

Configuring iSCSI Connectivity with VMware vSphere 6 and Dell PS Series Storage

How to configure and connect a Dell PS Series SAN to a VMware vSphere 6 environment using the software iSCSI initiator

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Revisions

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Executive summary

VMware[®] vSphere[®] 6 is the flagship VMware product for advanced server virtualization and management. Many advanced features provided by VMware, including the ability to move running virtual machines (VMs) between active servers, high availability (HA) clustering, and advanced load balancing, all require some manner of shared storage accessed by each of the servers. The Dell[™] PS Series SAN is a highly virtualized shared storage platform that works with VMware vSphere 6 to provide these advanced features. This document discusses how to configure your VMware ESXi[™] 6 environment to communicate with the PS Series SAN.

Audience

The information in this guide is intended for VMware vSphere administrators configuring iSCSI SAN access to a PS Series SAN.

Software and firmware revisions

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

Vendor	Model	Software revision
VMware	vSphere 6.x	6.0
Dell	PS Series SAN	8.x



1 Introduction

VMware vSphere 6 offers intelligent and advanced enhancements to the iSCSI software initiator in conjunction with iSCSI SAN connectivity. Many of these new features require advanced configuration in order to work properly.

This paper addresses some of these new features in vSphere and shows administrators how to connect a vSphere 6 environment to a Dell PS Series iSCSI SAN. While these steps are documented in the *VMware iSCSI SAN Configuration Guide* (available on the <u>VMware website</u>), this document provides a summary of the steps specific to connecting to a PS Series SAN. It covers the steps for utilizing the software iSCSI initiator inside the ESXi host. Users connecting their vSphere environment using iSCSI HBAs, both dependent and independent, should not follow these steps, and should configure their environment as outlined in the *VMware iSCSI SAN Configuration Guide*.

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Features of the vSphere software iSCSI initiator

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VMware vSphere has support for various advances with iSCSI SAN connectivity. This paper covers the features in the iSCSI software initiator as well as how to configure it to connect to the SAN.

Jumbo Frames: With ESXi, Jumbo Frames can be enabled on the iSCSI software initiator. Jumbo Frames support allows for larger packets of data to be transferred between the ESXi hosts and the SAN for increased efficiency and performance.

Note: Jumbo Frames are not required and are optional. Your network infrastructure must be able to fully support them to achieve any benefit.

MPIO: With ESXi, customers can benefit from MultiPath I/O from the ESXi hosts to the SAN. This allows for multiple connections to be concurrently used to allow for greater bandwidth. It also enables ESXi to take full advantage of the scale-out networking in the PS Series SAN.

Third-party MPIO support: VMware has provided an architecture that enables storage vendors to provide new and advanced intelligent integration. Dell has a MPIO plugin that will enhance MPIO with the existing iSCSI software initiator for easier management, better performance, and increased bandwidth.



Configuring the vSphere iSCSI software initiator with PS Series storage

Taking advantage of the vSphere iSCSI software initiator features requires advanced configuration by vSphere administrators. vSphere 6 requires the use of the new vSphere Web Client to access the latest features and will be used in this paper. Configuring both a vSphere Standard Switch (vSS) and vSphere Distributed Switch (vDS) will be covered. The correct vSwitch type will be depend on your environment.

The rest of this document focuses on the installation and configuration of an iSCSI software initiator connection to a PS Series SAN. Each of these steps can be found in the *VMware iSCSI SAN Configuration Guide*, and where names and IP Addresses are used, they will be different for each environment. This is merely an example of how to configure a new vSphere ESXi 6 environment correctly and connect it to the PS Series SAN.

The following assumptions are made for this example:

- VMware ESXi 6 the steps are similar for earlier releases
- Current Dell PS Series SAN Firmware

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• More than one network interface card (NIC) set aside for iSCSI traffic

Not every environment will require all of the steps detailed in this paper.

The rest of this document assumes the environment is using multiple NICs and attaches to a PS Series SAN utilizing the Native Multipathing Plug-in (NMP) from VMware.

4 Establishing sessions to the SAN

Before continuing, we first must discuss how VMware ESXi establishes its connection to the SAN utilizing the vSphere iSCSI software adapter. VMware uses VMkernel ports as the session initiators, so we must configure each port that we want to use as a path to the storage. This configuration will be a one-to-one (1:1) VMkernel-port-to-NIC relationship. Each session to the SAN will come from one VMkernel port which will go out a single physical NIC. Once these sessions to the SAN are initiated, both the VMware NMP and the Dell PS Series network load balancer will take care of load balancing and spreading the I/O across all available paths.

Each volume on the PS Series array can be utilized by ESXi as either a datastore or a raw device mapping (RDM). To do this, the iSCSI software adapter utilizes the VMkernel ports that were created and establishes a session to the SAN and to that volume to communicate. Administrators have the ability to use additional NICs for failover, but this document focuses on enabling NMP with Round Robin or preparation for third-party multipathing with the Dell PS Series Multipathing Extension Module (MEM). With the improvements to vSphere and MPIO, administrators can take advantage of multiple paths to the SAN for greater bandwidth and performance. This does require some additional configuration which is discussed in detail in this document.

Each VMkernel port is bound to a physical adapter. Depending on the environment, this can create a single session to a volume or up to eight sessions (ESXi maximum number of paths to a volume). Use a one-to-one (1:1) ratio of VMkernel ports to physical network cards. This means if there are two physical NICs, you would establish one VMkernel per physical NIC, associating a separate NIC with each VMkernel port. Looking at the following example, this means you would establish two sessions to a single volume on the SAN. This trend can be expanded depending on the number of NICs in the system.

Note: vSphere MPIO iSCSI traffic cannot be routed. If your environment requires the routing of iSCSI traffic then you must utilize Fixed path.



Figure 1 Example of iSCSI sessions using 1:1 VMkernel mapping with two physical NICs for iSCSI traffic on a standard vSwitch

5 Installation overview

Each environment will be different, but the following sections provide example installation steps for configuring a new ESXi host to connect to a PS Series SAN. Throughout these examples, the names and IP addresses assigned will need to be changed to be relevant in your environment. These examples assume a switch with Jumbo Frames support on the physical hardware.

This paper focuses on one-to-one VMkernel mapping with two physical NICs and two VMkernel ports. This would be a typical solution for many environments to utilize all of the bandwidth available to the ESXi host's network interfaces.

There are some suggested configurations depending on the number of NICs that will be used for iSCSI traffic. Every environment will differ depending on the number of hosts, the number of PS Series members, and the number of volumes. In a default configuration, assign one VMkernel port for each physical NIC in the system. So if there are two NICs, assign two VMkernel ports. This is referred to in the VMware iSCSI document as 1:1 port binding.

Keep in mind that it is the VMkernel port that establishes the iSCSI session to the volume and the physical NIC is just the means it utilizes to get there.

Due to how the PS Series SAN automatically load balances volumes across multiple members and iSCSI connections across multiple ports, this configuration will give both redundancy and performance gains when configured properly.

NICs	VMkernel ports			
2 physical 1GbE NICs	2 VMkernel ports (1 per physical NIC)			
4 physical 1GbE NICs	4 VMkernel ports (1 per physical NIC)			
2 physical 10GbE NICs	2 VMkernel ports (1 per physical NIC)			

Table 1 Sample configurations

This provides scalability and performance as the SAN environment grows without having to make changes on each ESXi host.

If more iSCSI connections are desired, follow the above sample configurations to obtain the number of VMkernel ports that match the environment and the number of paths you need to the PS Series SAN.

Always keep in mind the entire infrastructure of the virtual datacenter when deciding on network path and volume count. To see the current connection limits of pools and groups for the Dell PS Series SAN, view the release notes at <u>eqlsupport.dell.com</u> (login required).

All of these configurations are done at the iSCSI vSwitch level. This means that once the configuration is completed, the ESXi host will create multiple iSCSI connections to the PS Series SAN. Every new volume will have more iSCSI connections as well. Once this is configured, changes are only required if more NICs are being added or if more or less paths to the storage are needed.

6 Part 1: Configure vSwitches

This paper discusses two ways to configure the virtual switches in ESXi: vSphere Standard Switches (vSS) or vSphere Distributed Switches (vDS). Either method is viable for the environment and will depend on the administrator's familiarity with the method along with the VMware license structure in the environment. Administrators should choose one method and apply it to their entire ESXi cluster for ease of configuration and management. The steps are very similar but will be described in detail for each method.

Note: vDS requires the VMware vSphere Enterprise Plus license.

6.1 vSphere Standard Switch configuration

Note: If you are using vDS for iSCSI connectivity, skip these steps and go to the section, vSphere Distributed Switch configuration.

In the following example, an MPIO compatible standard vSwitch with two physical network adapters is created. If adding more than two physical adapters, repeat the relevant steps.

6.1.1 Step 1: Configure standard vSwitch

This step will create a new standard vSwitch designed for use with MPIO iSCSI traffic

- 1. From the vSphere Web Client GUI, select the ESXi host to be configured, click the **Actions** dropdown menu, and select **Add Networking**. This brings up the **Add Network Wizard**.
- 2. Select VMkernel Network Adapter and click Next.

10.124.6.173 - Add Networking		?
1 Select connection type 2 Select target device	Select connection type Select a connection type to create.	
 3 Connection settings 3a Port properties 3b IPv4 settings 4 Ready to complete 	VMIkernel Network Adapter The VMIkernel TCP/IP stack handles traffic for ESXi services such as vSphere vMotion, iSCSI, NFS, FCOE, Fault Tolerance, Virtual SAN and host management. Physical Network Adapter Aphysical network adapter handles the network traffic to other hosts on the network. Virtual Machine Port Group for a Standard Switch A port group handles the virtual machine traffic on standard switch.	
	Back Next Finish	Cancel



- 3. Select the New Standard Switch radio box and click Next.
- 4. Click the **Add adapters** icon, the green plus symbol, and select the physical network adapters to add to the vSwitch, making sure to assign the adapters to the Active Adapters. Repeat this step to add additional physical network adapters to the vSwitch.
- 5. Once all network adapters have been added to the vSwitch, click Next.

10.124.6.173 - Add Networking		?
 1 Select connection type 2 Select target device 3 Create a Standard Switch 4 Connection settings 4a Port properties 4b IPv4 settings 5 Ready to complete 	Create a Standard Switch Add Physical Adapters to the Switch Failover order group: Active adapters Network Adapters: wymnic2 wymnic3 Select a single network adapter from the list to view its details. m the list to view its	
	OK Cancel	
	Back Next Finish	Cancel

6. For the Network Label, enter VMkernel iSCSI-1, and click Next.

10.124.6.173 - Add Networking		(
 1 Select connection type 2 Select target device 	Port properties Specify VMkernel port settings.	
 2 Select angerteelde 3 Create a Standard Switch 4 Connection settings 4a Port properties 4b IPv4 settings 5 Ready to complete 	VMkernel port settings Network label: VLAN ID: IP settings: TCP/IP stack:	VMkernel ISCSI-1 None (0) v IPv4 v Default v (1)
	Available services	
	Enable services:	VMotion traffic Provisioning traffic Fault Tolerance logging Management traffic vSphere Replication traffic vSphere Replication NFC traffic Virtual SAN traffic
		Back Next Finish Cancel



- 7. Enter in the IP Address and Subnet Mask for the VMkernel iSCSI-1 port. This must be on the same network subnet as the PS Series Group IP Address. Click **Next**.
- 8. Verify the settings and click **Finish** to complete the vSwitch creation.

6.1.2 Step 2: Add additional iSCSI VMkernel ports

This step assigns additional iSCSI VMkernel ports to the new vSwitch. It also assigns the IP addresses to the iSCSI VMkernel ports. Each additional VMkernel port needs its own IP address, must be on the same subnet as each other, and must be on the same subnet as the PS Series group IP address.

- 1. Click the Actions drop-down menu and select Add Networking.
- 2. Select VMkernel Network Adapter and click Next.
- 3. Choose **Select an existing standard switch**, click **Browse**, and select the vSwitch created in the previous step (in this example, **vSwitch1**). Click **OK** and then click **Next**.

10.124.6.173 - Add Networking		•				
1 Select connection type 2 Select target device 3 Connection settings	Select target device Select a target device for the new connection.					
3a Port properties 3b IPv4 settings	Select Switch Select a standard switch on which to creat	ate a VMkernel adapter.				
4 Ready to complete	Switch	Discovered Iss				
	4	OK Cancel				
		Back Next Finish Cancel				

- 4. For the Network Label, enter VMkernel iSCSI-2 and click Next.
- 5. Enter the IP address and subnet mask for the VMkernel iSCSI-1 port. This must be on the same network subnet as the PS Series group IP address. Click **Next**.
- 6. Verify the settings and click **Finish** to complete the vSwitch creation.

At this point, you have created a standard vSwitch with two VMkernel ports. However, for iSCSI MPIO to function, the VMkernel ports must have only one physical network adapter to route their traffic out. The next step adjusts the failover order to resolve this.

6.1.3 Step 3: Associate VMkernel ports to physical adapters

This step creates the individual 1:1 mapping of each VMkernel port to a network adapter. This is required so that MPIO protocols like VMware Round Robin or Dell PS Series MEM can correctly route I/O through the VMkernel port and out from a particular physical network adapter, and therefore correctly load-balance across the available paths.

From the previous step, there are two or more iSCSI VMkernel ports and two or more network adapters. This section assigns each iSCSI VMkernel port one network adapter by modifying the failover order.

- 1. Select the host, click the **Manage** tab, and then click the **Networking** button.
- Select the vSwitch created previously (in this example, vSwitch1), select the VMkernel port VMkernel iSCSI-1, and click the Edit Setting icon on the left.
- 3. Click the **Teaming and failover** link, and then in the **Failover order** pane, check the **Override** checkbox.
- 4. Select the network adapters that are not going to be assigned to the VMkernel (vmnic3 in this example), and click the down arrow button until it is listed under **Unused adapters**.
- 5. When this is completed click **OK**.

👰 VMkernel iSCSI-1 - Edit Settings							?
Properties Security Traffic shaping Teaming and failover	Load balancing: Network failure detection: Notify switches: Failback:		verride verride verride verride	Route based on originating v Link status only Yes Yes	irtual port v		
	Failover order						
	Override		\square				
	Active adapters		All	Properties CDP LLDP	Intel Corporation 8257/L	Cigabit Network	
	vmnic2		Adapter		Connection	Sigabit Network	
	Standby adapters		Name Locati	e ion	vmnic3 PCI 0000:1b:00.0		
	vmnic3		Driver		e1000e		
			Statu: Stat Con Actu	s tus nfigured speed, Duplex ial speed, Duplex	Connected Auto negotiate 1000 Mb, Full Duplex		T
	Select active and standby a	dapters	. During	a failover, standby adapters a	activate in the order specified	above.	E.
						ОК	Cancel



 Repeat these steps for each iSCSI VMkernel, mapping a different network adapter to each VMkernel port. In the examples shown, VMkernel iSCSI-1 is mapped one-to-one with vmnic2, and VMkernel iSCSI-2 is mapped one-to-one with vmnic3.

Jirtual switches	
😟 😥 🛛 🐺 🕾 🥒 🗙 🚯	
Switch	Discovered Issues
T vSwitch0	
1 vSwitch1	-
VIAN ID:	Physical Adapters Market with the second s
VMkernel Ports (1) vmk1 : 10.10.11.175	
VMkernel-iSCSI-2 VLAN ID: VMkernel Ports (1) vmk2 : 10.10.11.176	

6.1.4 Step 4: Configure Jumbo Frames

In order for Jumbo Frames to work, it must be enabled end-to-end, on both the physical and virtual network infrastructure, or the frame size will fall back to standard frames. PS Series arrays have Jumbo Frames enabled by default. Verify with your network administrator that the network fabric has Jumbo Frames enabled.

For Jumbo Frames to be enabled for iSCSI traffic on an ESXi host, it must be enabled on both the vSwitch used for iSCSI and all VMkernel ports that will carry iSCSI traffic.

- 1. Select the host, click the **Manage** tab, and then click the **Networking** button.
- 2. Select the previously created vSwitch from the Switch list (in this example **vSwitch1**), then click the **Edit Setting** icon above it.
- 3. In Edit Setting under Properties, change the MTU from the default of 1500 to 9000, and click OK.



T vSwitch1 - Edit Settings			?
Properties Security Traffic shaping Teaming and failover	Number of ports: MTU (Bytes):	Elastic 9000 T	
		ОК Салс	cel

For each of the VMkernel ports, Jumbo Frames must also be enabled.

- 1. Select **VMkernel adapters**, select one of the VMkernel ports from the vSwitch configured for iSCSI (vSwitch1 in this this example), then click the **Edit Setting** icon above it.
- 2. Under NIC settings, change the MTU from the default of **1500** to **9000** and click OK.

				_			
10.124.6.173 Actions -							
Getting Started Summary Mo	nitor Manage Related O	bjects					
Settings Storage Networking Alarm Definitions Tags Permissions Dell VSM							
••	VMkernel adapters	📖 vmk1 - Edit Settings					
VMkernel adapters	Device Network Label	Port properties	MTU: 90001 -	2			
Physical adapters	mi vmk0 👰 Managem	nent No NIC settings					
TCP/IP configuration	় vmk1 👷 VMkernel	ISCSI- IPv4 settings					
Advanced	📠 vmk2 🧕 VMkernel	iSCSI IPv6 settings					
		Analyze impact					
	•						
	VMkernel network adapter	: vmk ²					
	All Properties IP Set	ttings					

3. Repeat this for each of the VMkernel ports assigned to iSCSI.

6.2 vSphere Distributed Switch configuration

Note: If you are using vSS, skip this section and go to Part 2: Configure VMware iSCSI software initiator.

Some environments utilize vSphere Distributed Switches (vDS) for network connections and management. One of the benefits to a vDS is the ability to create and configure a single network profile and then attach multiple hosts to this configuration.

Note: vSphere Distributed Switches require Enterprise Plus licensing.

6.2.1 Step 1: Configure vSphere Distributed Virtual Switch

- 1. In vSphere Web Client, select the data center from the pane on the left. Click the **Related Objects** tab, and then click the **Distributed Switches** button.
- 2. From the icon toolbar, click the **Create a new distributed switch** icon (it is the first icon).
- 3. On the **Name and location** page, in the **Name** textbox, enter a name for the new distributed switch (in this example, DSwitch_iSCSI is used). Click **Next** to continue.

A New Distributed Switch		(?	•
 New Distributed Switch 1 Name and location 2 Select version 3 Edit settings 4 Ready to complete 	Name: Location:	©Switch_ISCSI Datacenter	
		Back Next Finish Cance	



4. On the **Select version** page, select the newest version possible. If the environment is a mix of ESXi versions, select the oldest version in the environment that will be connected to this distributed switch. Click **Next** to continue.

La New Distributed Switch		(?) ₩
 1 Name and location 2 Selectiversion 	Select version Specify a distributed switch version.	
2 Select version 3 Edit settings 4 Ready to complete	 Distributed switch: 6 0.0 This version is compatible with VMware ESXI version 6.0 and later. The following new features are available: Network I/O Control version 3, and IGMP/MLD anooping. Distributed switch: 5 5.0 This version is compatible with VMware ESXI version 5.5 and later. The following new features are available: Traffic Filtering and Marking, and enhanced LACP support. Distributed switch: 5 1.0 This version is compatible with VMware ESXI version 5.1 and later. The following new features are available: Management Network Rollback and Recovery, Health Check, Enhanced Port Mirroring, and LACP. Distributed switch: 5 0.0 This version is compatible with VMware ESXI version 5.0 and later. The following new features are available: User-defined network resource pools in Network I/O Control, NetFlow, and Port Mirroring. 	
	Back Next Finish C	ancel

- 5. On the **Edit settings** page there are several values to change:
 - a. Set **Number of uplinks** to the maximum number of physical network adapters to be used for iSCSI (this example uses two).
 - b. Set **Network I/O Control** to **disabled**. Network I/O Control is used when a variety of different kinds of traffic are sharing the same physical infrastructure, and it enables the prioritizing of one type of traffic over another. For iSCSI, it is recommended to use dedicate network adapters and switches.
 - c. Leave the **Create a default port group** checkbox checked, and change the **Port group name** to **DPortGroup_iSCSI_1**. A later step adds the additional port groups and modifies the failover order to permit iSCSI binding.
 - d. Click **Next** to continue.

Level 2 New Distributed Switch						(?) ₩
 New Distributed Switch 1 Name and location 2 Select version 3 Edit settings 4 Ready to complete 	Edit settings Specify number of uplink p Number of uplinks: Network I/O Control: Default port group: Port group name:	borts, resource allocation and default port group. 2 2				***
			Back	Next	Finish	Cancel

6. On the **Ready to complete** page, review the setting, and click **Finish** to continue.

6.2.2 Step 2: Add additional port groups

The next step creates and configures the additional port groups used to assign the VMkernel ports to. You will need to have one port group for every physical NIC you are using for iSCSI.

- 1. Returning to the icon toolbar, click the **Create a new distributed port group** icon (it is the second icon).
- 2. On the **Select name and location** page, change the **Name** to **DPortGroup_iSCSI_2**, and click **Next** to continue.

😫 New Distributed Port Group		? **]
1 Select name and location	Name:	DPortGroup_iSCSI_2	1
2 Configure settings 3 Ready to complete	Location:	DSwitch_ISCSI	
		Back Next Finish Cancel	

- 3. On the **Configure settings** page, change nothing and click **Next** to continue.
- 4. On the **Ready to complete** page, review the settings and click **Finish**.
- 5. Repeat these steps to add additional port groups as needed for your environment if utilizing more than two NICs for iSCSI.

6.2.3 Step 3: Modify the port group failover order

For iSCSI multipathing there must be only one physical uplink that the VMkernel port is attached to. By default, a VMkernel port is attached to all uplinks in the vDS. This example maps DPortGroup_iSCSI_1 to Uplink 1, and DPortGroup_iSCSI_2 to Uplink 2.

- 1. Continuing from the data center **Related Objects** tab, select the **Distributed Port Groups** button.
- 2. Select the first distributed port group (DPortGroup_iSCSI_1 in this example), and click the **Edit distributed port group setting** icon from the toolbar (is it the second icon).
- 3. From the Edit Settings wizard, select the Teaming and failover page.
- 4. In the **Failover order** pane, all the uplinks associated with this distributed port group, DPortGroup_iSCSI_1, are listed under the **Active uplinks** section in which there must only be one active uplink for multipathing iSCSI.



5. Select **Uplink 2** and click the down-arrow button to move it to the **Unused uplinks**. If there are additional uplinks, they must also be moved. Click **OK** to apply the change.

DPortGroup_iSCSI_1 - Edit Setting	S			?
DPortGroup_iSCSI_1 - Edit Setting General Advanced Security Traffic shaping VLAN feaming and failover Monitoring Traffic filtering and marking Miscellaneous	IS Load balancing: Network failure detection: Notify switches: Failback: Failback: Failback: Failover order Children of the second seco	Route based on originating virtual port Link status only Yes Yes		
	Select active and standby up	links. During a failover, standby uplinks activ	vate in the order specified above.	
			OK Canc	el

6. Repeat these steps on the each of the distributed port groups created for iSCSI until each port group and uplink has a one-to-one mapping.

6.2.4 Step 4: Add the VMkernel adapters to the vDS

This step adds the vDS to a host and creates VMkernel ports which will be linked 1-to-1 to a particular distributed port group. The step consists of the following phases: selecting a host, selecting which network adapters on that host to use, and adding the VMkernel adapters to the vDS.

1. Return to the **Distributed Switches** button, select the previously created vDS (**DSwitch_iSCSI**), and click the icon, **Add hosts to this distributed switch and migrate physical or virtual network adapters** (the fourth icon on the toolbar).

2. On the Select task page, select the Add hosts radio button and click Next to continue.



3. On the **Select hosts** page, click the **New hosts** button. From the new dialog box, select at least one ESXi host in the data center, and then click **OK**. Click **Next** to continue.

Aud and manage Hosts				
1 Select task	Select hosts Select hosts to add	to this distributed switch		
2 Select hosts				
3 Select network ada tasks	Select new hosts			×
4 Manage physical ne adapters	Incompatible Hosts		Q Filter	•
, Manage VMkernel n	Host	Host State	Cluster	
^o adapters	10.124.6.102	Connected	VSAN Cluster	
6 Analyze impact	10.124.6.103	Connected	VSAN Cluster	
7 Ready to complete	10.124.6.104	Connected	VSAN Cluster	
	10.124.6.171	Connected	VVol Cluster	
	10.124.6.172	Connected	VVol Cluster	
	🗹 🔋 10.124.6.173	Connected (maintenance mode)	🗊 VVol Cluster	
	M Q Find	•	6 item	ns
				_
			OK Cance	
	Configure identi	cal network settings on multiple bosts (temp	late mode)	
	Configure facility	car network betange on manipre rroots (temp		
			Back Next	Finish Cance



4. On the Select network adapter tasks page, check the checkboxes for Manage physical adapters and Manage VMkernel adapters, then click Next to continue.

🕞 Add and Manage Hosts		?			
 1 Select task 2 Select hosts 3 Select network adapter tasks 	Select network adapter tasks Select the network adapter tasks to perform.				
4 Manage physical network adapters	Add physical network adapters to the distributed switch, assign them to uplinks, or remove existing ones.				
5 Manage VMkernel network adapters 6 Analyze impact	Manage VMkernel adapters Add or migrate VMkernel network adapters to this distributed switch, assign them to distributed port groups, configure VMkernel adapter settings, or remove existing ones.				
7 Ready to complete	Migrate virtual machine networking Migrate VM network adapters by assigning them to distributed port groups on the distributed switch.				
	Manage advanced host settings Set the number of ports per legacy host proxy switch.				
	Sample distributed switch				
	Manage VMkernel adapters VMkernel ports wrk VM port group V Virtual Machines wrm				
	Back Next Finish Cano	cel			

5. On the Manage physical network adapters page, select one of the network adapters (referred to as vmnic) that are to be used for iSCSI and click the Assign uplink button. On the popup dialog box, select the uplinks and click OK. In this example vmnic2 has been assigned to Uplink 1, and vmnic3 will be assigned to Uplink 2.

🕞 Add and Manage Hosts				(?
 1 Select task 2 Select hosts 	Manage physical network adapters Add or remove physical network adapters	to this distributed switch.		
 3 Select network adapter tasks 	🔚 Assign uplink 🕐 Reset changes 🧃	View settings		
4 Manage physical network	Host/Physical Network Adapters	1 🛦 In Use by Switch	Uplink	Uplink Port Group
5 Manage VMkernel network adapters	 10.124.6.173 On this switch 			
6 Analyze impact	vmnic2 (Assigned)	-	Uplink 1	DSwitch_iSCSI-DVUpli
7 Ready to complete	vmnic3 (Assigned)	-	Uplink 2	DSwitch_iSCSI-DVUpli
	 On other switches/unclaimed 			
	📷 vmnic0	vSwitch0		-
	📷 vmnic1	-		-
			Back	Next Finish Cancel



- 6. Click **Next** to continue.
- 7. On the **Manage VMkernel network adapters** page, click the **New adapter** button. On the new **Add network** dialog box, click the **Browse** button to select an existing network.
- 8. On the **Select Network** dialog box, select one of the port groups created for iSCSI to which the new VMkernel will be attached to.

	Select Network			×	
10.124.6	Show all columns				
1 Select	G	Q Filte	۲	•	
2 Conne	Name				
2a Por	PortGroup_iSCSI_1				
2b IPv4	PortGroup_iSCSI_2				
3 Ready					
	A Q Find			2 items	
			ОК	Cancel	Cancel
		Back	Next	Finish	Cancel

- 9. Click **OK** to return to the **Add Networking** dialog box.
- 10. On the **Port properties** page, choose **IPv4** or **IPv6** from the **IP settings** dropdown menu, and click **Next** to continue. No other setting needs to be changed on this page for iSCSI.
- 11. Enter the IP address to be assigned to the VMkernel port, and click **Next** to continue.
- 12. On the **Ready to complete** page, review the setting selected, and click **Finish** to continue.

Repeat steps 6 through 10 for each VMkernel adapter to be created. In step 7, make sure to not select a port group that has previously been assigned to a VMkernel port.

13. Once all the VMkernel ports have been created and assigned to a port group, click **Next** to continue.

🕼 Add and Manage Hosts				(?)
✓ 1 Select task	Manage VMkernel network adapters Manage and assign VMkernel network a	adapters to the distributed switch.		
 Z Select nosts Select network adapter 				
3 tasks	🚑 Assign port group 🕂 New adapte	r 🥒 Edit adapter 💥 Remove 🐚	Reset changes 🚯 View set	ttings
 4 Manage physical network adapters 	Host/VMkernel Network Adapters	1 🛦 In Use by Switch	Source Port Group	Destination Port Group
5 Manage VMkernel network	- 👕 10.124.6.173			
adapters	 On this switch 			
6 Analyze impact	📷 vmk1 (new)	DSwitch_iSCSI	-	DPortGroup_iSCSI_1
7 Ready to complete	pm vmk2 (new)	DSwitch_iSCSI	-	DPortGroup_iSCSI_2
	📷 vmk0	vSwitch0	Management Network	Do not migrate
			Back Next	Finish Cancel

- 14. On the **Analyze impact** page, review the status and resolve any issues that may be outstanding. Click **Next** to continue.
- 15. On the **Ready to complete** page, review the chosen setting and click **Finish**.

6.2.5 Step 5: Configure Jumbo Frames

In order for Jumbo Frames to work, it must be enabled end-to-end on both the physical and virtual network infrastructure, or the frame size will fall back to standard frames. PS Series arrays have Jumbo Frames enabled by default. Verify with your network administrator that the network fabric has Jumbo Frames enabled.

For Jumbo Frames to be enabled for iSCSI traffic on an ESXi host, it must be enabled on the distributed vSwitch used for iSCSI and on all VMkernel ports that will carry iSCSI traffic.

To enable Jumbo Frames on the vDS:

- 1. Start from the data center object under the **Networking** inventory view, select the **Related Objects** tab, select the **Distributed Switches** button, and select the **Edit distributed switch setting** icon (the fifth icon on the toolbar).
- 2. On the Edit Setting page, select Advanced.
- 3. Change the **MTU** setting from the default of **1500** to **9000**.

DSwitch_iSCSI - Edit Settings			?
General Advanced	MTU (Bytes): Multicast filtering mode:	9000 A	
	Discovery protocol Type: Operation:	Cisco Discovery Protocol Listen	
	Administrator contact Name:		
	Other details:		
		ОК Салс	el

4. Click **OK** to apply.

To enable Jumbo Frames on the VMkernel ports:

- 1. Select the **Hosts and clusters** inventory view, and select the individual host with the VMkernel ports you wish to enable Jumbo Frames on.
- 2. Select the Manage tab, then the Networking button, and click VMkernel adapters.
- 3. Select one of the VMkernel ports assigned to iSCSI, and then click the **Edit setting** icon (the third icon on the toolbar).
- 4. From the Edit setting wizard, select NIC settings.
- 5. Change the **MTU** setting from the default of **1500** to **9000**.

🐖 vmk1 - Edit Settings		?
wk1 - Edit Settings Port properties VIC settings IPv4 settings IPv6 settings	MTU: 9000	3
	OK Cancel),
`	Back Next Finish Canc	Ē

- 6. Click **OK** to apply.
- 7. Repeat these steps for each VMkernel assigned to iSCSI.



7 Part 2: Configure VMware iSCSI software initiator

Now that the virtual switch (vSS or vDS) is configured and the VMkernel ports are bound to physical NICs in a 1:1 fashion, the next thing to configure is the iSCSI initiator. This section details the enablement and configuration of the VMware iSCSI software initiator. These steps are done on each ESXi host that needs connectivity to the SAN.

7.1.1 Step 1: Enabling the iSCSI software initiator

VMware ESXi does not enable the iSCSI software initiator by default, and it can be enabled using the following steps:

- 1. From the vCenter Web Client GUI, select the ESXi host, select the **Manage** tab, click the **Storage** button, and then select **Storage Adapters**.
- 2. Click Add new storage adapter (the green plus button), and select Software iSCSI Adapter.



3. Click OK on the Add Software iSCSI Adapter dialog box.

7.1.2 Step 2: Binding VMkernel Ports to the iSCSI software initiator

The next step is to bind each of the iSCSI VMkernel ports to the iSCSI software adapter. This indicates to the iSCSI software adapter which VMkernel ports to use for connectivity to the SAN.

1. Continuing from the previous section, select the newly enabled **iSCSI Software Adapter** from the **Storage Adapters** list. Select the **Network Port Binding** tab, and then click the **Add** button (the green plus icon).



2. From the list of VMkernel network adapters, select the ones created for iSCSI (in this example, vmk1 and vmk2) and click **OK**.

10.124.6.173 - Bind vmhba33 with VMkernel Adapter					
VMkernel network adapter					
Only VMkernel adapters compatible with the iS	CSI port binding requirements and av	ailable physical network adapters are listed.			
Port Group	VMkernel Adapter	Physical Network Adapter			
Management Network (vSwitch0)	📖 vmk0	对 vmnic0 (1 Gbit/s, Full)			
VMkernel iSCSI-1 (vSwitch1)	飅 vmk1	pm vmnic2 (1 Gbit/s, Full)			
VMkernel-iSCSI-2 (vSwitch1)	🗾 vmk2	mic3 (1 Gbit/s, Full)			
	-	对 vmnic1 (1 Gbit/s, Full)			
Port group policy:	ompliant				

Note: After the addition of the VMkernel ports to the iSCSI initiator, the vSphere Web Client may recommend a rescan of the storage adapter. As additional changes are yet to be made, this can be ignored at this time.

3. When the VMkernel network adapters are added to the iSCSI software adapter, vSphere will display **Compliant** in the **Port Group Policy** if they are correctly configured. It will also display which physical NIC each one is bound to. Path status will show **Not used** until volumes are attached.

iSCSI Software Adapter					
🔄 vmhba33	iSCSI	Online	iqn.1998-01.com	.vmware:esx03-wol-335cfb48	
Adapter Details Properties Devices Paths Targets Network Port Binding Advanced Options + X 3					
Port Group	VMkernel Ad Po	ort Group Policy	Path Status	Physical Network Adapter	
Q VMkernel iSCSI-1 (💓 vmk1 🔮	Compliant	🔷 Notused	mic2 (1 Gbit/s, Full)	
👳 VMkernel-iSCSI-2 (🗾 vmk2 🔮	Compliant	ONDER NOT USED	🗾 vmnic3 (1 Gbit/s, Full)	

8 Part 3: Connect to Dell PS Series SAN

Now that the configuration for the vSphere iSCSI software initiator has been completed, the next stage is to connect to the Dell PS Series SAN and to the volumes it contains.

This example attaches the iSCSI software initiator to the SAN and to a single volume. For more information on complete administration of the Dell PS Series SAN, see the *Dell EqualLogic Group Manager Administrator's Guide* available on <u>eqlsupport.com</u> (login required).

8.1.1 Step 1: Configure dynamic discovery of the PS Series SAN

The first step adds the PS Series group IP address to the dynamic discovery of the ESXi host iSCSI software initiator. This is done to enable rescans to find new volumes that the ESXi host has access rights to.

- 1. Continuing from the previous steps, select the **Targets** tab from the selected **iSCSI Software Adapter**.
- 2. Click the **Dynamic Discovery** button, and then click the **Add** button.
- 3. On the **Add Send Target Server** dialog box, enter the group IP address of the PS Series SAN in the **iSCSI Server** text box, and click **OK**.



4. vSphere will prompt for a rescan of the storage adapter due to the recent configuration changes. If there are no volumes configured on the PS Series array for this ESXi host to access, there is no need to perform this rescan. To perform a rescan, click the **Rescan** button (the forth icon on the toolbar).



8.1.2 Step 2: Create and configure a volume

The next step creates a new volume and assigns it to the ESXi host. There are multiple ways to do this, so refer to the *Group Manager Administrator's Guide* for more information. This can also be done from directly within the vSphere Web Client using the Dell Virtual Storage Manager plugin and completed in only a few clicks. For details, see the document, <u>Dell Virtual Storage Manager: Installation Considerations and Datastores Manager</u>.

This example creates a 500GB volume and assigns it to this ESXi host through an IP-based basic access point. For a more detailed discussion on volume access control, see the document, <u>Access Control</u> <u>Policies</u>, and the firmware *Group Manager Administrator's Guide*.

1. From the Dell PS Series Group Manager web GUI, click the **Volumes** button in the lower left pane, and then click the **Create volume** link in the **Activities** pane.

EqualLogic Group Manager					
🏮 Volumes 🛛 🔳 🔻	🗸 Volumes				
Group TMProd	Activities	Volumes			
 ♥ Volume Collections ♥ Volume ♥ Volume Administr Create vi Manage I ♥ Volume ♥ Volum	Volumes Administration Create volume Create volume folder	Total volumes: 11 Online volumes: 11 Volumes not shown: 0 <u>V</u> iew: Overview Eitter by tag Settings Pick tag columns No filter			
	Manage recovery bin Manage tags	Volume Status Pool			
	Volume Modify settings Modify tags	SpaceBorrow online default VMFS01 online default VMFS02 online default VMFS03 online default			
	Clone Set offline Set access type Delete volume Convert to template	VMFS04 Online default VMFS05 Online default VMFS06 Online default			
Group	<u>Move volume</u> Folder	VMFS08 Online default			



2. The first step in the **Create Volume** wizard is provide a volume name and select which pool to place the volume. In this example, a name of **vSphereDemo** has been used, and the volume has been placed in the default pool. Click **Next**.

Create volume						X
1 - Volume Settings						?
> 1 - General	General propertie	s				
2	* Name: vSpher	reDemo				
4	Folder	folder: FolderExam	ole			•
5	Storago pool appi	mmont				,
6	storage poor assig	gnment			1	
	Storage pool	Capacity	Free 68.2 TB	49.5 TB	Drives	Pool encryption
	FastPool		2.42 TB	23.48 GB	SAS HDD	None
				Back	Next	Skip to end Cancel

3. Set the volume size (500GB in this example), options for enabling thin provisioning, and snapshot reserve space. Click **Next** to continue.

eate volume				
2 - Space				(
- General	Volume space			
2 Space	* Volume <u>s</u> ize: 500 GB▼	(max. 15 TB)		
z - space	Thin provisioned volume (use slide	ers below to adjust settings)		
	Snapshot space			
	Snapshot reserve (% of volume rese	rve): 100		
	📒 Reported volume size 500.	01 GB		8
	╞╞ Reported volume size 500.	01 GB Free 500.01 GE	3	18
	Reported volume size 500. Statimated changes in storage Storage and dofault	of GB Free 500.01 GE e pool default	3 Nov	Change
	Reported volume size 500. Storage pool default Volume reserve.	Pree 500.01 GE) New 294 TB	Change 500.01.0
	Reported volume size 500. Stimated changes in storage Storage pool default Volume reserve Snapshot reserve	01 GB Free 500.01 GE pool default Current 1.96 TB	3 New 2.94 TB 2.44 TB	Change 500.01 (500.01 (
	Reported volume size 500. Estimated changes in storage Storage pool default Volume reserve Snapshot reserve Replication reserve	01 GB Free 500.01 GE e pool default Current 1.96 TB 1.01 GB	3 New 2.94 TB 2.44 TB 1.01 GB	Change 500.01 C 500.01 C 0 h
	Reported volume size 500. Estimated changes in storage Storage pool default Volume reserve Snapshot reserve Replication reserve Delegated space	01 GB Free 500.01 GE 2 pool default Current 2.46 TB 1.96 TB 1.01 GB 200.01 GB	New 2.94 TB 2.44 TB 1.01 GB 200.01 GB	Change 500.01 (500.01 (0 N 0 N
	Reported volume size 500. Estimated changes in storage Storage pool default Volume reserve Snapshot reserve Replication reserve Delegated space Free pool space	01 GB Free 500.01 GE e pool default Current 2.46 TB 1.96 TB 1.01 GB 200.01 GB 49.5 TB	3 New 2.94 TB 2.44 TB 1.01 GB 200.01 GB 48.52 TB	Change 500.01 (500.01 (0) 0) - 1000.02 (- 1000.02 (
	Reported volume size 500. Setimated changes in storage Storage pool default Volume reserve Snapshot reserve Replication reserve Delegated space Free pool space Avsilable for borrowing	01 GB Free 500.01 GE current 2.46 TB 1.96 TB 200.01 GB 200.01 GB 49.5 TP 51.28 TB	New 2.94 TB 2.94 TB 2.44 TB 1.01 GB 200.01 GB 48.52 TB 50.79 TB	Change 500.01 (C 500.01 (C 0 N 0 N -1000.02 (C -500.01 (C
	Reported volume size 500. Estimated changes in storage Storage pool default Volume reserve Snapshot reserve Replication reserve Delegated space Free pool space Available for borrowing	01 GB Free 500.01 GE 2 pool default Current 1.96 TB 1.01 GB 200.01 GB 49.5 TB 51.28 TB	3 2.94 TB 2.44 TB 1.01 GB 2.00.01 GB 48.52 TB 50.79 TB	24 Change 500.01 G 500.01 G 0 M 0 M -1000.02 G -500.01 G
	Reported volume size 500. Storage pool default Volume reserve Snapshot reserve Replication reserve Delegated space Free pool space Available for borrowing	01 GB Free 500.01 GE c pool default Current 1.96 TB 1.01 GB 200.01 GB 49.5 TB 51.28 TB	3 New 2.94 TB 2.44 TB 1.01 GB 200.01 GB 48.52 TB 50.79 TB	Change 500.01 C 0 M 0 M -1000.02 C -500.01 C

4. This example creates a basic access point using IP access controls, and assigns the IPs used in the previously created standard iSCSI vSwitch. Select the Define one or more basic access points radio button, and then under Define one of more basic access points pane, click Add. In the New Basic Access Point dialog window, in the IP address field, enter the IP address assigned to the first VMkernel port in the previously created iSCSI vSwitch. Repeat this step for each VMkernel port in the host assigned to iSCSI vSwitch.

1	Create volume			X
	3 - Define iSCSI access po	ints		0
"	1 - General 🗸	What kind of acces	Dell EqualLogic Group Manager	
	2 - Space 🖌	Copy access cont	New Basic Access Point	
	> 3 - iSCSI access	Define one or mor	Description: esx173	
	4	Define one or more	You must supply at least one of the following:	
	5	Basic access points: CHAP account		Applies to O Add
	0	(any)	SCSI initiator name:	Volumes and snapshots Volumes and snapshots
			IP address: 10.10.11.176	
			Access point applies to: Volumes and snapshots	
			 ✓olumes only Snapshots only 	
		Do you want to allo	OK Cancel Help	nitiator?
				,
			<u>B</u> ack New	tt Skip to end Cancel

Note: There are many options for defining access to an iSCSI volume, and this is beyond the scope of the document. Refer to the firmware Group Administrators Guide and the document, <u>Access Control</u> <u>Policies</u>, for additional information.

5. Select the **Yes** radio button to **allow simultaneous access to the volume from more than one initiators**. This option is necessary to enable the multiple ESXi hosts in the vSphere cluster to access to this volume at the same time.

Create volume					X
3 - Define iSCSI acce	ss points				?
1 - General 2 - Space > 3 - ISCSI access 4	What kind of acc Copy access Copy access Seject or defin Define one or m Define one or m	ess type do you want for this controls from another volume e access control policies more basic access points llow access) ore access points	volume?		
6	Basic access poin CHAP account (arry) (arry)	ts: SCSI initiator (any) (any)	P addresses 10.10.11.175 10.10.11.176	Applies to Volumes and snapshots Volumes and snapshots	Add Add Modify X Delete
	Do you want to a © Yes © No	Illow simultaneous access to	this volume from more than one	iSCSI initiator?	
			Back	Next Skip to end	Cancel

- 6. Click the **Skip to end** button to skip the optional Tags and Sector size page, and review the content on the **Summary** page.
- 7. Review the volume creation information on the Summary page and click Finish.

The volume will now be created on the PS Series array.

8.1.3 Step 3: Connect to a volume on PS Series SAN

The next step connects to the volume on the SAN and verifies the connection status. Since the iSCSI access and configuration was completed in the last step, the remaining step involves rescanning the storage adapter on the ESXi host and making sure the volume appears correctly.

- 1. Return to the vSphere Web Client Hosts and Clusters inventory view and select the ESXi host.
- 2. In the Actions drop-down menu, click Storage, and then click Rescan Storage.
- 3. On the **Rescan Storage** dialog box, leave the boxes checked, and click **OK**.
- 4. Once the rescan is completed, a new EQLOGIC iSCSI Disk will be listed under the iSCSI Software Adapter **Devices** tab.

iSCSI Software Adapter							
🚱 vmhba33 i	SCSI	Online iqn.1998-01.com.vmware:esx03-wol-335cfb48					
Adapter Details ==							
Properties Devices Paths Ta	Properties Devices Paths Targets Network Port Binding Advanced Options						
😺 📑 🛋 🎼 🖓 All Ac 🍙 🗸 🗸							
Name	Туре	Capacity	Operational	Hardware Acceleration	Drive Type		
EQLOGIC iSCSI Disk (naa.60fff	disk	500.01 GB	Attached	Supported	HDD		

- 5. Click the Actions dropdown, select Storage, and select Add Datastore.
- 6. For the datastore **Type**, select **VMFS**, and click **Next** to continue.
- 7. In the **Datastore name** field, enter a name for the datastore. A common best practice is to use the same name as used on the volume on the array. In this case, **vSphereDemo** is used. Select the recently created EQLOGIC iSCSI Disk, and click **Next** to continue.

New Datastore							(?) ₩
✓ 1 Type	Datastore name: vSphereDemo						
2 Name and device selection					(0	Filter	•
3 Partition configuration	Name		LUN	Capacity	Hardware Acceler	Drive Type	Snapshot Vo
4 Ready to complete	Local VMware Di	sk (mpx.vmhba1:C0:T0:L0)	0	2.00 GB	Not supported	HDD	
	EQLOGIC ISCSI	Disk (naa.60fff14afe816982b963d5b5	0	500.01 GB	Supported	HDD	
	M						2 items
				Bac	Next	Finish	Cancel
				Baci			Cancer

8. On the Partition configuration page, leave the defaults selected, and click Next to continue.

9. On the Ready to complete page, review the setting and select Finish.

The datastore is now available for use by this ESXi host. To enable other ESXi hosts to access this datastore, it will be necessary to update the volume access controls to include those other hosts, and then perform a rescan of the iSCSI storage adapter on that host.

8.1.4 Step 4: Enabling VMware native multipathing with Round Robin

By configuring the iSCSI software initiator in the previous steps, now we can take advantage of the VMware native MPIO by enabling Round Robin. This advanced feature, combined with the fan-out intelligent design of the PS Series group, allows for greater and better bandwidth utilization.

- 1. From the vSphere Web Client homepage, select **Storage**, and then select the recently added datastore.
- 2. From that datastores page, select the **Manage** tab, then the **Settings** button, and finally click on **Connectivity and Multipathing**.
- 3. Select the hosts to which the datastore is mounted to, and then click the **Edit Multipathing** button to the lower right.
- 4. From the drop-down menu on the **Edit Multipathing Policies**, select **Round Robin**, and click **OK**. This will configure the initiator to utilize all available paths to the volume for reading and writing I/O for this volume.

Note: These steps needs to be completed for all existing and any new volumes that you want the Round Robin policy to apply to, and on each host in the cluster.

Now the multiple paths that exist to the volume show a Status of Active (I/O) for all paths.

SphereDemo Actions -							=*
Getting Started Summary Mon	nitor Manage Related	Objects					
Settings Alarm Definitions Tage	s Permissions Schedu	led Tasks Files Dell VSM	4				
44	Connectivity and Multipa	athing					
General	Select a host to view the	multipathing details for its	devices.				
Device Backing	Mount Unmour	nt					
Connectivity and Multipathing	Host	Datastore Mount	ed	Datastore Connectivity	Mount Point		
Capability sets	10.124.6.173	Mounted		Connected	/vmfs/volumes/56461fee-9f500bb0-a82e-00	5056b7fa4	7
					_		
	Multipathing Details						
	Device: EQLOGIC iSCSI	Disk (naa.60fff14afe81698	2b963d5b5ba6d6d32)			
	Multipathing Policies					E	Edit Multipathing
	Path Selection Pol	licy Round Robin (VMw	vare)				
	Storage Array Type	Policy VMW_SATP_EQL					
	Paths						
	Owner Plugin	NMP					
		Refresh Enable	e Disable				
		Runtime Name	Status	Target		LUN	Preferred
		vmhba33:C1:T0:L0	 Active (I/O) 	ign.2001-05.com.equ	uallogic:0-af1ff6-826981fe4-326d6dbab5d5	0	
		vmhba33:C0:T0:L0	 Active (I/O) 	ign.2001-05.com.equ	uallogic:0-af1ff6-826981fe4-326d6dbab5d5	0	



9 Summary

This paper has demonstrated proper configuration of the VMware iSCSI software initiator and how to connect it to the Dell PS Series SAN. With all of the advanced vSphere features that rely on shared storage, it is important to follow these steps to enable them in the vSphere environment. Always consult the *VMware iSCSI SAN Configuration Guide* for the latest documentation on configuring vSphere environments.



A Additional resources

A.1 Technical support and customer service

Offering online and telephone-based support and service options, Dell support service can answer your questions about PS Series arrays, groups, volumes, array software, and host software. Availability varies by country and product, and some services might not be available in your area.

Visit Dell.com/support or call 800-945-3355 (United States and Canada).

For international support of Dell PS Series products, visit http://www.dell.com/support/contents/us/en/555/article/Product-Support/Dell-Subsidiaries/equallogic

Note: If you do not have access to an Internet connection, contact information is printed on your invoice, packing slip, bill, or Dell product catalog.

For PS Series software and documentation, visit eqlsupport.dell.com (login required).

A.2 Dell PS Series storage solutions

To learn more about current and upcoming Dell PS Series solutions, visit the <u>PS Series Dell TechCenter</u> <u>page</u>. Here you can find articles, demos, online discussions, technical documentation, and more details about the PS Series product family.

For PS Series technical content, visit the <u>PS Series Technical Content</u> page on Dell TechCenter.

Dell Storage technical content can be found on the <u>Storage Applications Engineering</u> page.

A.3 Related documentation

Vendor	Document title
VMware	iSCSI SAN Configuration Guide (available at <u>vmware.com</u>)
VMware	vSphere system administration guides (available at <u>vmware.com</u>)
Dell	Dell EqualLogic Group Manager Administrator's Guide (available on eqlsupport.dell.com)
Dell	Configuring and Installing the PS Series Multipathing Extension Module for VMware vSphere and PS Series SANs
Dell	Access Control Policies
Dell	Best Practices for Implementing VMware vSphere in a Dell PS Series Storage Environment