time copies of data (also called *shadow copies*), —delivering a turn-key backup solution to IT departments without the need for scripting.

Like a snapshot, a VSS shadow copy enables you to quickly copy data at the volume level. The volume copy can then be used as the source for backup operations. Shadow copy creation does not disrupt access to the volume.

When used with the Dell EqualLogic Host Integration Tools Kit, PS Series arrays can serve as the storage hardware in a VSS-aware backup solution.

For more information, see the *Host Integration Tools for Microsoft Windows* documentation. You should also consult the documentation that came with your backup application.

Backing Up Data to Disk Media

When using SAN storage, you can utilize disk as backup media (for example, in a disk-to-disk-to-tape (D2D2T) backup procedure). This common hybrid solution leverages the strengths of both disk and tape media to improve backup efficiency. Usually, disk media is used as a staging area to store data for short time periods (for example, a week to a month), while tape is used for long-term data retention. This results in a solution that performs well and is cost effective over time.

PS Series storage can be used with many backup applications, including VSS requestors, as disk backup media.

Using Near-Continuous Backup and Archiving

Another method of protecting Windows Storage Server 2003 files is by using a near-continuous backup and archiving solution that unifies data protection, disaster recovery, and archiving. This type of solution provides immediate data recovery, instant user access, and regulatory compliance. You can maintain copies of data on a separate server and continuously update these copies as the data changes. If a catastrophic failure occurs, the data loss is zero or at most a few minutes.

Backup applications that support near continuous backup and archiving fall under different categories and include the following:

- **Microsoft Data Protection Manager (DPM)** – DPM optimizes disk-based backup and recovery. It provides continuous data protection for file servers. See the following for more information:

<http://www.microsoft.com/windowsserversystem/dpm/default.aspx>

Also, see the *Deploying Microsoft System Center DPM 2006 in an iSCSI SAN* Technical Report on the Customer Support website (<https://www.equallogic.com/support/>).

- **Veritas® (Symantec®) Backup Exec**– Provides continuous data protection and web-based, end-user file recovery functionality. See the following for more information:

<http://www.veritas.com/Products/www?c=product&refId=449>

Also, see the *Deploying Symantec Backup Exec 10d for Windows Servers with PS Series Arrays* Technical Report on the Customer Support website (<https://www.equallogic.com/support/>).

- **LiveVault®** – Provides disk-based, online backup and recovery solutions. InSync and InControl are disk-to-disk solutions for businesses with remote offices. See the following for more information:

http://www.livevault.com/solutions/solutions_overview.aspx

Using PS Series Replication Technology

PS Series SANs include replication technology that enables you to easily copy volume data from one PS Series group to another—with no distance limitations—for a robust disaster recovery configuration. If the primary group is destroyed, you can recover volume data from the recovery group and configure servers to access the data from the new location.

Similar to a snapshot, a replica represents the contents of a volume at a specific point in time. However, unlike a snapshot, a replica is located in a group separate from the group where the original volume resides. Because the volume and the replicas are physically separated, a complete disaster at one site does not destroy the data at the other site.

For more information on auto-replication, see the *Sizing Replication Space* Technical Report on the Customer Support website (<https://www.equallogic.com/support/>), as well as Chapter 7 of the *PS Series Storage Arrays Group Administration* guide.

PREPARING FOR DEPLOYMENT

This Technical Report provides information about deploying a Windows Storage Server 2003 with a PS Series SAN. In addition, information about configuring the server for multipath I/O, using Challenge Handshake Authentication Protocol (CHAP) to restrict volume access, and booting from the SAN is included, although these tasks are optional.

Detailed information about setting up and managing a PS Series group and using Auto-Snapshot Manager can be found in the documentation described in *Dell EqualLogic Documentation and Customer Support*.

Technical Reports, located on the Customer Support website (<https://www.equallogic.com/support/>), provide detailed information about deploying various applications and configurations with PS Series storage.

In addition, the following can be useful:

- Microsoft iSCSI Software Initiator Version 2.03 description:
<http://www.microsoft.com/downloads/details.aspx?familyid=12CB3C1A-15D6-4585-B385-BEFD1319F825&displaylang=en>
- Microsoft MPIO description:
<http://download.microsoft.com/download/3/0/4/304083f1-11e7-44d9-92b9-2f3cdbf01048/mpio.doc>
- Microsoft Support FAQ *Setting up iSCSI Multi-Path I/O (MPIO) on Windows 2003 with QLA40xx HBAs*:
http://kb.qlogic.com:8080/KanisaPlatform/Publishing/272/14322_f.html

Basic Steps for Deploying Windows with a PS Series SAN

There are 9 basic operations for configuring Windows Storage Server 2003 to work with a PS Series SAN. The bulk of the second half of this technical report describes those operations, which are:

1. Set up the PS Series group
2. Create volumes
3. Set up the Windows Storage Server
4. Connect to PS Series volumes
5. Align the disk partitions
6. Configure basic disks
7. Assign drive letters and format partitions

Repeat steps 6 through 9 as necessary to prepare each volume.

DEPLOYING

The following sections provide basic information for deploying any Windows server with a PS Series SAN. This information includes how to set up and access the group, set up pools, volumes, and access controls, and configure CHAP for host authentication.

In addition:

- The PS Series *QuickStart* contains detailed PS Series storage array installation and group setup information.
- The *Group Administration* manual contains comprehensive information about group administration and advanced features like snapshots and replication and focuses on how to use the Group Manager graphical user interface (GUI) to perform the tasks.
- The *CLI Reference* manual describes how to use the command line interface (CLI) to manage the group and individual arrays (only for maintenance purposes).
- The *Network Connection and Performance Guidelines* technical report aides in setting up the network connections for optimum performance.

Always read the PS Series *Release Notes* for the latest product information, information about firmware updates, and browser requirements for accessing the GUI.

1. Set up the PS Series Group

You must install the hardware and connect the network cables on the array that will be the first group member. Use the PS Series Remote Setup Wizard to configure the array and create a group. See the Host Integration Tools for Microsoft Windows *User Guide and Release Notes* for detailed installation and setup information.

See *Choose the Optimal RAID Level* for information about choosing the member RAID level that will give you the best performance under all conditions for you particular environment.

To achieve optimal throughput between servers and the group, it is recommended to connect and configure multiple network interfaces on each array in the group. See the Technical Report *Storage Array Network Performance Guidelines* on the Customer Support website (<https://www.equallogic.com/support/>) for more information.

Using the PS Series Group Manager

To access the Group Manager GUI, connect to the group IP address from a web browser. Once you connect to the group IP address, log in to a group administration account, such as the default `grpadmin` account.

The Group Summary window appears as shown Figure 2. Click and expand items in the far left panel of the GUI for detailed information about group components.

To access the CLI, you can connect to the group IP address using telnet or SSH. If you do not have a network connection, use the serial cable that shipped with an array and create a serial connection between that array and a console terminal or a computer running a terminal emulator. Once you connect to the group IP address, log in to a group administration account, such as the `grpadmin` account. For more information, see the *CLI Reference*.

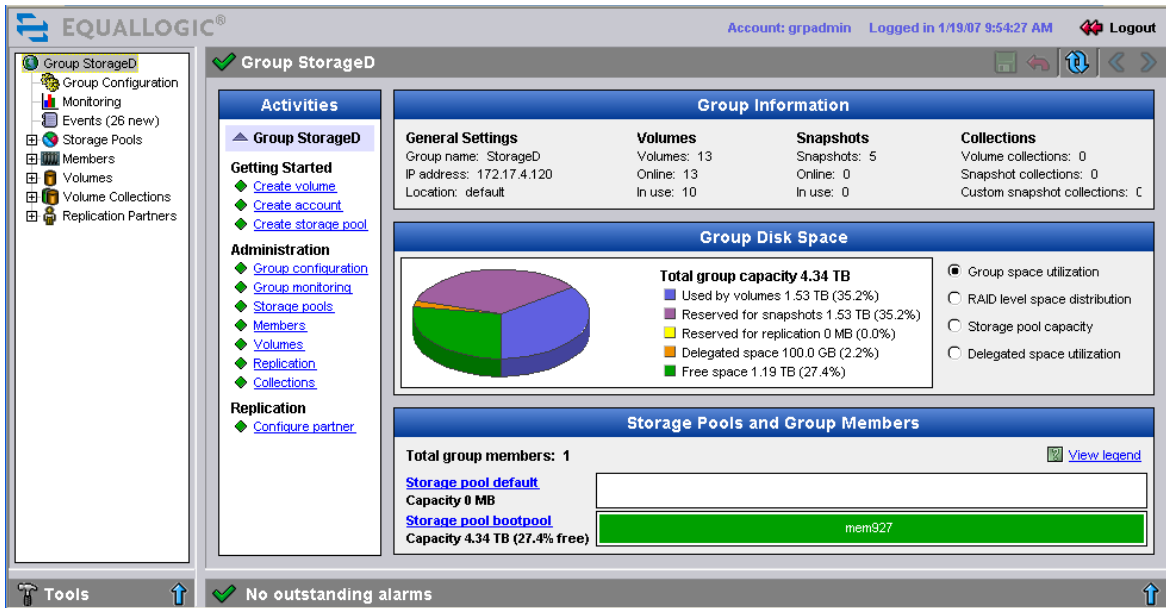


Figure 2: PS Series Group Summary

2. Create Volumes

Use the Group Manager GUI or CLI to create the volumes you need for your file server. Many volumes can be created depending on your other applications and configuration needs and include:

- Data volumes. These volumes will hold the server file system data or application data, as needed. Before creating volumes, be sure to fully understand the disk space needs of the users and applications. Note that you can easily expand volumes on line at any time.

If you want to create snapshots of the volume or use VSS to backup a volume, be sure to reserve snapshot space. For each volume, be sure to create one or more access control records that will permit access to authorized hosts, while denying access to other hosts.

- Volumes for disk backup media. Required only if you want to backup data to a volume. The volume size depends on the backup space needs.
- Volumes for SAN boot. Required only if you are booting servers directly from the SAN.
- Volume for a quorum resource. Required only if you are using Microsoft clustering. See the cluster documentation for sizing guidelines.

To use the GUI to create a volume, click `Create Volume` in the Group Summary window. The Create Volume dialog box appears, as shown in Figure 3. Enter a unique volume name and the volume size. Optionally, reserve snapshot space for the volume, or thin provision the volume. If applicable, assign the volume to the appropriate storage pool. The table at the bottom of the dialog box shows the current group capacity and the capacity with the new volume.

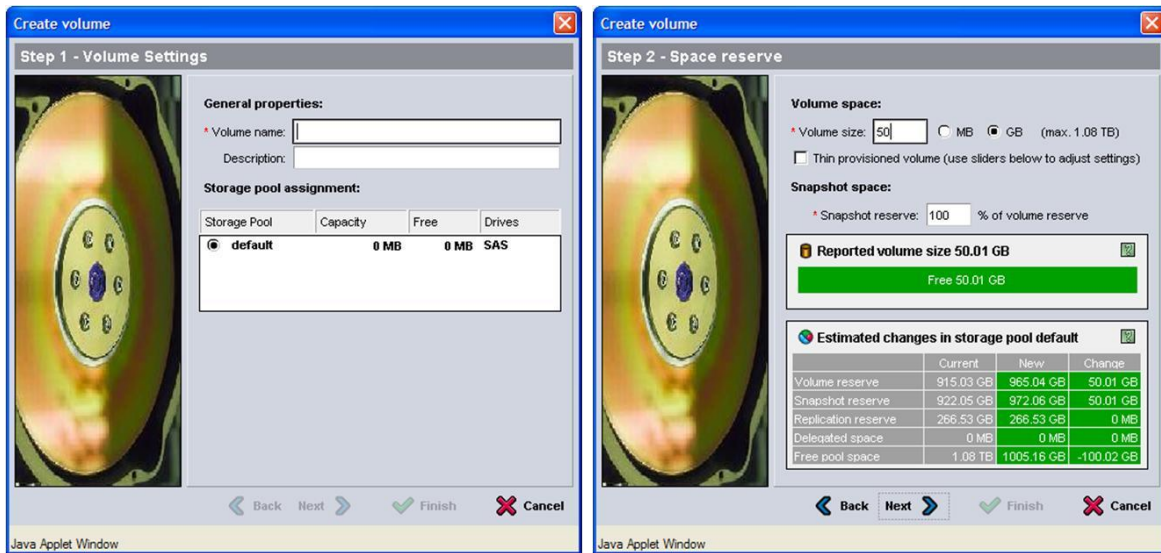


Figure 3: PS Series Group Manager – Create Volume

Click **Next** to display the dialog box that enables you to set up an access control record for the volume. Note that you can create and modify access control records for a volume at any time.

After you specify the access control information, click **Next**, confirm the volume configuration, and then click **Finish** to create the volume. The volume should appear when you expand **Volumes** in the far left panel of the GUI. Select the volume name to display volume details.

Control Host Access to Volumes

Access control records are used to restrict host access to volume data in a PS Series group. A group volume and its snapshots share a list of access control records (sometimes called the access control list, or ACL). You can configure a record to apply to the volume, its snapshots, or both, as needed.

When you create a volume with the GUI or CLI, you can create an access control record at that time. You can also create and modify access control records at any time.

For example, in the GUI, select the volume name in the far left panel, click the **Access** tab in the window that appears, and then either click **Add** or select an existing record and click **Modify**. If you click **Modify**, the Modify Access Control Record dialog box (Figure 4) appears.

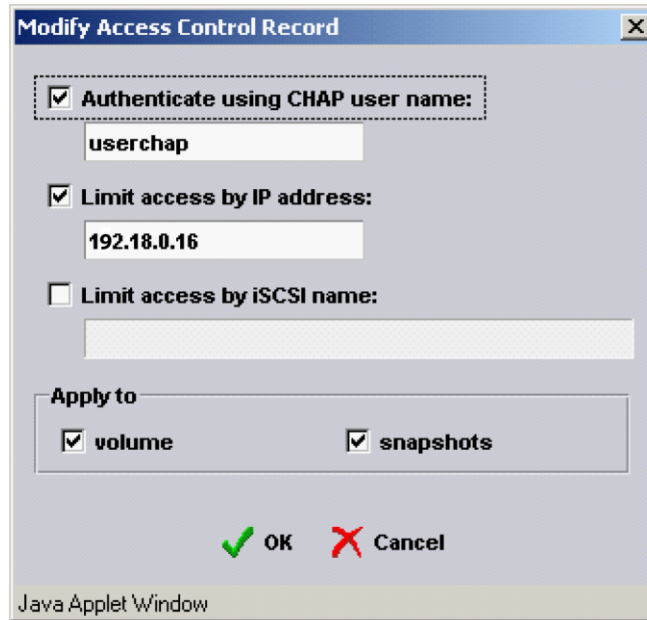


Figure 4: Group Manager – Modify Access Control Record

In each access control record, you can specify an IP address, iSCSI initiator name, or CHAP user name (or any combination). A server must match *all* the requirements in *one* record in order to access the volume or snapshot.

The most secure way to control access to your volumes is to use a combination of IP address and CHAP. For example, if a record includes both an IP address and a CHAP user name, a server must present the IP address *and* supply the CHAP user name and its associated password (using the iSCSI initiator) in order to match the record.

You can also specify whether the record applies to the volume, the volume snapshots, or both.

Notes: If you use IP addresses or iSCSI initiator names to restrict access, create an access control record for each IP address or initiator name presented by the server. For example, if a server has two NICs that are handling iSCSI traffic, create two records, one with the IP address assigned to one NIC and the other with the IP address assigned to the other NIC. This ensures that the server can access the volume (or snapshot), regardless of which NIC is used for the connection.

To use CHAP to restrict host access to volumes, you must configure CHAP in the group, as described in the *Group Administration* guide.

When using CHAP to restrict host access, it is recommended that you also specify an IP address in an access control record. If only a CHAP user name is specified in a record, initiators that support discovery will unsuccessfully try to connect to the volume, increasing event log activity.

Once you specify the access control information, click OK to create the record. The record should appear in the Volume Access window (Figure 5).

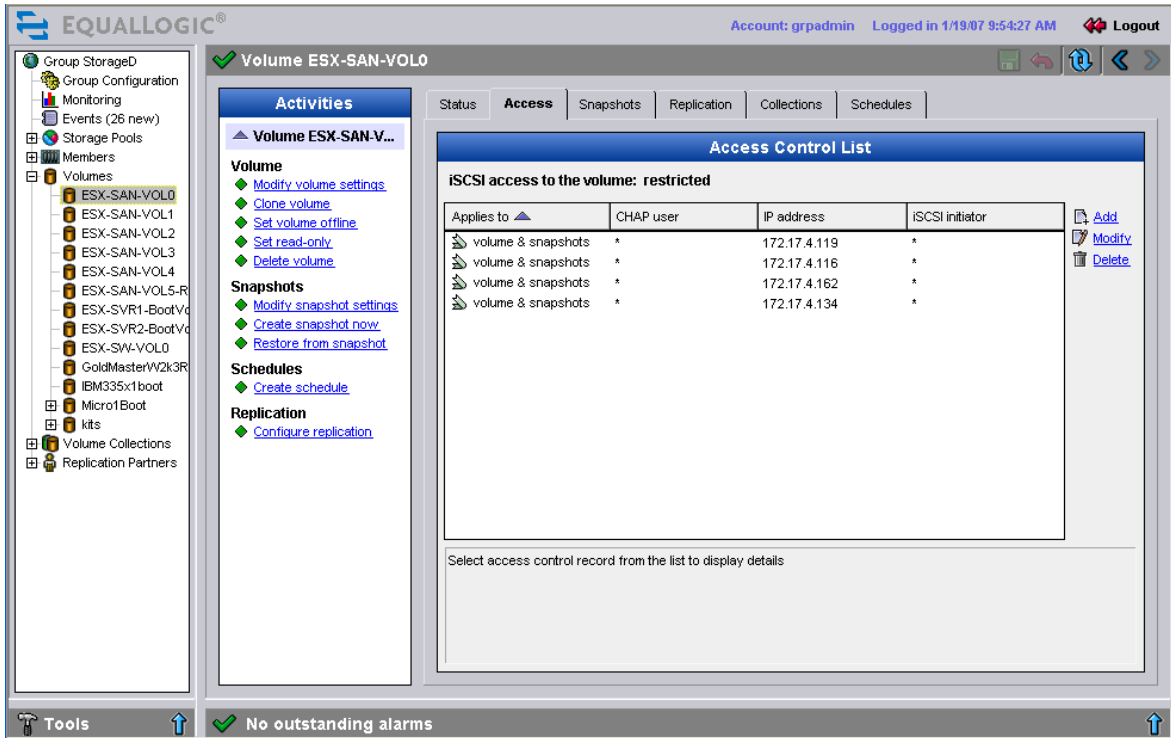


Figure 5: Volume Access

Configure CHAP

If you want to use Challenge Handshake Authentication Protocol (CHAP) to restrict host access PS Series volumes, you must configure CHAP in the group.

CHAP is a network login protocol that uses a challenge-response mechanism. With CHAP authentication, volume or snapshot access can be restricted to hosts that supply the iSCSI initiator with the correct user name and password (or “secret”) combination. This information must match an access control record for the volume, in addition to an entry in a CHAP database, in order to gain access to the volume.

You can implement a CHAP database in a group in the following ways:

- **Local CHAP accounts configured in the group.** Local CHAP is not dependent on any external system and is easy to deploy if you have few accounts to maintain.
- **External RADIUS server whose IP address is configured in the group.** An external RADIUS server is beneficial if you have a large number of CHAP user names and passwords. However, the availability of the server will affect host access. See the Solutions section of the Customer Service website for information about setting up RADIUS servers.

To use the GUI to configure CHAP in a group, click *Group Configuration* in the far left panel and then click the *iSCSI* tab. See the *Group Administration* manual for more information.

3. Set up the Windows Storage Server

When Windows Server is used for file serving, best practices dictate the modification of certain parameters to optimize the server for file serving. Windows Storage Server 2003 is an OEM only product in which the physical server is delivered with the Operating System installed and optimized for file serving.

To manage the physical server, you can connect to the Windows Storage Server via the local console (monitor, mouse, and keyboard), Remote Desktop (RDP), or a Remote RDP Client ActiveX control. For the

initial setup, you will have to connect via a local console (at minimum) to configure the server's network addressing.

Once the server has been installed, be sure to complete the following tasks. For more information regarding the steps to take, please refer to the Windows Storage Server Users Guide that shipped with your particular OEM server.

1. Configure TCP/IP for static or dynamic addresses on each Ethernet interface
2. Change the computer name if desired
3. If a domain is available, join the domain. This will also allow you to take advantage of an available Active Directory Server.

Please refer to the User's Guide shipped with your Windows Storage Server for more detail regarding your server.

4. Connect to PS Series Volumes

Using the iSCSI initiator configuration utility on the server, connect to the volume or volumes created for the file server. You will need to specify the group IP address as the target portal or discovery address. Once connected, a volume appears as a disk (sometimes called an iSCSI disk) in the Disk Management utility.

Notes:

- Be sure to establish a persistent connection to the volume, so the connection is established each time the server boots.
- Be sure to bind the volume to ensure that the volume is available when Windows starts the iSCSI service. Be sure to perform the bind after assigning a drive letter.
- If CHAP is used for volume authentication, you can enter the CHAP credentials at login time.
- If you want multipath access to the volumes, the server must have at least two network connections to each volume.

The following steps describe how to connect the server to a PS Series volume. A volume is seen on the network as an iSCSI target. When you create a volume, the group automatically generates the iSCSI target name. The volume name is appended to the end of the target name.

Once connected, the volume appears as a locally-attached disk (sometimes called an iSCSI disk).

The section focuses on using the Microsoft iSCSI Software Initiator to connect to a volume.

1. Launch the Microsoft iSCSI initiator. Click **Start > Programs > Microsoft iSCSI Initiator > Microsoft iSCSI Initiator**. The iSCSI initiator Properties dialog box (Figure 6) appears.

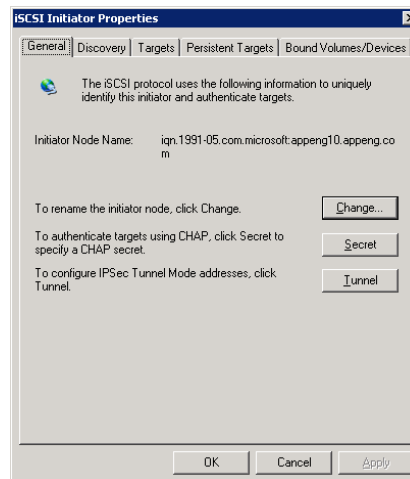


Figure 6: Microsoft iSCSI Initiator Properties – General Tab

2. Click the **Discovery** tab, then click **Add**. The Add Target Portal dialog box in Figure 7 appears. Specify the PS Series group IP address, and then click **OK**. This will enable the initiator to “discover” the iSCSI targets associated with the group volumes.

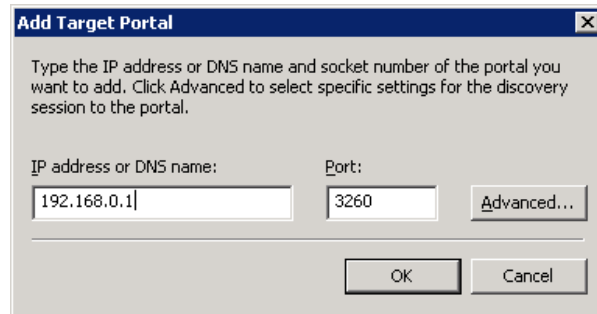


Figure 7: Microsoft iSCSI Initiator Properties – Add Target Portal

3. In the Microsoft iSCSI Initiator Properties dialog box, select the **Targets** tab, and click the **Refresh** button (Figure 8).

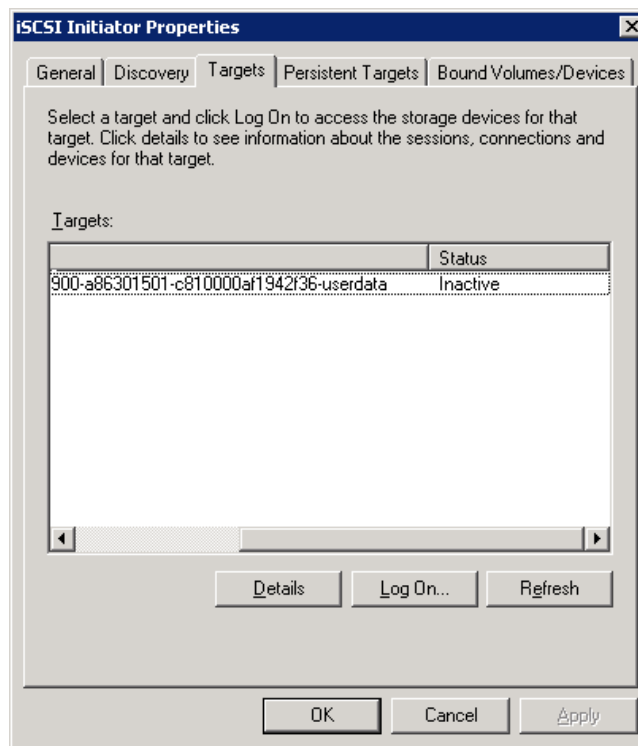


Figure 8: Microsoft iSCSI Initiator Properties – Targets Tab

4. Select the desired iSCSI target and click **Log On**. In the Log On to Target dialog box (Figure 9), check the box next to **Automatically restore this connection when the system reboots**.

Single Interface Log On

MPIO Log On

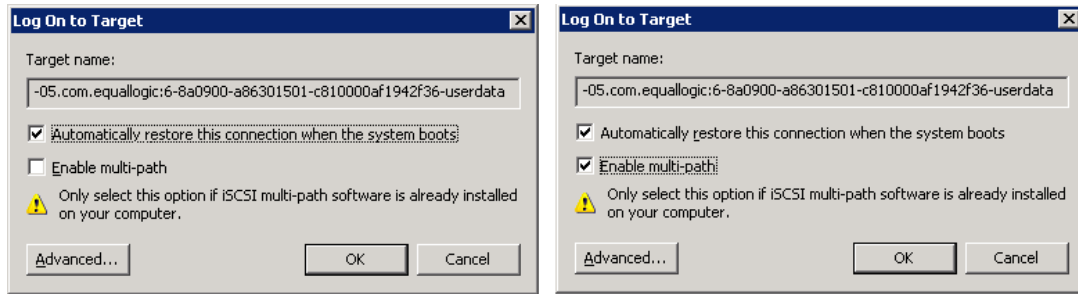


Figure 9: Microsoft iSCSI Initiator Properties – Log On to Target

5. If you are using multipath I/O, in the Log On to Target dialog box, check the box **Enable multi-path**. Next, click **Advanced**. This enables you to specify multiple physical paths to the same target. See the Technical Report *Deploying Microsoft Windows Server 2003 MPIO® in an iSCSI SAN* for more information about configuring multipath I/O.

If you have enabled Dell EqualLogic’s enhanced MPIO utility for Microsoft MPIO then you will only need to check the box for **Enable multi-path**. The remaining configuration will be accomplished automatically.

6. If the volume requires CHAP credentials, click **Advanced** in the Log On to Target dialog box. The Microsoft iSCSI Initiator Properties – Advanced Settings dialog box (Figure 10) appears. Set the **CHAP logon information** check box and specify the CHAP user name and secret. The user name must match an access control record for the volume. In addition, the user name and password must match a record in a CHAP database set up locally in the group or on an external RADIUS server. Click **OK** when done.

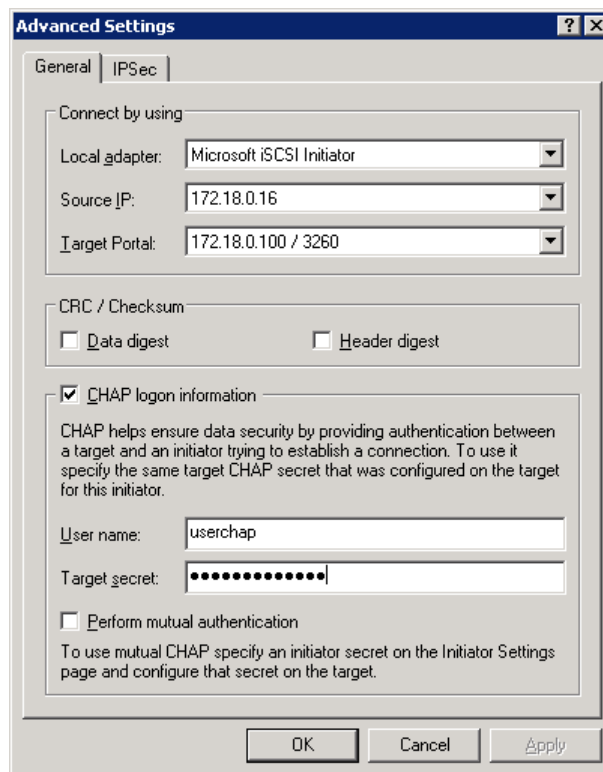


Figure 10: Microsoft iSCSI Initiator Properties – Advanced Settings

7. In the Log On to Target dialog box, click **OK** to complete the login.
8. Confirm the connection by clicking the **Targets** tab in the Microsoft iSCSI Initiator Properties dialog box. The target should appear in the list with the status *Connected*.
9. Click the **Bound Volumes/Devices** tab (Figure 11). To ensure that the volume will be available when the iSCSI service is started by Windows, click **Bind All**. Then, click **OK**. If you have an application that uses drive letters (for example, SQL or Exchange), perform the bind after assigning a drive letter.

The server now appears as a locally-connected iSCSI disk in the Disk Management utility.

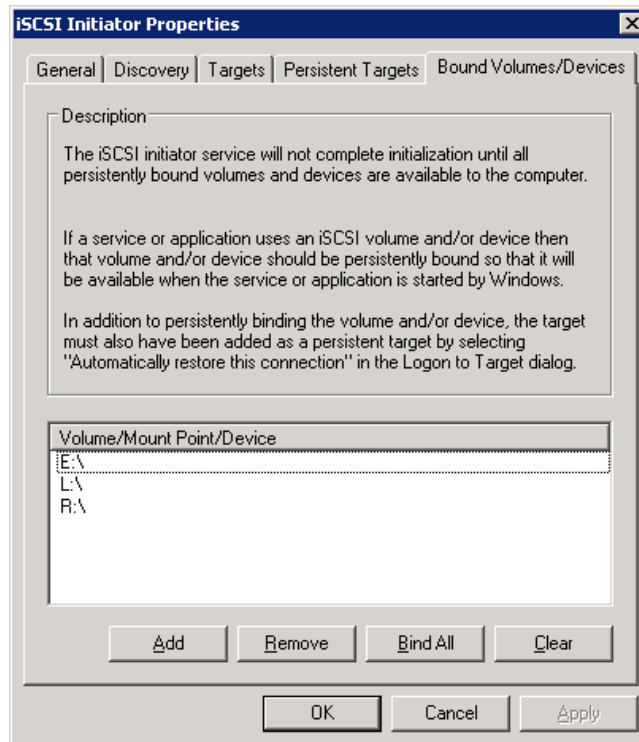


Figure 11: Microsoft iSCSI Initiator Properties – Bound Volumes/Devices Tab

5. Align the Disk Partitions

This provides optimal disk performance with PS Series volumes and is a Best Practice for SQL Server and Exchange Server on Windows Server 2003. For more information, see the Technical Report *Microsoft Windows: Aligning Disk Sectors for Optimal Performance* on the Customer Support website (<https://www.equallogic.com/support/>).

6. Configure Basic Disks

When you perform the disk sector alignment procedure, as described in the previous section, the default action will create a basic disk.

Do *not* convert the disk to a dynamic disk, because there are limitations when using dynamic disks, as described in *Format Volumes as Basic Disks*.

8. Assign Drive Letters and Format a Partitions

After you have aligned disk sectors and created a basic disk, the new volume will be seen in the Disk Management utility as with the status *On-Line* and *Healthy*. In this section, a disk associated with a connected PS Series volume is referred to as an iSCSI disk.

Note: Although you can create multiple disk partitions on an iSCSI disk, it is recommended that you only use one partition.

To assign a drive letter and format an iSCSI disk, follow these steps:

1. Click **Start > Settings > Control Panel > Administrative Tools > Computer Management** and then select **Disk Management** from the far left panel.

Alternately, you can load an MMC Snap-In. Click **Start > Run**, enter `mmc`, and press the Enter key. Pull down the **File** menu and select **Add/Remove Snap-in**. Click **Add** and select **Disk Management** from the **Add Standalone Snap-in** menu. Click **Finish > Close > OK**.

2. The Disk Management window (Figure 12) shows the iSCSI disk as *On-Line* and *Healthy*.

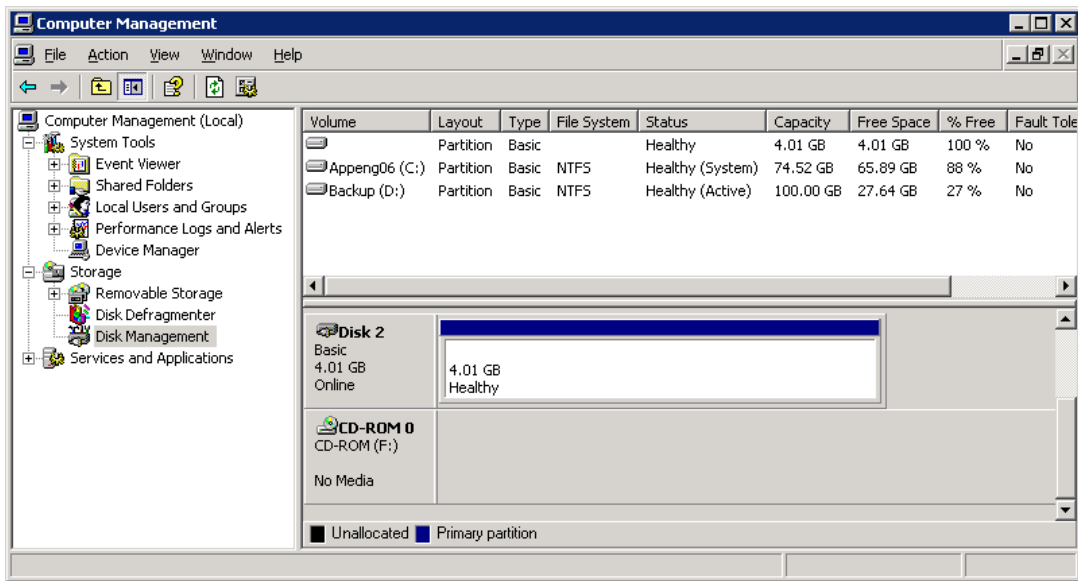


Figure 12: Disk Management

3. Right-click the white box next to the iSCSI disk, and select **Change Drive Letter and Paths**. (Figure 13)

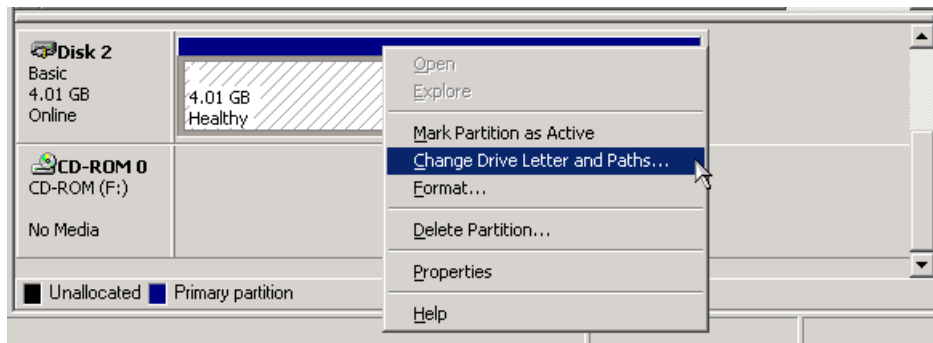


Figure 13: Disk Management – Change Drive Letter and Paths

- In the Change Drive Letter and Paths dialog box, click Add. In the Add Drive Letter or path dialog box, click **Assign the following drive letter** and then assign the drive letter (Figure 14). Then, click **OK**. The drive letter will appear by the iSCSI disk in the Disk Management utility.

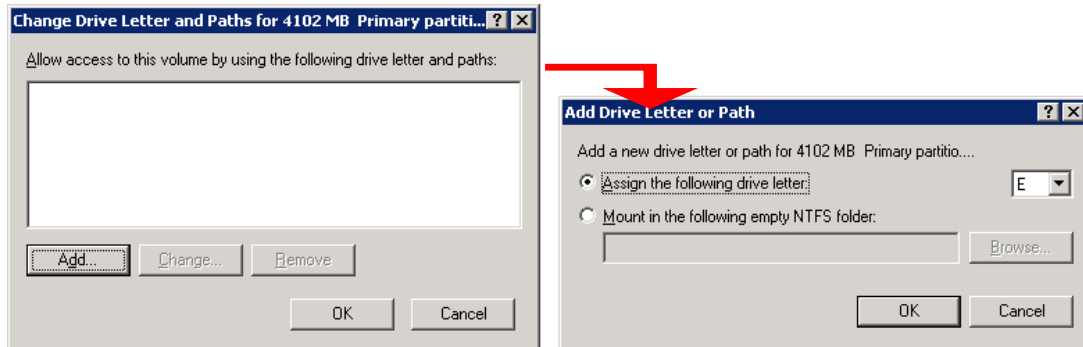


Figure 14: Disk Management – Add Drive Letter or Path

- To format the partition, right-click the white box next to the iSCSI disk, and in the shortcut menu that appears, select **Format**. (See Figure 15)

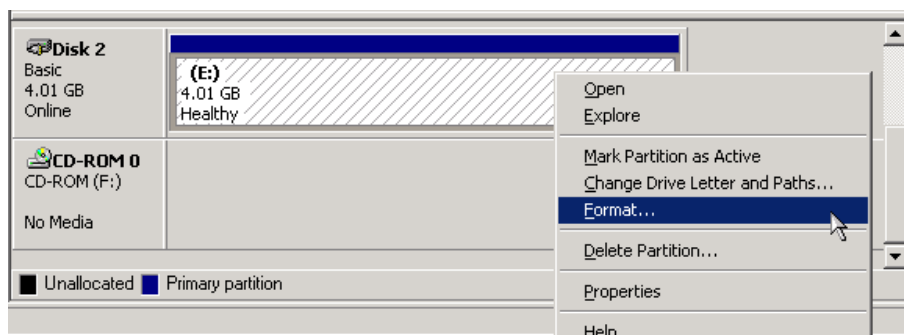


Figure 15: Disk Management – Drive Letter Assigned

- In the Format Partition dialog box that appears, you are giving the option of performing a regular format (the default) or a quick format (select **Perform a quick format**).

For a regular format, files are deleted from the partition, and the hard disk is scanned for bad sectors. The scan for bad sectors is responsible for the majority of the time that it takes to format a partition. If you choose the quick format option, files are deleted from the partition, but it is not scanned for bad sectors.

In the Format Partition dialog box (Figure 16), specify a volume label that is descriptive. You can keep the default values in the **File system** and **Allocation unit size** fields. Then, click **OK**.

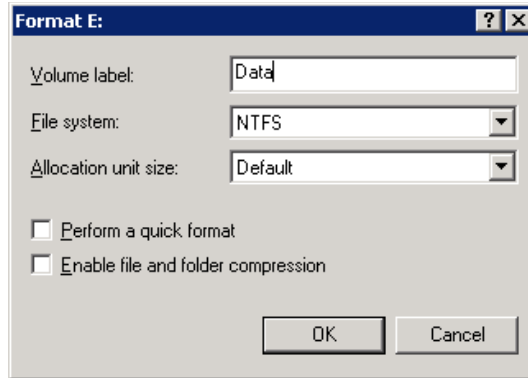


Figure 16: Disk Management – Format Partition

7. A pop-up message will appear warning you that you are about to erase data (Figure 17). Click **OK** to confirm your action.

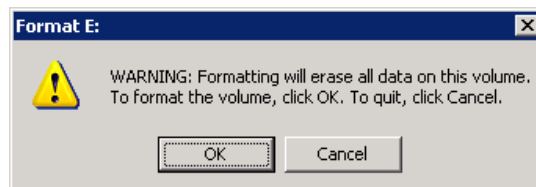


Figure 17: Disk Management – Format Partition Warning

ADDITIONAL OPERATIONS

The following sections describe additional operations that are related to working with Windows Storage Server 2003 in an iSCSI SAN, but that are not part of the core, design, plan, and implement process. These operations include:

- Expanding SAN storage online
- Backing up data with VSS
- SAN and network upgrades

Expanding SAN Storage Online

As the storage requirements increase for the server applications and users, you can easily expand individual PS Series volumes and SAN capacity, online and without disruption.

You can increase the size of a PS Series volume by using the Group Manager GUI or CLI. You must then enable Windows to recognize the size change. For more information, see *Increasing the Size of a PS Series Volume*.

If you need more SAN capacity to accommodate new volumes or expanded volumes, you can add more members to the PS Series group. See *Increasing PS Series Group Capacity* for more information.

Increasing the Size of a PS Series Volume

You can use the Group Manager GUI or CLI to increase the size of a PS Series volume without disrupting users. You do not need to reboot servers, and the space will be immediately available.

Follow these steps to use the Group Manager GUI to increase the size of a volume:

1. Expand **Volumes** in the far left panel, and select the volume name.
2. In the **Activities** panel of the window that appears, click **Modify volume settings**. In the **Modify Volume Settings** window, select the **Space** tab, and verify that the “Free pool space” displayed in the Space utilization table is larger than the desired expansion size.

You may also decide to thin provision the volume by checking the **Thin provisioned volume** box. See the *Deploying Thin Provisioning in a PS Series SAN* technical report for more information

3. Specify the new volume size, as shown in Figure 18. When finished, click **OK**.

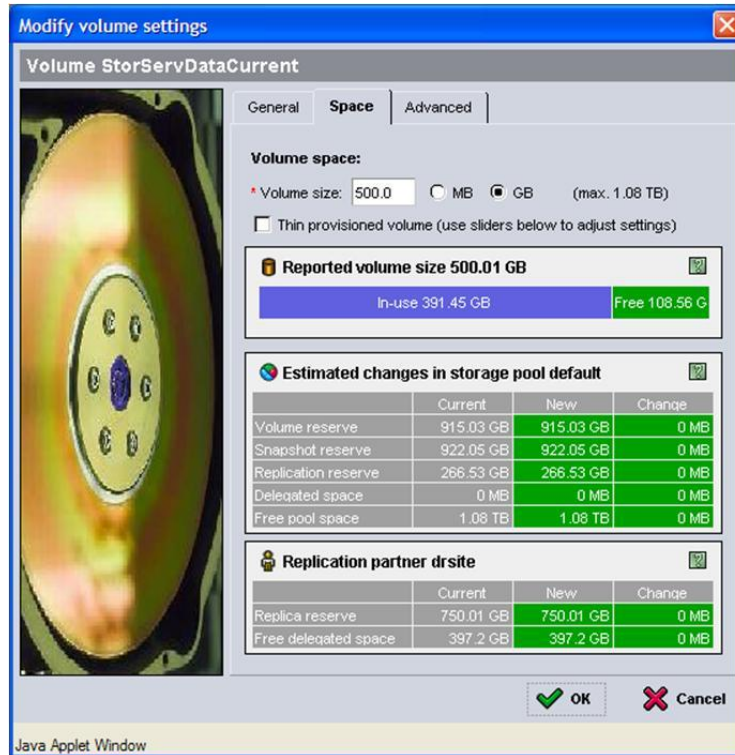


Figure18: Modify Volume Settings

To enable Windows Storage Server 2003 to recognize the volume size increase, you must rescan the disks in the Disk Management utility and then use the DiskPart utility. For more information, see the Technical Report *Microsoft Windows: Expanding Basic Disk Volumes* on the Customer Support website (<https://www.equallogic.com/support/>).

Increasing PS Series Group Capacity

If additional PS Series storage capacity is needed in order to create more volumes or expand volumes, you can add more members (arrays) to the group.

First, set up the hardware for the new PS Series storage array. Then, run setup. When prompted for the PS Series group to join, specify the group name and IP address. For complete array setup and member configuration instructions, see the PS Series *QuickStart* or the *Group Administration* manual.

Once the array has been added to the group, volume data will be load balanced across all the group members and the group capacity expanded. You can then add new volumes or increase the size of existing volumes.

Backing Up Data with VSS

VSS provides a framework that integrates VSS-aware storage hardware and applications with operating system drivers to create point-in-time copies of data—delivering a turn-key backup solution to IT departments without the need for scripting.

Using the Auto-Snapshot Manager VSS provider, a backup application VSS requestor, and an application with a VSS writer (such as NTFS or SQL Server), you can quickly and easily perform coordinated backups of data stored in a PS Series group.

See the Technical Reports on the Customer Support website for (<https://www.equallogic.com/support/>) information on backing up particular VSS-aware applications to a PS Series group.

MPIO

Multipath I/O (or MPIO) is the ability to use more than one physical path to a storage device, improving server reliability and availability through path redundancy and I/O traffic load balancing. MPIO can be implemented using standard network interfaces with the Microsoft iSCSI Software Initiator or third-party HBAs combined with the Microsoft iSCSI Software Initiator.

For more information on deploying Microsoft MPIO, see the *Deploying Microsoft Windows Server 2003 MPIO® in an iSCSI SAN* Technical Report located on the Customer Support website (<https://www.equallogic.com/support/>).

The EqualLogic MPIO DSM enables administrators to easily install and configure multipath I/O for iSCSI networks. If enabled, the MPIO DSM automatically makes the appropriate connections to the target. The number of connections per target will depend on the number of arrays in the group and the number of NIC's being used for MPIO.

You can manage specific subnets to use MPIO on the host by modifying the lists through the Remote Setup Wizard. By including and excluding specific subnets for MPIO you can control what networks you want to use for iSCSI traffic more easily.

The MPIO DSM requires the Microsoft iSCSI Initiator to make the appropriate connections to the target volumes. You may use offload cards such as HBAs but the connections must be made through the Microsoft initiator for the DSM to work correctly. When using the Microsoft iSCSI Initiator Service, each connection is added to the connections list upon the first connection to the target.

For more information on deploying the MPIO DSM for Microsoft MPIO, see the *PS Series Best Practices Deploying Microsoft Multipath I/O in an iSCSI SAN* Technical Report located on the Customer Support website (<https://www.equallogic.com/support/>).

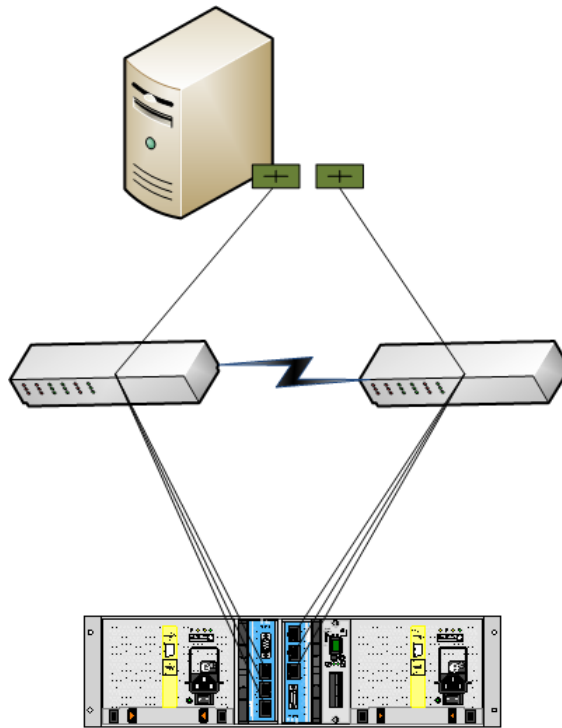


Figure 19: Basic MPIO Configuration

WINDOWS STORAGE SERVER OPERATIONS

The following sections describe additional operations that are related to working with Windows Storage

Share and Storage Management

With the Share and Storage Management snap-in, you can more easily set up and manage shared folders and storage. Share and Storage Management provides the following:

- MMC-based management of shared folders and storage.
- Provision Storage Wizard for creating and configuring storage, including creating a LUN and formatting a volume.
- Provision a Shared Folder Wizard for creating and configuring shared folders that can be accessed using either the server message block (SMB) or NFS protocol.

This makes it possible to complete most of the administrative tasks required to create and manage shared folders and volumes without having to use the Shared Folder Management, Storage Manager for SANs, or Disk Management snap-ins. This includes configuring quotas to restrict the quantity of data, configuring file screening to prevent certain file types or only allowing certain file types defined by the administrator, and enabling indexing.

Share and Storage Management includes the following tabs for managing shared folders and volumes:

- **Volumes:** This tab displays all volumes available to the server and information about each volume. From here, you can track and manage volumes.
- **Shares:** This tab displays all shared folders created using Share and Storage Management and information about each shared folder. From here, you can track and manage shared folders.

Single Instance Storage (SIS)

Share and Storage Management includes support for configuring Single Instance Storage (SIS). SIS recovers disk space by reducing the amount of redundant data stored on a volume. It identifies identical files, storing only a single copy of the file in the SIS common store, and replacing the files with pointers to the file in the SIS common store.

SIS can be managed only through the command line tool, Sisadmin.exe. The following table lists the Sisadmin.exe command line parameters:

- (none) Lists volumes on which SIS is installed.
- /i [vol] Installs SIS on volumes (creates common store, activates filter and groveler).
- /f [vol] Puts the groveler into foreground mode.
- /b [vol] Puts the groveler into background mode.
- /e Enables the groveler on all volumes.
- /d Disables the groveler on all volumes.
- /v [vol] Displays statistics about SIS usage on volumes (including disk space saved).
- /l [vol] Lists SIS-controlled volumes.
- /s [file] Displays information about SIS files.
- /h or /? Displays Help text.

The SIS groveler searches for and combines files that are identical on the NTFS volume. It then reports those files to the SIS filter driver. It does most of its work when the system is not busy. This is referred to as "background mode." It is possible to run the groveler at maximum capacity by using the Sisadmin.exe tool. This is referred to as "foreground mode." After the groveler completes its work in foreground mode, it resumes normal operation in background mode.

Distributed File System (DFS)

The Distributed File System (DFS) solution in Windows Storage Server 2003 R2 provides simplified, fault-tolerant access to files and WAN-friendly replication. Distributed File System consists of two technologies:

- **DFS Namespaces.** Formerly known as Distributed File System, DFS Namespaces allows administrators to group shared folders located on different servers and present them to users as a virtual tree of folders known as a namespace. A namespace provides numerous benefits, including increased availability of data, load sharing, and simplified data migration.
- **DFS Replication.** The successor to File Replication service (FRS), DFS Replication is a new state-based, multimaster replication engine that supports scheduling and bandwidth throttling. DFS Replication uses a new compression algorithm known as Remote Differential Compression (RDC). RDC is a protocol that can be used to efficiently update files over a limited-bandwidth network. RDC detects insertions, removals, re-arrangements of data in files, enabling DFS Replication to replicate only the deltas (changes) when files are updated.

SUMMARY

An iSCSI SAN comprised of PS Series storage arrays provide an ideal storage infrastructure for a Windows Storage Server 2003 installation. A PS Series SAN brings all the reliability and performance needed for a successful deployment. As the storage requirements grow and the workload increases, the SAN can scale easily, while maintaining availability.

An important part of a successful Windows Storage Server 2003 implementation is to follow Microsoft's recommendations for Windows configurations. You should also follow the best practices described in this Technical Report to ensure a robust installation that will meet your needs now and in the future.

DOCUMENTATION AND CUSTOMER SUPPORT

Visit the Customer Service website, where you can download the latest documentation and firmware. You can also view FAQs, the Knowledge Base, and Technical Reports and submit a service request.

PS Series storage array documentation includes the following:

- *Release Notes*. Provides the latest information about PS Series storage arrays and groups.
- *QuickStart*. Describes how to set up the hardware and start using a PS Series storage array.
- *Group Administration*. Describes how to use the Group Manager GUI to manage a PS Series group. This manual provides comprehensive information about product concepts and procedures.
- *CLI Reference*. Describes how to use the Group Manager command line interface to manage a group and individual arrays.
- *Hardware Maintenance*. Provides information on maintaining the PS Series storage array hardware.

To report a problem or to get access to the resources available on the Customer Support website, go to <https://www.equallogic.com/support/> and click LOGIN. If you do not already have an account, you can request one here. Once you are logged in, click Log a Case to report a problem.

To report an urgent issue, please call us at 1-877-887-7337 and speak with a member of the Customer Support team.

If you have any comments or suggestions related to this technical report, please send them to techreports@equallogic.com