

Deploying ESXi 6.0 with Dell PS and SC Series Storage on Separate iSCSI Networks

Dell Storage Engineering
October 2016

Revisions

Date	Description
October 2016	Initial release

Acknowledgements

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1 Introduction

Dell™ Storage PS Series and SC Series systems both support storage area networks (SANs) over the iSCSI protocol. This document provides best practices for deploying VMware vSphere® host servers that connect to an existing:

- PS Series storage target using a dedicated iSCSI network
- SC Series storage target using two additional dedicated iSCSI networks.

1.1 Scope

The scope of this paper focuses on:

- Dedicated switches for iSCSI storage traffic
- Non-DCB (Data Center Bridging) enabled iSCSI SAN
- Standard TCP/IP implementations utilizing standard network interface cards (NICs)
- Standard TCP/IP implementations utilizing network interface cards with iSCSI Offload Engine
- vSphere Software iSCSI Adapter for PS Series iSCSI connectivity
- vSphere Dependent Hardware iSCSI adapters for SC Series iSCSI connectivity
- Virtual LAN (VLAN) untagged solution
- IPv4 only for PS Series and SC Series

The scope of this paper does **not** include:

- DCB or sharing the same SAN infrastructure for multiple traffic types
- NIC partitioning (NPAR)
- VLAN tagging at the switch, initiator, or target
- SC Series storage systems using Fibre Channel over Ethernet (FCoE) SAN connectivity
- Non-MPIO (Multipath Input/Output) implementation

1.2 Audience

This paper is intended for storage administrators, network administrators, SAN system designers, storage consultants, or anyone tasked with configuring a SAN infrastructure for VMware ESXi hosts using PS Series and SC Series storage. It is assumed that readers have experience in designing and/or administering a shared storage solution. There are assumptions made in terms of familiarity with all current Ethernet standards as defined by the Institute of Electrical and Electronic Engineers (IEEE) as well as TCP/IP standards defined by the Internet Engineering Task Force (IETF) and FC standards defined by the T11 committee and the International Committee for Information Technology Standards (INCITS).

1.3 Terminology

The following terms are used throughout this document:

Converged network adapter (CNA): A network adapter that supports convergence of simultaneous communication of both traditional Ethernet and TCP/IP protocols as well as storage networking protocols, such as internet SCSI (iSCSI) or Fibre Channel over Ethernet (FCoE), using the same physical network interface port.

Data Center Bridging (DCB): A set of enhancements made to the IEEE 802.1 bridge specifications for supporting multiple protocols and applications in the same data center switching fabric. It is made up of several IEEE standards including Enhanced Transmission Selection (ETS), Priority-based Flow Control (PFC), Data Center Bridging Exchange (DCBX), and application Type-Length-Value (TLV). For more information read [*Data Center Bridging: Standards, Behavioral Requirements, and Configuration Guidelines with Dell EqualLogic iSCSI SANs*](#).

EqualLogic Multipathing Extension Module (MEM) for VMware vSphere: The PS Series multipath I/O (MPIO) module for ESXi.

Fault domain (FD): A set of hardware components that share a single point of failure. For controller-level redundancy, fault domains are created for SC Series storage to maintain connectivity in the event of a controller failure. In a dual-switch topology, each switch acts as a fault domain with a separate subnet and VLAN. Failure of any component in an FD will not impact the other FD.

iSCSI offload engine (iSOE): Technology that can free processor cores and memory resources to increase I/Os per second (IOPS) and reduce processor utilization.

Link aggregation group (LAG): A group of Ethernet switch ports configured to act as a single high-bandwidth connection to another switch. Unlike a stack, each individual switch must still be administered separately and function independently.

Local area network (LAN): A network carrying traditional IP-based client communications.

Logical unit (LUN): A number identifying a logical device, usually a volume that is presented by an iSCSI or Fibre Channel storage controller.

Multipath I/O (MPIO): A host-based software layer that manages multiple paths for load balancing and redundancy in a storage environment.

Native VLAN and default VLAN: The default VLAN for a packet that is not tagged with a specific VLAN or has a VLAN ID of 0 or 1. When a VLAN is not specifically configured, the switch default VLAN will be utilized as the native VLAN.

Network interface card (NIC): A network interface card or network interface controller is an expansion board inserted into the computer/server so that the computer/server can connect to a network. Most NICs are designed for a particular type of network (typically Ethernet) protocol (typically TCP/IP) and media.

NIC partitioning (NPAR): A technology used by Broadcom and QLogic which enables traffic on a network interface card (NIC) to be split into multiple partitions. NPAR is similar to QoS on the network layer and is usually implemented with 10GbE.

Storage area network (SAN): A Fibre Channel, Ethernet, or other specialized network infrastructure specifically designed to carry block-based traffic between one or more servers to one or more storage and storage inter-process communications systems.

Virtual LAN (VLAN): A method of virtualizing a LAN to make it appear as an isolated physical network. VLANs can reduce the size of and isolate broadcast domains. VLANs still share resources from the same physical switch and do not provide any additional QoS services such as minimum bandwidth, quality of a transmission, or guaranteed delivery.

VLAN tag: IEEE 802.1Q: The networking standard that supports VLANs on an Ethernet network. This standard defines a system of tagging for Ethernet frames and the accompanying procedures to be used by bridges and switches in handling such frames. Portions of the network that are VLAN-aware (IEEE 802.1Q conformant) can include VLAN tags. When a frame enters the VLAN-aware portion of the network, a tag is added to represent the VLAN membership of the frame port or the port/protocol combination. Each frame must be distinguishable as being within exactly one VLAN. A frame in the VLAN-aware portion of the network that does not contain a VLAN tag is assumed to be flowing on the native (or default) VLAN.

2 Storage product overview

The following sections provide an overview of the Dell Storage products and technologies presented in this paper.

2.1 Dell Storage PS Series arrays

PS Series arrays provide an enterprise storage solution that delivers the benefits of consolidated networked storage in an affordable and easy to use self-managing iSCSI SAN, regardless of scale. Built on an advanced, peer storage architecture, PS Series storage simplifies the deployment and administration of consolidated storage environments, enabling perpetual self-optimization with automated load balancing across PS Series members in a pool. This provides efficient enterprise scalability for both performance and capacity without forklift upgrades. PS Series storage provides a powerful, intelligent and simplified management interface.

2.2 Dell Storage SC Series arrays

SC Series storage is the Dell enterprise storage solution featuring multi-protocol support and self-optimizing, tiering capabilities. SC Series storage can be configured with all flash, as a hybrid system, or with only traditional spinning disks and features automatic migration of data to the most cost-effective storage tier. Efficient thin provisioning and storage virtualization enable disk capacity usage only when data is actually written, enabling a pay-as-you-grow architecture. This self-optimizing system can reduce overhead cost and free up the administrator for other important tasks.

3 PS and SC Series with separate iSCSI SANs

vSphere hosts can be connected to both PS and SC Series arrays through separate, dedicated iSCSI SAN infrastructures. In most cases, the need for this configuration would arise when implementing 10Gb iSCSI SC Series storage to an existing 1Gb iSCSI PS Series storage environment. However, the same configuration can be used for an all 10Gb iSCSI environment as well. The reason for isolating the PS Series and SC Series iSCSI SAN infrastructures is due to the differences in connectivity best practices for each platform. Figure 1 depicts the proper configuration of this environment.

Note: Implementing both PS and SC Series storage on vSphere where the iSCSI SAN infrastructure is shared is covered in the Dell TechCenter paper: [Best Practices for Sharing an iSCSI SAN Infrastructure with Dell PS Series and Dell SC Series Storage using VMware ESXi Hosts](#).

3.1 Topology

Figure 1 depicts the best practices for connecting a vSphere host to both PS Series and SC Series iSCSI storage using isolated 1Gb and 10Gb iSCSI SAN infrastructures. This environment has two 1Gb NICs and two 10Gb NICs on the host, each is connected to the respective 1Gb PS Series and 10Gb SC Series storage platforms. Additionally, the network switch design and storage port connectivity is shown.

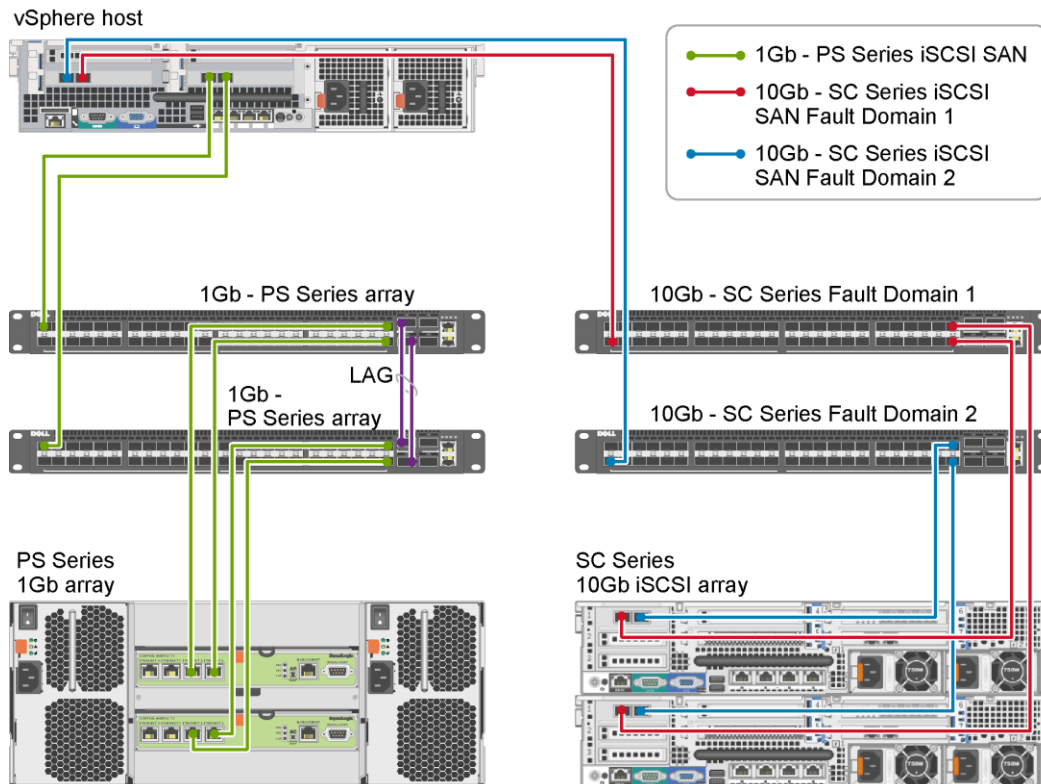


Figure 1 Isolated iSCSI SANs for both 1Gb PS Series and 10Gb SC Series storage

3.2 PS Series specific settings

The use cases defined in this paper consist of PS Series storage connected to vSphere hosts utilizing an isolated iSCSI SAN infrastructure. It is expected that the Ethernet network supporting the iSCSI SAN, as well as the vSphere hosts accessing the PS Series storage, are configured using best practice recommendations as defined in the documents, [VMware ESXi 5.1, 5.5, or 6.0 Host Configuration Guide](#) and [Dell PS Series Configuration Guide](#).

The PS Series Virtual Storage Manager (VSM), Multipath Extension Module (MEM), and iSCSI port binding best practice settings for PS Series storage are applicable on this isolated iSCSI SAN infrastructure.

Each PS Series volume is presented as a unique target with LUN 0. The PS Series volumes that are accessible to the host are listed in the iSCSI initiator properties. When a volume is connected, the iSCSI initiator establishes the initial iSCSI session and then the PS Series MPIO plugin determines if additional sessions are necessary for redundancy.

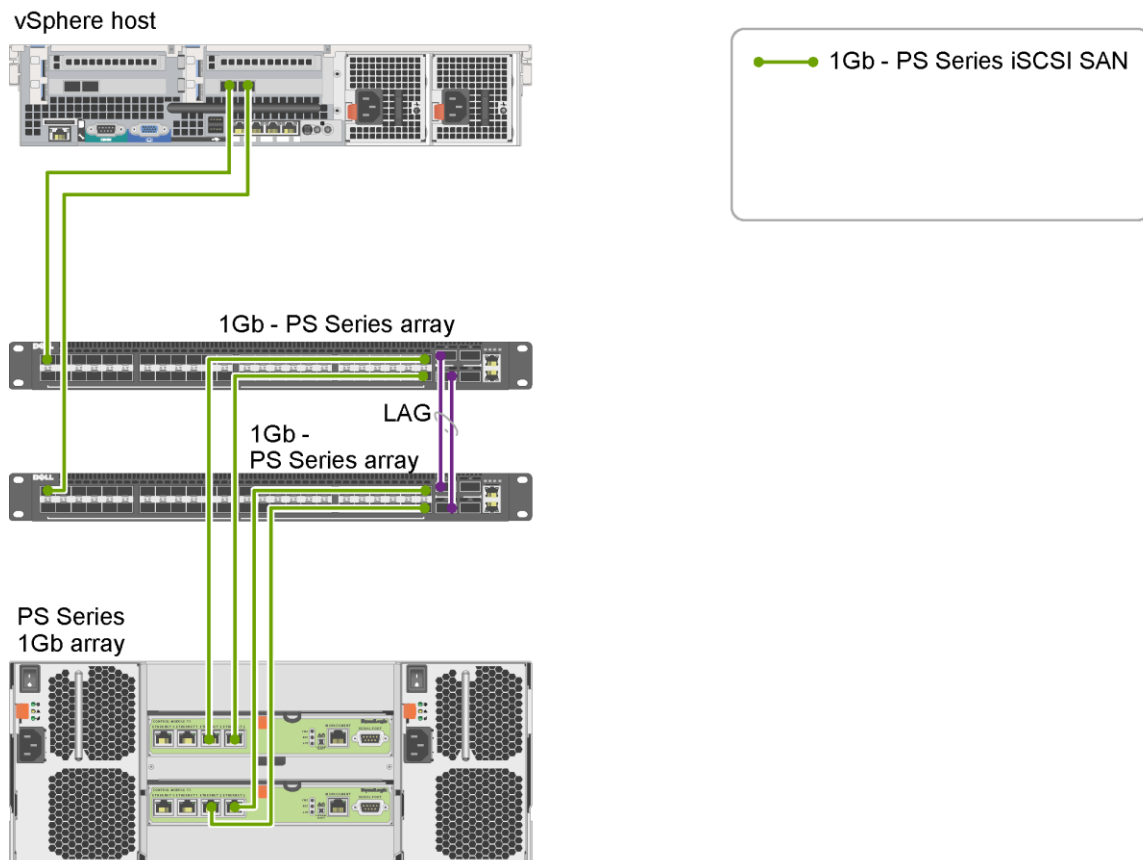


Figure 2 vSphere host connectivity showing only isolated 1Gb PS Series storage SAN

3.2.1 PS Series: Host physical connectivity and IP assignment

Connecting hosts to PS Series storage utilizes a fairly simplistic iSCSI SAN infrastructure design. This design creates an easy implementation process – one of the goals of PS Series storage. The iSCSI SAN infrastructure design includes a single VLAN, a single IP subnet, and two network switches connected together to allow traffic to pass from one to the other. Supported switches can be found in the [Dell Storage Compatibility Matrix](#).

Note: The preferred method of connecting the network switches is to use a stacking connection if available. If stacking is not available, an Inter Switch Link (ISL) using multiple connections and Link Aggregation Protocol (LAG) would be the secondary recommendation.

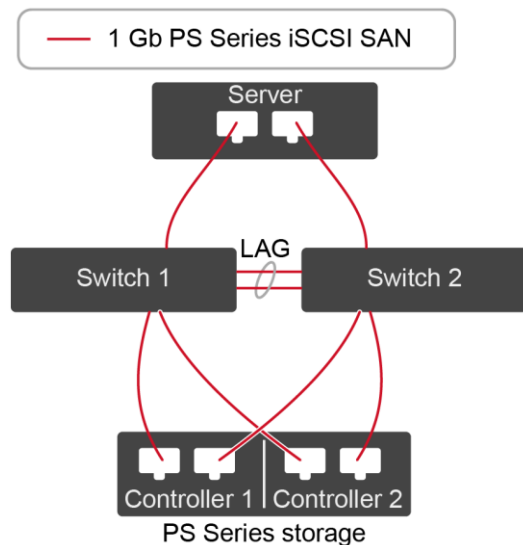


Figure 3 Connecting the host to PS Series storage

3.3 SC Series specific settings

A typical SC Series iSCSI implementation involves two separate, dedicated Ethernet iSCSI SAN fabrics, two iSCSI fault domains with an independent IP subnets, and two redundant network switches. Since connectivity to the PS Series storage is on its own separate, isolated iSCSI SAN infrastructure, the typical SC Series implementation will be used for this paper.

Each SC Series array has both front-end and back-end ports. The front-end ports present unique target LUN IDs. Every initiator (host) IP has a connection to each port that it can access. Redundant connections are made by creating multiple sessions with each of the virtual iSCSI ports of the SC Series storage system. For example, one initiator port and two target ports in each fault domain means there will be four connections (two for each fault domain).

Note that the host port on one fault domain cannot access the target port on the other fault domain. This creates a redundant iSCSI SAN infrastructure.

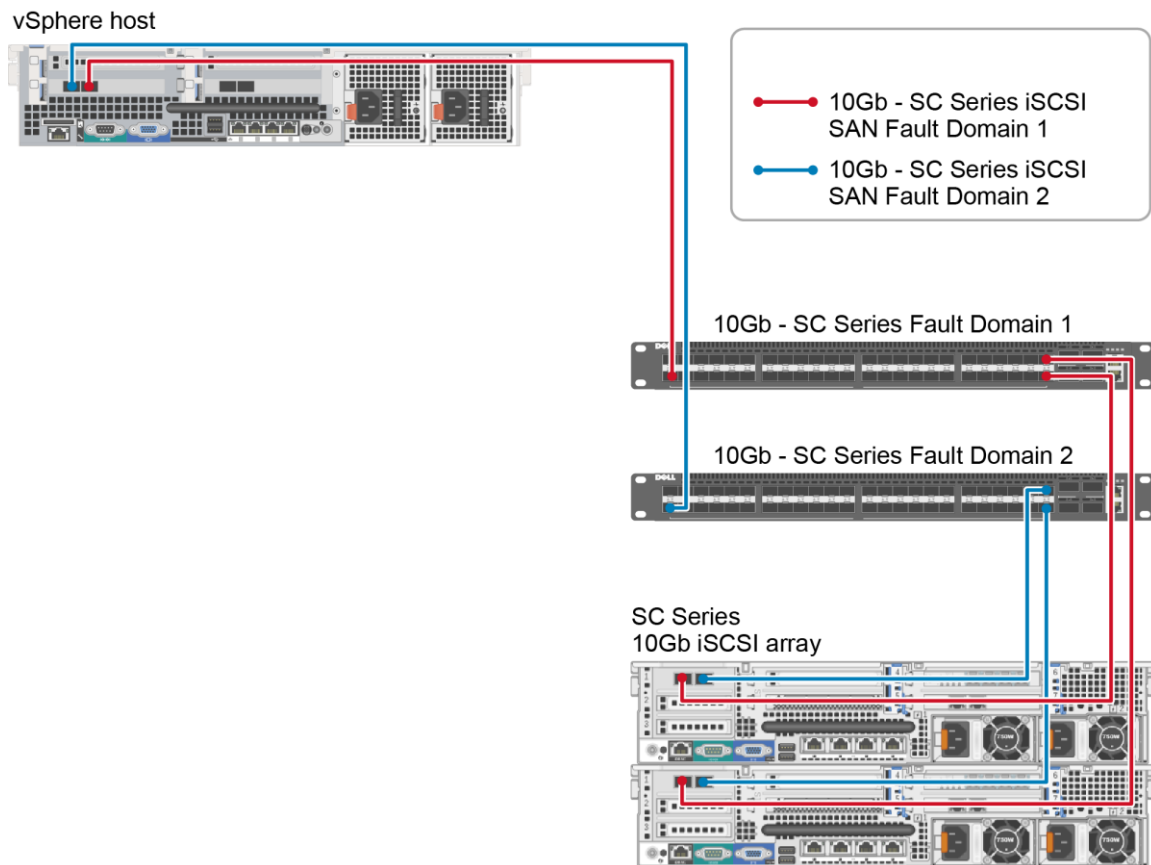


Figure 4 vSphere host connectivity showing only isolated 10Gb SC Series storage SAN

3.3.1 SC Series: Host physical connectivity and IP assignment

Depending on the OS-specific implementation, different methods are used to connect the arrays and assign IP addresses. For this environment, two SC Series Fault Domains are used for fault tolerance. As is recommended, the iSCSI Fault Domains are isolated through the use of two switches; each using a different IP subnet. It is important to ensure all host ports assigned and addressed for each Fault Domain connect to the same switch as the SC Series ports assigned and addressed for the same Fault Domain.

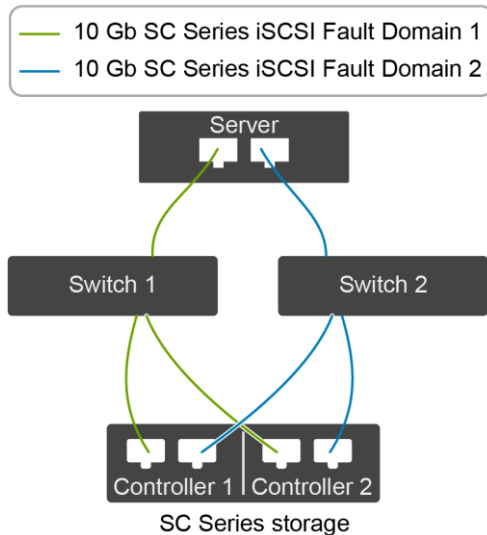


Figure 5 Connecting the host to SC Series ports

4 Enable ESXi 6.0 host access to PS Series iSCSI storage

To enable an ESXi 6.0 host to access PS Series storage when implemented in a vCenter environment, the PS Series Multipath Extension Module (MEM) is recommended. However, if the vSphere licensing in use is less than standard (vSphere 5.x or previous requires Enterprise), MEM is not supported. Although portions of the host configuration can be configured using the MEM setup processes described in section 4.2, manual configuration is described in sections [4.3](#) and [4.4](#).

4.1 Install PS Series Multipath Extension Module (MEM) for VMware

Configure VMware vSphere servers using the best practices defined in the [Dell PS Series Configuration Guide](#), including the installation of MEM on the vSphere host servers.

For more information on MEM, see [Configuring and Installing the PS Series Multipathing Extension Module for VMware vSphere and PS Series SANs](#).

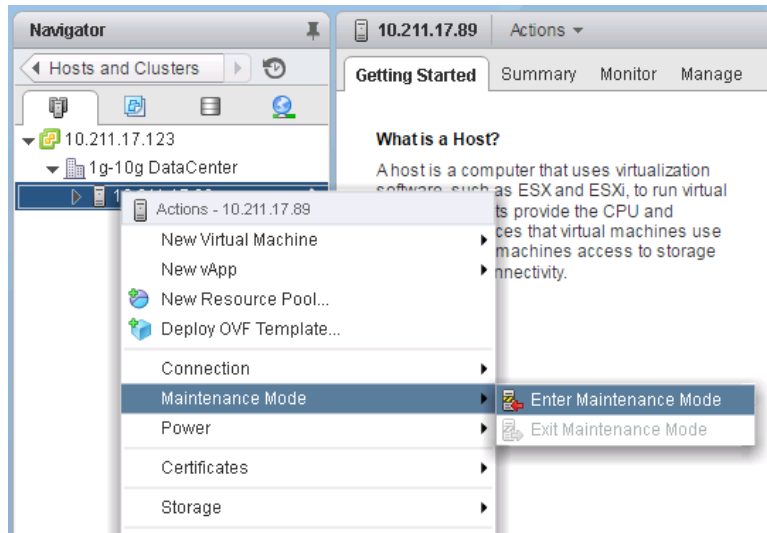
Note: When working with vSphere 6.0 or newer, configure additional security access as described in chapter 3 of [ESXi Versions 5.1, 5.5, or 6.0 Host Configuration Guide](#) before installing MEM. Additional information can be found in this [VMware KB article](#).

Prerequisites for installing and configuring MEM on a vSphere host are:

- Do NOT configure iSCSI networking prior to installing/configuring MEM – for either the PS Series or SC Series iSCSI SAN infrastructures.
- Do not enable the Software iSCSI Adapter
- Put the vSphere host into maintenance mode to install MEM.
- Reboot of the vSphere host is recommended. A reboot is not required for installation, however, enabling configuration of MEM through the vCLI does require a reboot.

MEM can be installed using the VMware Update Manager (VUM) or using one of the following command line tools: vSphere CLI, vMA (virtual Management Appliance), or the vSphere ESXi console. This paper provides the steps required to install and configure MEM using the vSphere CLI utility.

1. From the **Hosts and Clusters** view, right-click the vSphere host and select **Maintenance Mode** and click **Enter Maintenance Mode**. Click **OK** to confirm.



2. Open the vSphere CLI, navigate to the location of the downloaded MEM installation files and execute the following command and options:
`setup.pl --install --server=server IP address --reboot` (reboot is optional, but recommended)
3. Enter the username and password for the server (the username and password can be included as options with the setup.pl script).

Note: When working with vSphere 6.0 or newer, configure additional security access as described in chapter 3 of [ESXi Versions 5.1, 5.5, or 6.0 Host Configuration Guide](#) before installing MEM. Additional information can be found in this [VMware KB article](#).

```
C:\EqualLogic-ESX-Multipathing-Module>setup.pl --install --server=10.211.17.89 --
-bundle=dell-eql-mem-esx6-1.3.0.410095.zip --reboot
You must provide the username and password for the server.
Clean install of Dell EqualLogic Multipathing Extension Module.
Bundle being installed dell-eql-mem-esx6-1.3.0.410095.zip
Copying dell-eql-mem-esx6-1.3.0.410095.zip to [datastore1]/dell-eql-mem-esx6-1.3
.0.410095.zip
The install operation may take several minutes. Please do not interrupt it.
Check to see if the install succeeded
Install succeeded
Clean install was successful.
Rebooting host.
```

4. When the vSphere host is back online, confirm the installation of MEM by executing the following command:

`setup.pl --server server IP address --query`

```
C:\EqualLogic-ESX-Multipathing-Module>setup.pl --server 10.211.17.89 --query
You must provide the username and password for the server.
Found Dell EqualLogic Multipathing Extension bundle installed: 1.3.0-407867
Default PSP for EqualLogic devices is DELL_PSP_EQL_ROUTED.
No UMkernel ports bound for use by iSCSI multipathing.
C:\EqualLogic-ESX-Multipathing-Module>_
```

Note: MEM is only supported when using VMware ESXi Enterprise or Enterprise Plus licensing.

4.2 Configure MEM to access PS Series volumes

Configuring MEM to access PS Series volumes is an automated process that prompts for specific information. With the complete information provided, all relevant settings are made on the vSphere host where MEM is being configured.

1. Configuration of MEM is performed using the vCLI by executing the following command:

```
setup.pl --configure --server=server IP address
```

Note: Specific settings for your environment may differ from those used in this example. MEM configuration settings that must be used to adhere to best practices are noted.

2. Enter the username and password for the server
3. Select the new vSwitch type: Press **Enter** to accept the default
4. Enter the new vSwitch name: **vSwitch-1G-PS-iSCSI**
5. Identify the vmnics dedicated to PS Series iSCSI storage traffic: **vmnic0 vmnic1**
6. Enter the IP address for the vmknic using vmnic0: **10.30.10.89**
7. Enter the IP address for the vmknic using vmnic1: **10.30.10.90**
8. Enter the Netmask for all vmknics: **255.255.255.0**
9. Enter the MTU to be used: **9000**
10. Enter the desired VMKernel Portgroup prefix: **1g-PS-iSCSI**
11. Enter the VlanID to be used: **0**
12. Specify SW iSCSI or HW iSCSI: **SW** (required for this configuration)
13. Software iSCSI initiator, if not enabled, do you wish to enable it: **yes** (required if asked)
14. Enter PS Group IP address for target discovery: **10.30.10.130**
15. Configure CHAP if desired: press **enter**
16. Apply Dell Equallogic best practice settings to the iSCSI adapters: **yes**
17. Confirm information provided and proceed: **yes**

```

C:\EqualLogic-ESX-Multipathing-Module>setup.pl --configure --server=10.211.17.89
You must provide the username and password for the server.

Do you wish to use a standard vSwitch or a vNetwork Distributed Switch (vSwitch/
vDS) [vSwitch]:
Found existing switches vSwitch0.
vSwitch Name [vSwitch1ISCSI]: vSwitch-1G-PS-iSCSI

Which nics do you wish to use for iSCSI traffic? [vmnic0 vmnic1 vmnic2 vmnic4 vm
nic5 vmnic6 vmnic7]: vmnic0 vmnic1

IP address for vmknics using nic vmnic0: 10.30.10.89
IP address for vmknics using nic vmnic1: 10.30.10.90

Netmask for all vmknics [255.255.255.0]:

What MTU do you wish to use for iSCSI vSwitches and vmknics? Before increasing
the MTU, verify the setting is supported by your NICs and network switches. [150
0]: 9000

What prefix should be used when creating VMKernel Portgroups? [iSCSI]: 1g-PS-iSC
SI

What VLANid do you wish to use for Portgroup for vSwitch to be configured [0]:

Do you wish to use SW iSCSI or HW iSCSI? (sw/hw) [SW]:

The SW iSCSI initiator is not enabled, do you wish to enable it? [yes]:

What PS Group IP address would you like to add as a Send Target discovery addres
s (optional)? : 10.30.10.130

What CHAP user would you like to use to connect to volumes on this group (option
al)? :

Would you like to apply Dell EqualLogic best practice settings to the iSCSI adap
ters? See the Installation and User Guide for more information on the settings
that will be applied. [yes]:
Configuring iSCSI networking with following settings:
    Using a standard vSwitch 'vSwitch-1G-PS-iSCSI'
    Using NICs 'vmnic0,vmnic1'
    Using IP addresses '10.30.10.89,10.30.10.90'
    Using netmask '255.255.255.0'
    Using MTU '9000'
    Using prefix '1g-PS-iSCSI' for VMKernel Portgroups
    Using SW iSCSI initiator
    Enabling SW iSCSI initiator
    Adding PS Series Group IP '10.30.10.130' to Send Targets discovery list.
    Applying best practice configuration settings

The following command line can be used to perform this configuration:
C:\EqualLogic-ESX-Multipathing-Module\setup.pl --configure --server=10.211.17.89
--vswitch=vSwitch-1G-PS-iSCSI --mtu=9000 --nics=vmnic0,vmnic1 --ips=10.30.10.89
,10.30.10.90 --vlanid=0 --netmask=255.255.255.0 --vmkernel=1g-PS-iSCSI --nohwisc
si --enableswiscsi --groupip=10.30.10.130 --bestpractices

Do you wish to proceed with configuration? [yes]: _

```



```

Do you wish to proceed with configuration? [yes]:
Configuring networking for iSCSI multipathing:
  vswitch = vSwitch-1G-PS-iSCSI
  mtu = 9000
  nics = vmnic0 vmnic1
  ips = 10.30.10.89 10.30.10.90
  netmask = 255.255.255.0
  vmkernel = 1g-PS-iSCSI
  enableswiscsi = 1
  nohwiscsi = 1
  EQL group IP = 10.30.10.130
  bestpractices = 1
Creating vSwitch vSwitch-1G-PS-iSCSI.
Setting vSwitch MTU to 9000.
Creating portgroup 1g-PS-iSCSI0 on vSwitch vSwitch-1G-PS-iSCSI.
Assigning IP address 10.30.10.89 to 1g-PS-iSCSI0.
Creating portgroup 1g-PS-iSCSI1 on vSwitch vSwitch-1G-PS-iSCSI.
Assigning IP address 10.30.10.90 to 1g-PS-iSCSI1.
Creating new bridge.
Adding uplink vmnic0 to vSwitch-1G-PS-iSCSI.
Adding uplink vmnic1 to vSwitch-1G-PS-iSCSI.
Setting new uplinks for vSwitch-1G-PS-iSCSI.
Setting uplink for 1g-PS-iSCSI0 to vmnic0.
Setting uplink for 1g-PS-iSCSI1 to vmnic1.
Enabling SW initiator.
Enabled SW initiator.
Bound vmk1 to vmhba39.
Bound vmk2 to vmhba39.
Set SATP Host System Best Practices.
Set SATP HostSystem Best Practices.
Checking global HBA settings for adapter vmhba39.
LoginTimeout is already set to 60
DelayedAck is already set to false
Refreshing host storage system.
Adding discovery address 10.30.10.130 to storage adapter vmhba39.
Rescanning all HBAs.
Network configuration finished successfully.
C:\EqualLogic-ESX-Multipathing-Module>_

```

18. Reboot the server (not required, but recommended).

Note: Install and configure MEM on all hosts connecting to PS Series storage prior to creating VMs, or alternatively, install and configure one host at a time by evacuating all VMs to other hosts in the cluster.

19. Exit Maintenance Mode on the vSphere host.

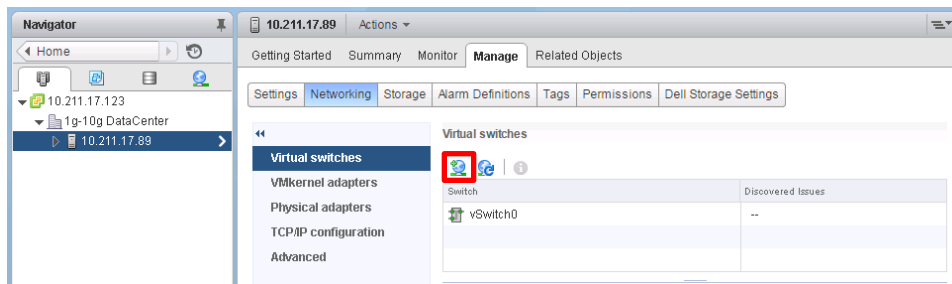
After successfully installing and configuring MEM on all vSphere hosts connecting to PS Series storage, create needed volumes and configure access to them on the PS Group using either PS Group Manager or Dell Storage Manager. A rescan of the Software iSCSI Adapter may be required.

Note: MEM is only supported when using VMware ESXi Standard or above (Enterprise or above for vSphere 5.x or previous) licensing.

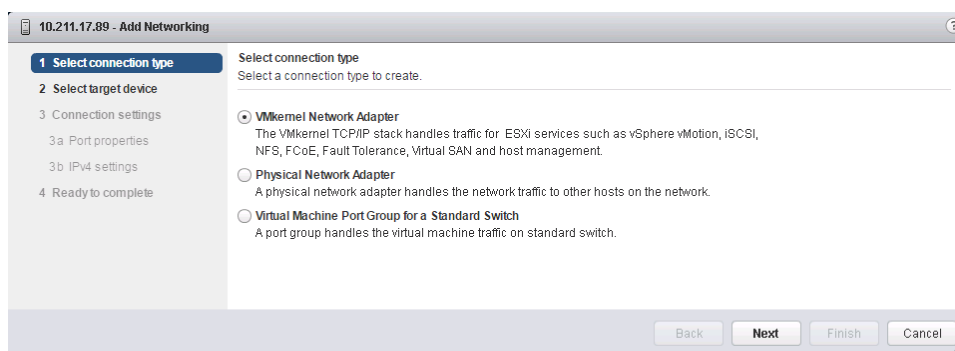
4.3 Manually configure networking to access PS Series volumes (Optional – No MEM)

In environments where MEM is not supported, networking must be configured manually to connect the ESXi host to the 1Gb PS Series iSCSI storage. The configuration consists of a single vSwitch with all (in this case, two) vmnics dedicated to 1Gb iSCSI traffic as uplinks. Additionally, a VMkernel (VMK) port is created and linked to each vmnic used. For the purposes of this paper, the addresses assigned to the two vmk ports used to connect to the 1Gb iSCSI PS Series storage are: 10.30.10.89 and 10.30.10.90.

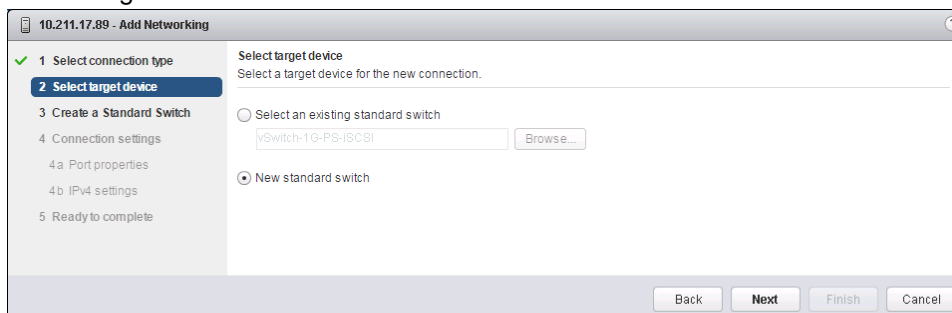
5. From the Hosts and Clusters view, select **Manage, Networking, Virtual switches**, and click the **Add host networking** icon.



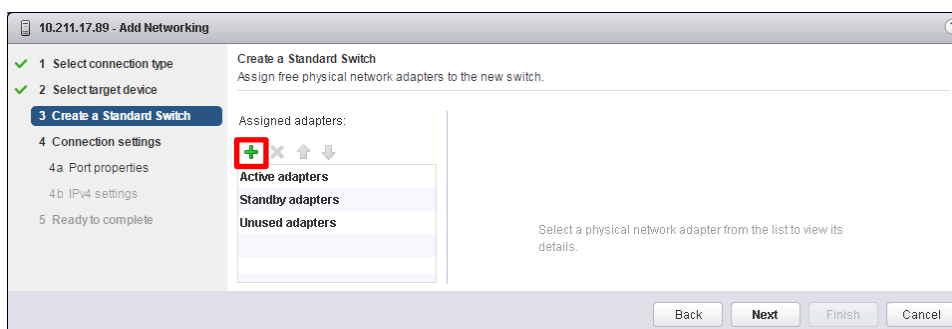
6. Select Connection Type: **VMkernel Network Adapter** and click **Next**



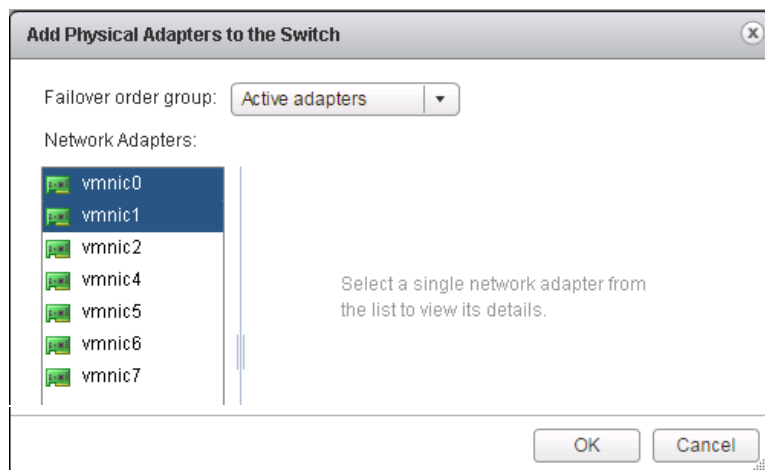
7. Select target device: **New standard switch** and click **Next**



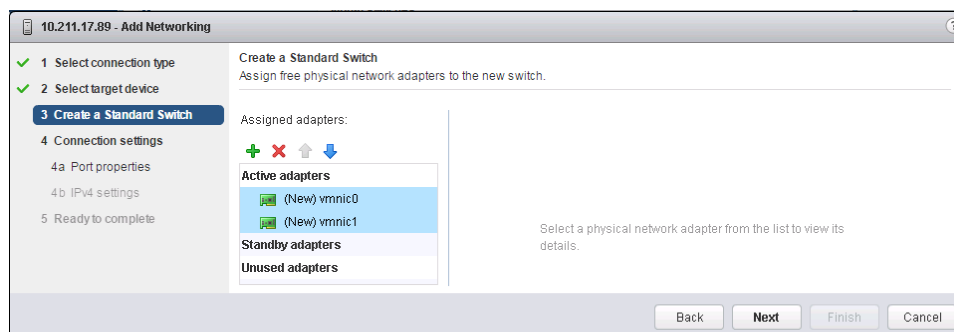
8. Create a Standard Switch: click the **Add Adapter** icon



9. Add Physical Adapters to the Switch: Select appropriate adapters (**vmnic0**, **vmnic1**) from list and click **OK**



10. Click **Next**.



11. Port properties (for the first vmk port), make the following selections:

- Network label: **1g-PS-iSCSI0** (descriptive name)
- VLAN ID: **Default** (or appropriate)
- IP Settings: **Default** (IPv4)
- TCP/IP stack: **Default**
- Available services: **No other selections**

12. Click **Next**.

The screenshot shows the '10.211.17.89 - Add Networking' wizard. The left sidebar shows the progress: 1 Select connection type, 2 Select target device, 3 Create a Standard Switch, 4 Connection settings, 4a Port properties (selected), 4b IPv4 settings, and 5 Ready to complete. The main area is titled 'Port properties' with the subtitle 'Specify VMkernel port settings.' It contains 'VMkernel port settings' with fields for 'Network label' (1g-PS-ISCST0), 'VLAN ID' (None (0)), 'IP settings' (IPv4), and 'TCP/IP stack' (Default). Below is the 'Available services' section with a list of services to enable: vMotion traffic, Provisioning traffic, Fault Tolerance logging, Management traffic, vSphere Replication traffic, vSphere Replication NFC traffic, and Virtual SAN traffic. At the bottom are 'Back', 'Next' (highlighted), 'Finish', and 'Cancel' buttons.

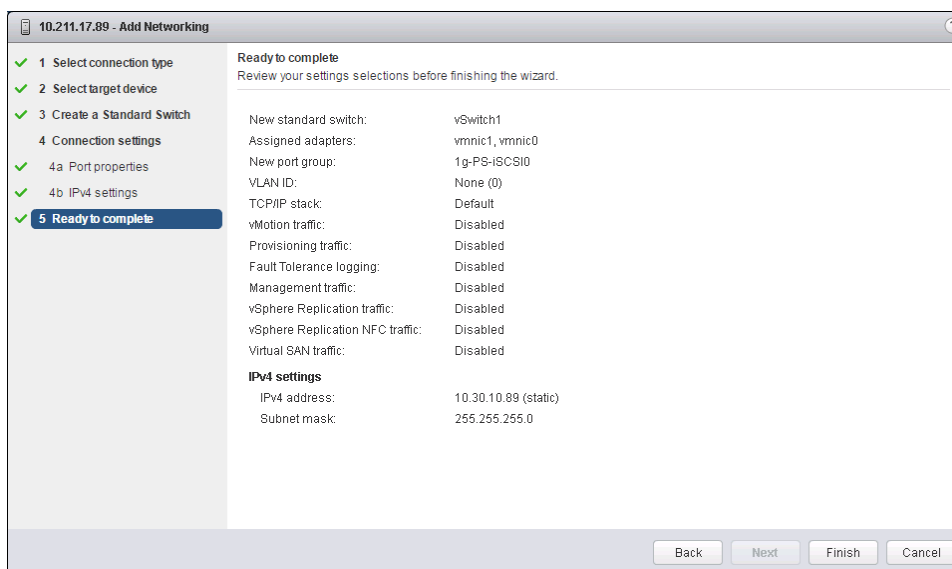
13. IPv4 settings:

- **Use static IPv4 settings** (your environment may differ)
- IPv4 address: **10.30.10.89** (used for this example)
- Subnet mask: **255.255.255.0** (used for this example)
- Default gateway for IPv4: **Leave default**
- DNS server addresses: **Leave default**

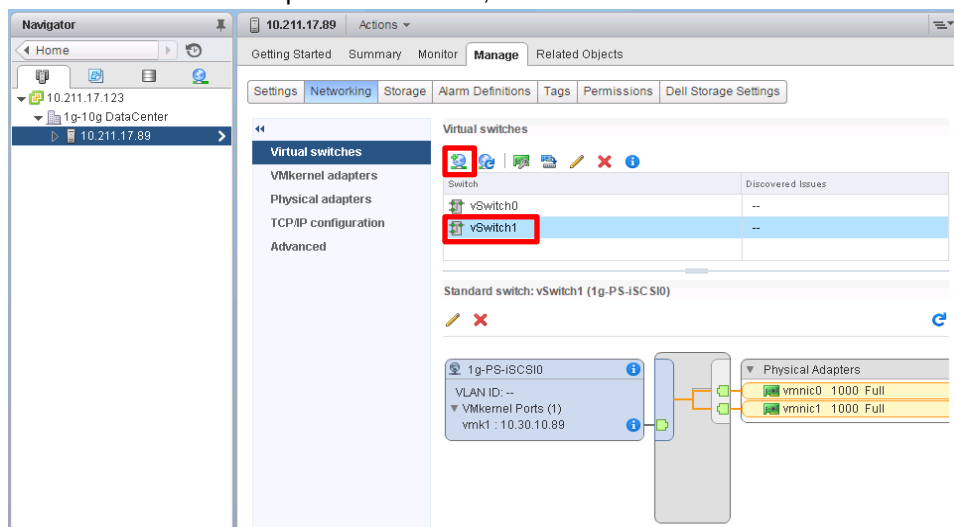
14. Click **Next**.

The screenshot shows the '10.211.17.89 - Add Networking' wizard, Step 4b: IPv4 settings. The left sidebar shows the progress: 1 Select connection type, 2 Select target device, 3 Create a Standard Switch, 4 Connection settings, 4a Port properties, 4b IPv4 settings (selected), and 5 Ready to complete. The main area is titled 'IPv4 settings' with the subtitle 'Specify VMkernel IPv4 settings.' It has two radio buttons: 'Obtain IPv4 settings automatically' and 'Use static IPv4 settings' (selected). Below are fields for 'IPv4 address' (10 . 30 . 10 . 89), 'Subnet mask' (255 . 255 . 255 . 0), 'Default gateway for IPv4' (10.211.17.126), and 'DNS server addresses' (10.211.18.4). At the bottom are 'Back', 'Next' (highlighted), 'Finish', and 'Cancel' buttons.

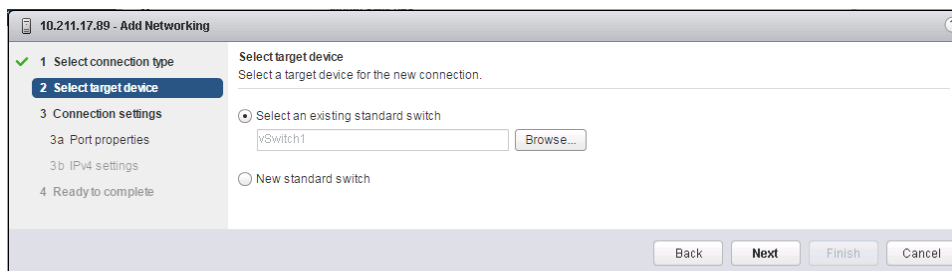
15. Confirm the settings and click **Finish**.



16. To add the second vmk port to vSwitch 1, select **vSwitch1** and click the **Add host networking** icon.



17. Select an existing standard switch. If not listed already, click browse to select the proper standard switch. Click **Next**.



18. Port properties:

- Network label: **1g-PS-iSCSI1** (descriptive name)
- VLAN ID: **Default** (or appropriate)
- IP Settings: **Default** (IPv4)
- TCP/IP stack: **Default**
- Available services: **No other selections**

19. Click **Next**.

The screenshot shows the '10.211.17.89 - Add Networking' wizard. The left sidebar shows the progress: 1 Select connection type, 2 Select target device, 3 Connection settings (with sub-steps 3a Port properties, 3b IPv4 settings, and 4 Ready to complete). The main area is titled 'Port properties' with the instruction 'Specify VMkernel port settings.' Under 'VMkernel port settings', the 'Network label' is '1g-PS-iSCSI1', 'VLAN ID' is 'None (0)', 'IP settings' is 'IPv4', and 'TCP/IP stack' is 'Default'. Under 'Available services', there are checkboxes for 'vMotion traffic', 'Provisioning traffic', 'Fault Tolerance logging', 'Management traffic', 'vSphere Replication traffic', 'vSphere Replication NFC traffic', and 'Virtual SAN traffic', all of which are currently unchecked. At the bottom are 'Back', 'Next', 'Finish', and 'Cancel' buttons.

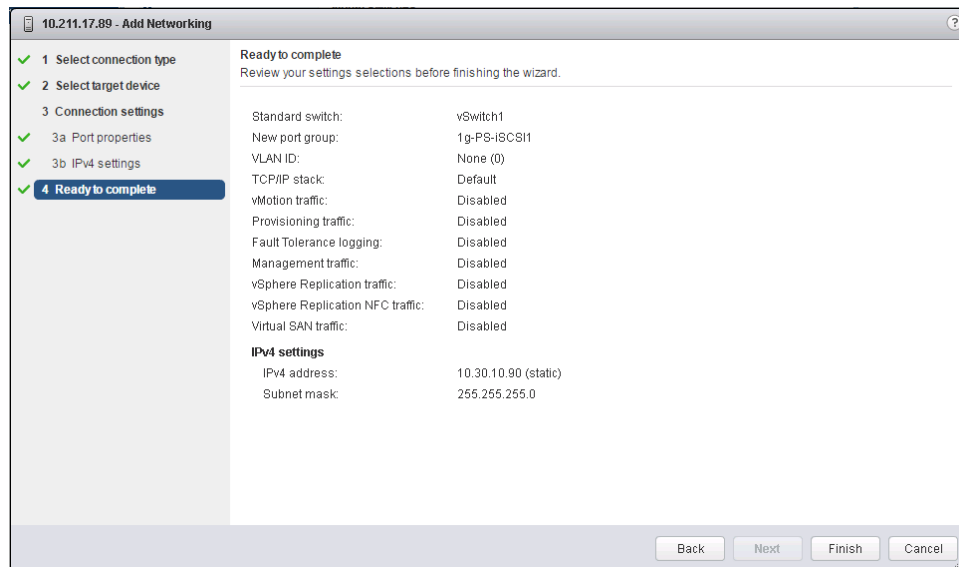
20. IPv4 settings:

- **Use static IPv4 settings** (your environment may differ)
- IPv4 address: **10.30.10.90** (used for this example)
- Subnet mask: **255.255.255.0** (used for this example)
- Default gateway for IPv4: **Default**
- DNS server addresses: **Default**

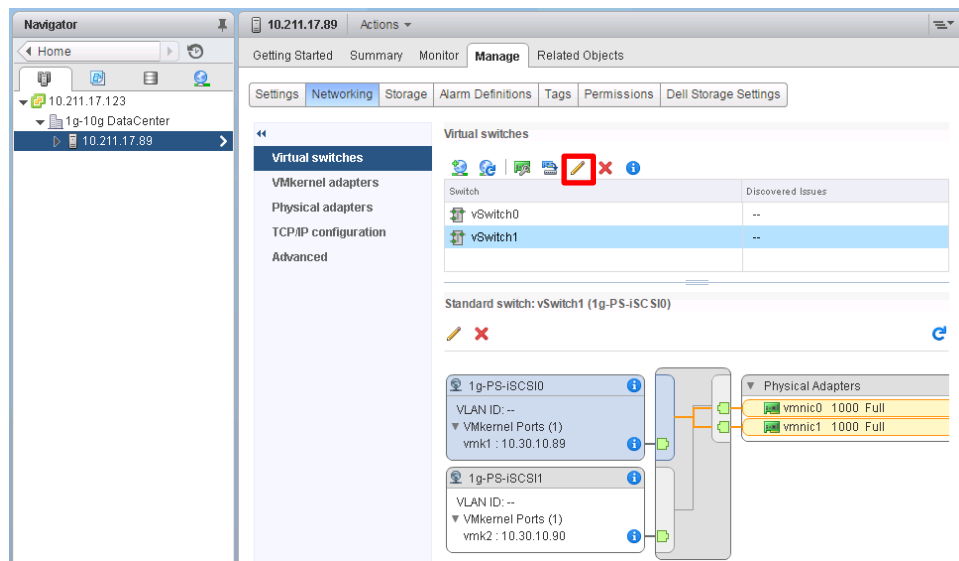
21. Click **Next**.

The screenshot shows the '10.211.17.89 - Add Networking' wizard at Step 3b: IPv4 settings. The left sidebar shows the progress: 1 Select connection type, 2 Select target device, 3 Connection settings (with sub-steps 3a Port properties, 3b IPv4 settings, and 4 Ready to complete). The main area is titled 'IPv4 settings' with the instruction 'Specify VMkernel IPv4 settings.' There are two radio buttons: 'Obtain IPv4 settings automatically' (unchecked) and 'Use static IPv4 settings' (checked). Under 'Use static IPv4 settings', the 'IPv4 address' is '10 . 30 . 10 . 90', the 'Subnet mask' is '255 . 255 . 255 . 0', the 'Default gateway for IPv4' is '10.211.17.126', and the 'DNS server addresses' are '10.211.18.4'. At the bottom are 'Back', 'Next', 'Finish', and 'Cancel' buttons.

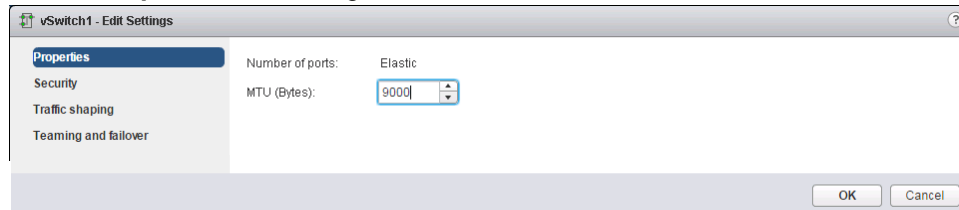
22. Confirm settings and click **Finish**.



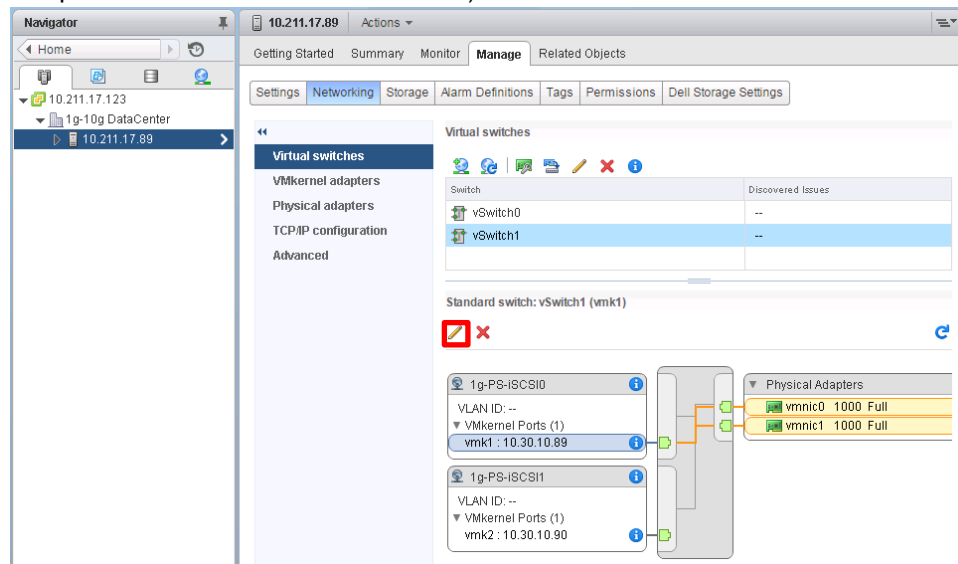
23. Select the newly created vSwitch (vSwitch1) and click the Edit icon.



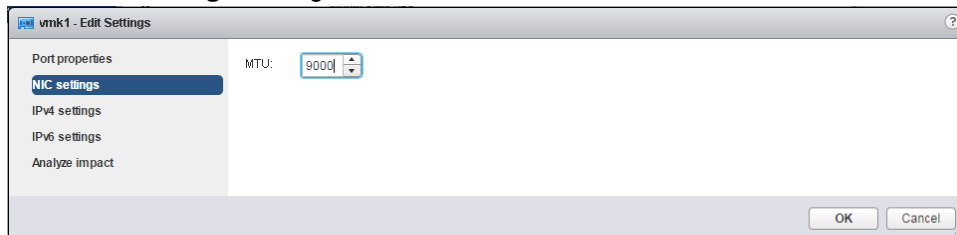
24. On the **Properties** tab, change the MTU to **9000** and click **OK**.



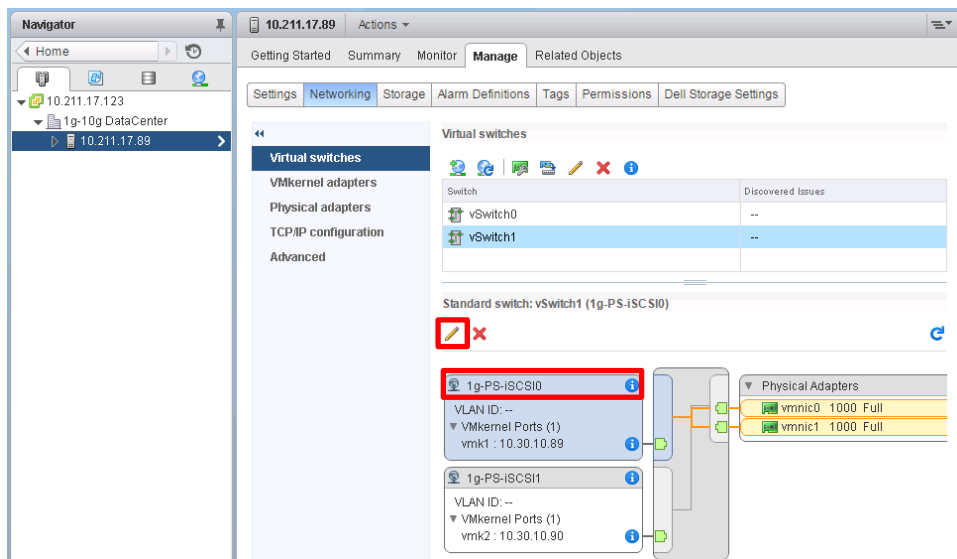
25. Select the vmk (**vmk1/vmk2**) port and click the **edit** icon (steps 21-22 must be performed for each vmk port used for 1Gb PS Series iSCSI).



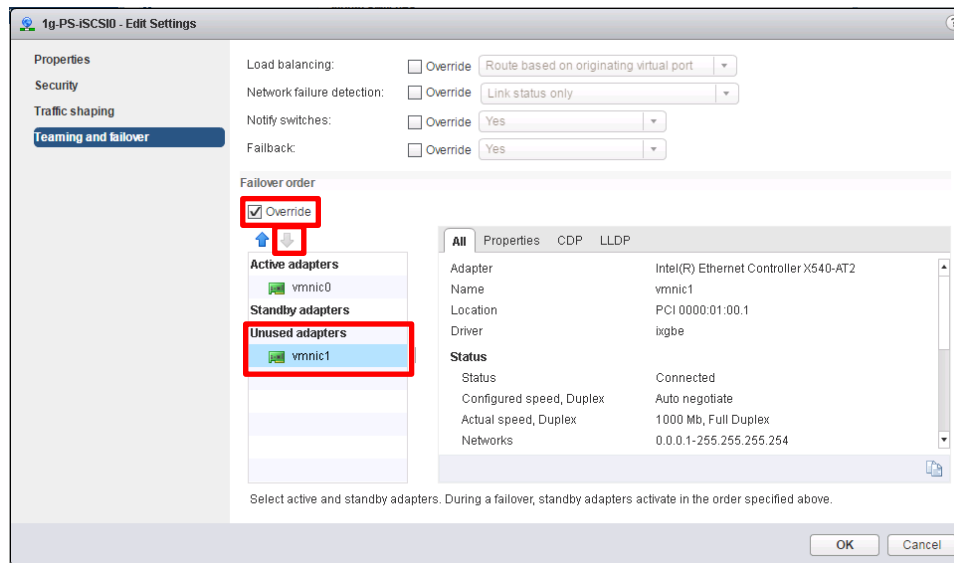
26. In the **NIC settings**, change the MTU to **9000** and click **OK**.



27. Repeat steps 21-22 for **vmk2**.
28. Select the portgroup (**1g-PS-iSCSI0**) and click the **Edit** icon (repeat steps 24-25 for **1g-PS-iSCSI1**).

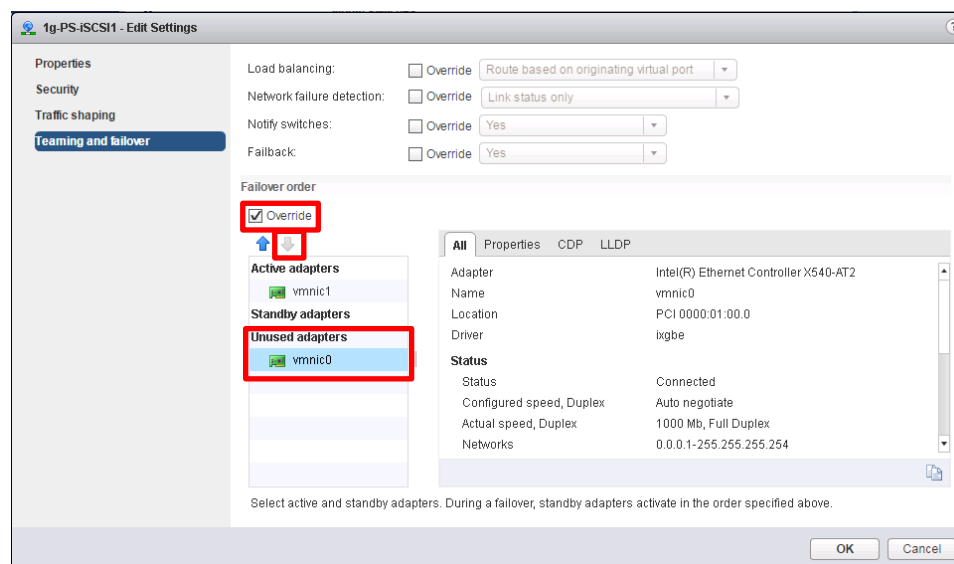


29. On the **Teaming and failover** tab, check the **Override** box and use the arrow buttons to move **vmnic1** to the **Unused adapters** section and click **OK**.



Note: Overriding the adapter failover so that each vmnic is active for only one vmk portgroup (and the other adapter is set to unused) directs iSCSI traffic over specific vmnic adapters for each vmk portgroup. This is required to bind the vmk portgroups to the iSCSI Software Adapter (explained in section 4.4).

30. Repeat steps 24-25 for portgroup **1g-PS-iSCSI1** and move **vmnic0** to the **Unused adapters** section.

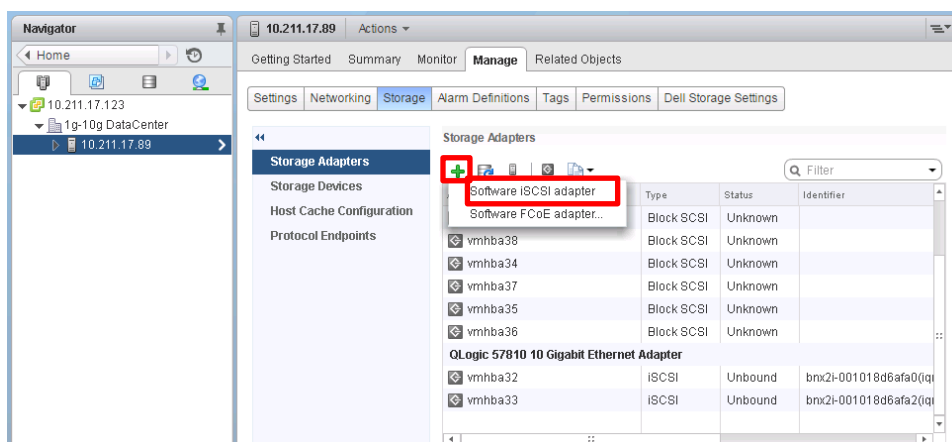


4.4 Manually configure iSCSI Software Adapter to access PS Series volumes (Optional – No MEM)

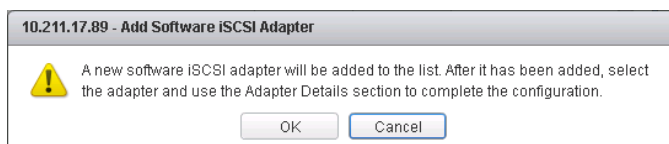
In environments where MEM is not supported, the VMware iSCSI Software Adapter must be configured manually to be bound to the VMkernel ports configured in section 4.3. This configuration results in all 1Gb vmk ports dedicated to the PS Series iSCSI storage being bound to the iSCSI Software Adapter and the PS Series Group IP address entered as the storage target. For the purposes of this paper, the address used as the iSCSI target portal (the PS Series Group address) is 10.30.10.130.

For port binding to work properly, the initiator (host) must be able to reach the target (storage) on the same subnet. iSCSI port binding does not support routing.

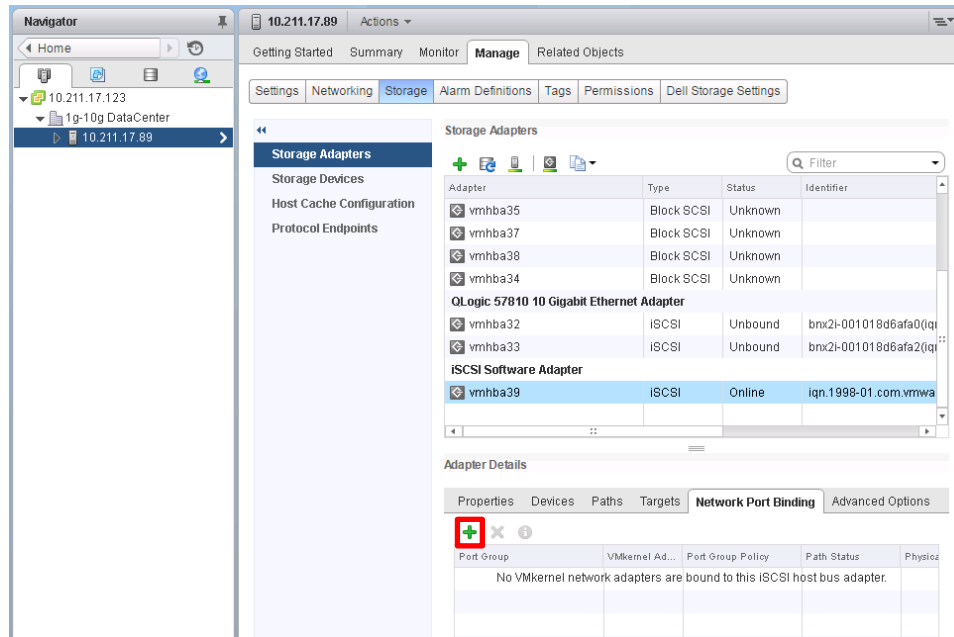
1. From the **Hosts and Clusters** view, select **Manage, Storage, Storage Adapters**, click the **Add (+)** button, and click **Software iSCSI adapter**. (Skip to step 3 if the **iSCSI Software Adapter** already exists)



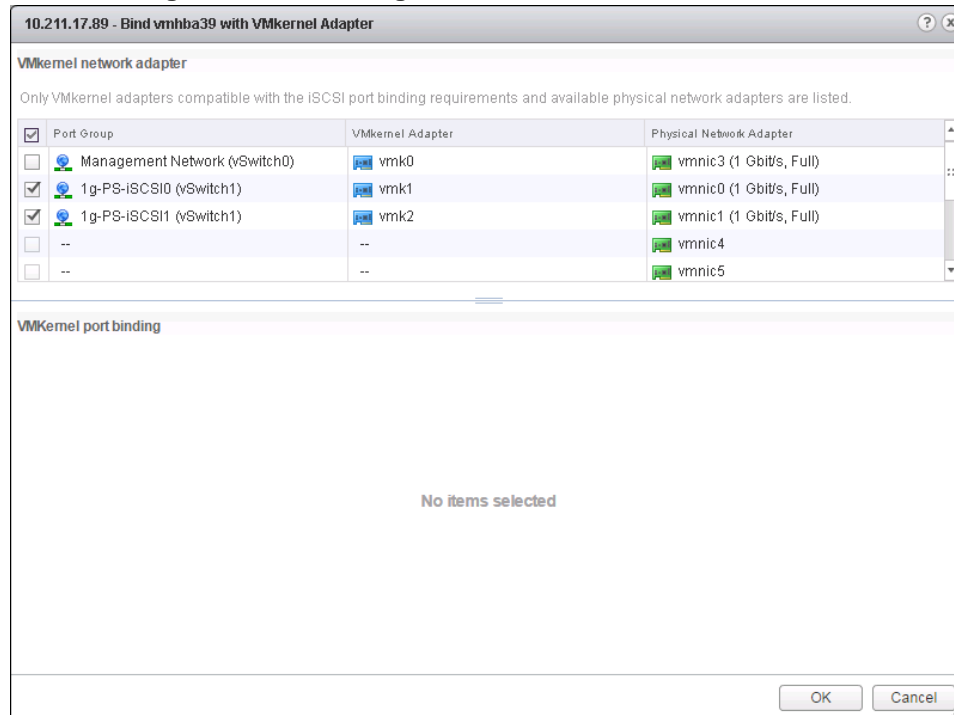
2. Click **OK** to confirm adding the Software iSCSI Adapter.



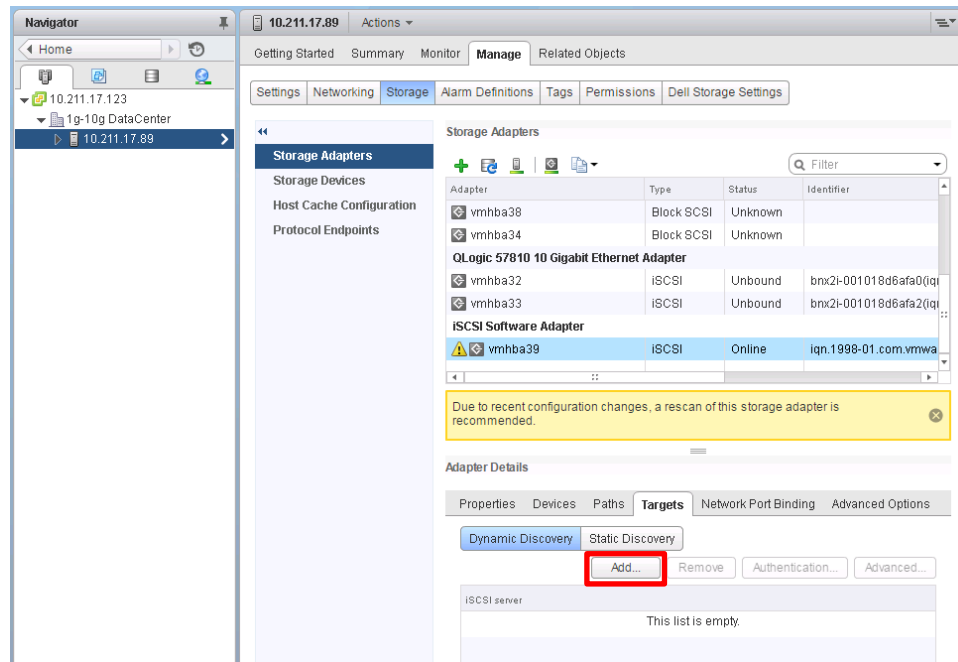
- From the **Hosts and Clusters** view, select **Manage, Storage, Storage Adapters**, the iSCSI Software Adapter (**vmhba39**), **Network Port Binding** in **Adapter Details**, and click the **Add (+)** icon.



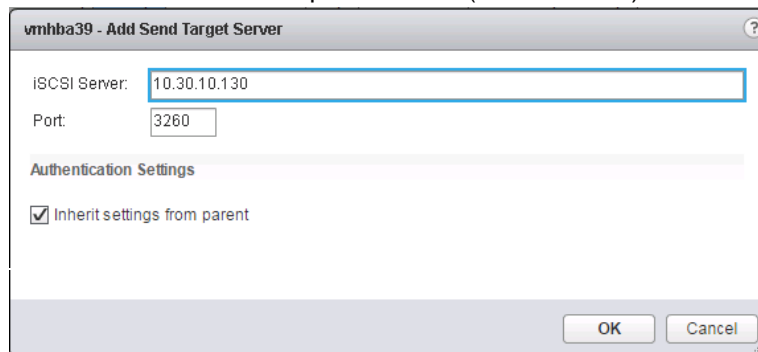
- Select both **1g-PS-iSCSI0** and **1g-PS-iSCSI1** from the list and click **OK**.



5. Select the **Targets**, click **Dynamic Discovery**, and click **Add**.



6. Enter the PS Series Group IP address (**10.30.10.130**) and click **OK**.



After successfully configuring networking and the VMware iSCSI Software Adapter on all vSphere hosts connecting to PS Series storage, create volume(s) and configure Access to those volumes on the PS Group using either PS Group Manager or Dell Storage Manager. A rescan of the Software iSCSI Adapter may be required.

5 Enable ESXi 6.0 host access to SC Series iSCSI storage

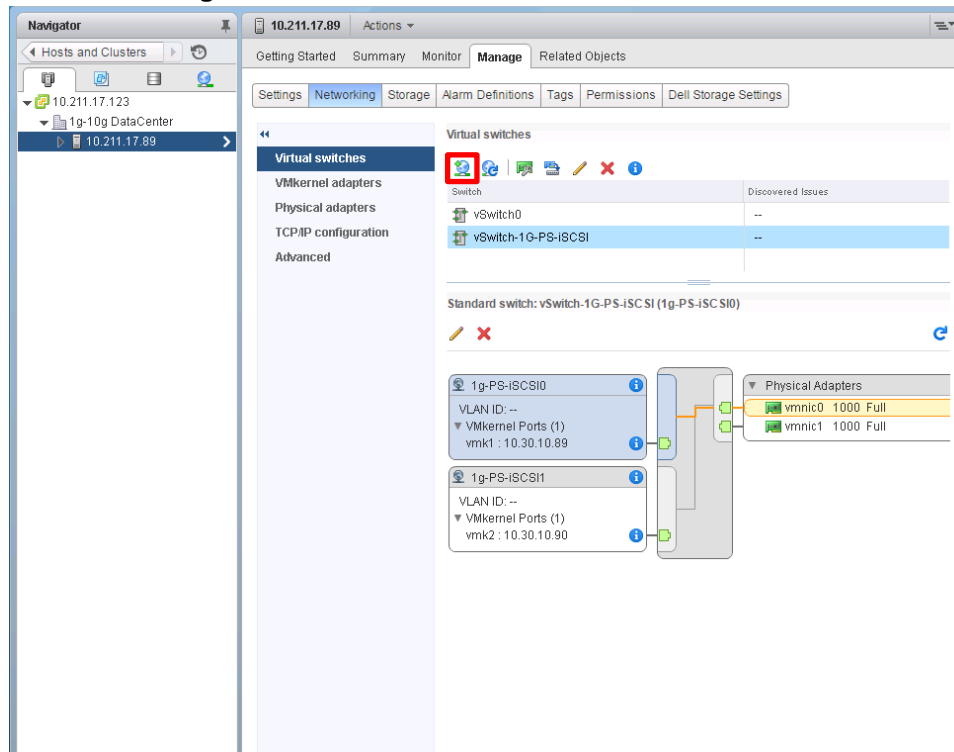
To enable an ESXi 6.0 host to access SC Series storage when implemented in a vCenter environment, the networking and storage access requires manual configuration due to the large number of configuration differences. The steps to configure network and storage access are below.

Note: Configure 10g iSCSI networking for the SC Series storage only after the PS adapters have been configured in [section 4](#).

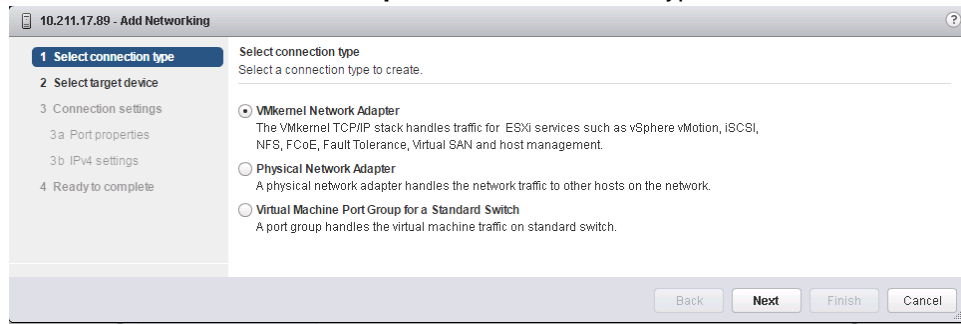
5.1 Manually configure networking to access SC Series volumes

Configuring ESXi hosts to access SC Series iSCSI storage using a dual subnets and fault domains by creating a vSwitch with one vmnic and one VMkernel (vmk) port for each dependent hardware iSCSI adapter used.

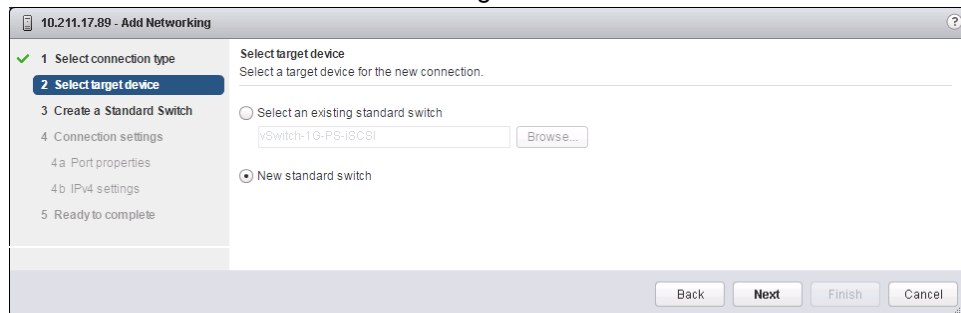
1. From the Hosts and Clusters view, select **Manage, Networking, Virtual switches**, and click the **Add host networking** icon.



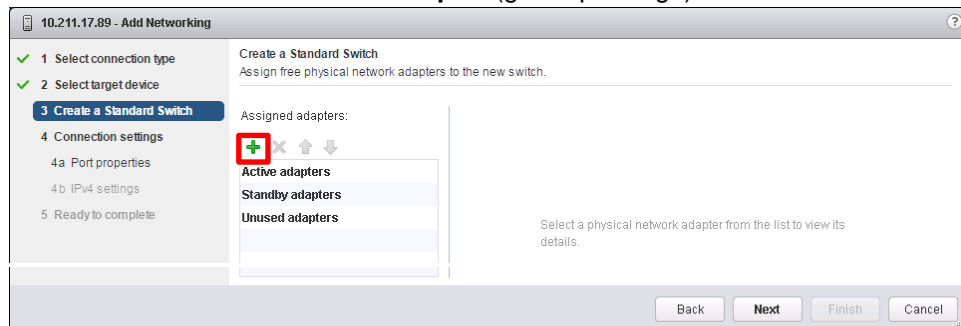
2. Select **VMKernel Network Adapter** as the connection type and click **Next**.



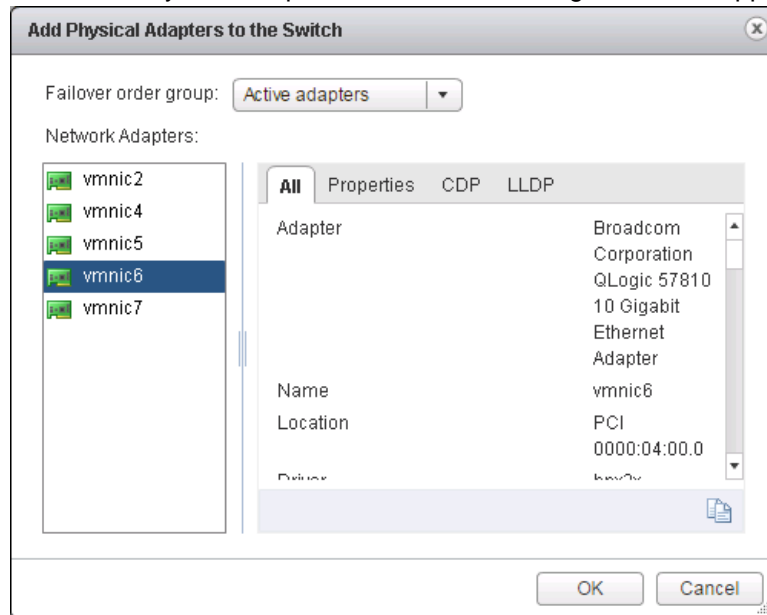
3. Select **New standard switch** for the target device and click **Next**.



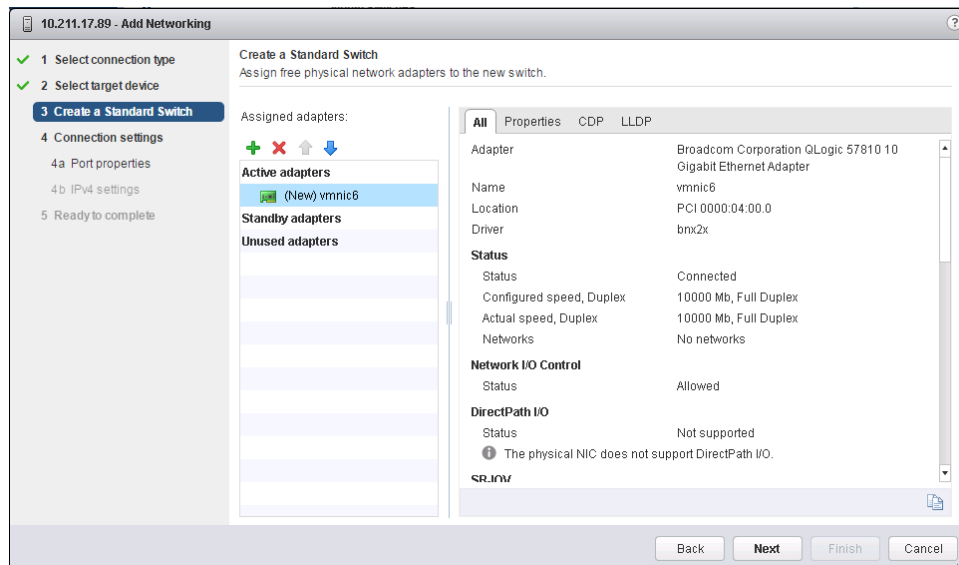
4. Create a Standard Switch: **Add Adapter** (green plus sign)



5. In the Add Physical Adapters to the Switch dialog, select the appropriate adapter and click **OK**.



6. Click **Next**.



7. Port properties:
 - Network label: **10g-SC-iSCSI0/10g-SC-iSCSI1** (descriptive name)
 - VLAN ID: **Default** (or appropriate)
 - IP Settings: **Default** (IPv4)
 - TCP/IP stack: **Default**
 - Available services: **No other selections**

8. Click **Next**.

10.211.17.89 - 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

Port properties
Specify VMkernel port settings.

VMkernel port settings

Network label: 10g-SC-iSCSI0

VLAN ID: None (0)

IP settings: IPv4

TCP/IP stack: Default

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

9. IPv4 settings:

- **Use static IPv4 settings** (your environment may differ)
- IPv4 address: **10.10.10.89/10.20.10.89** (used for this example)
- Subnet mask: **255.255.255.0** (used for this example)
- Default gateway for IPv4: **Leave default**
- DNS server addresses: **Leave default**

10. Click **Next**.

10.211.17.89 - 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

IPv4 settings
Specify VMkernel IPv4 settings.

☐ Obtain IPv4 settings automatically
☒ Use static IPv4 settings

IPv4 address: 10 . 10 . 10 . 89

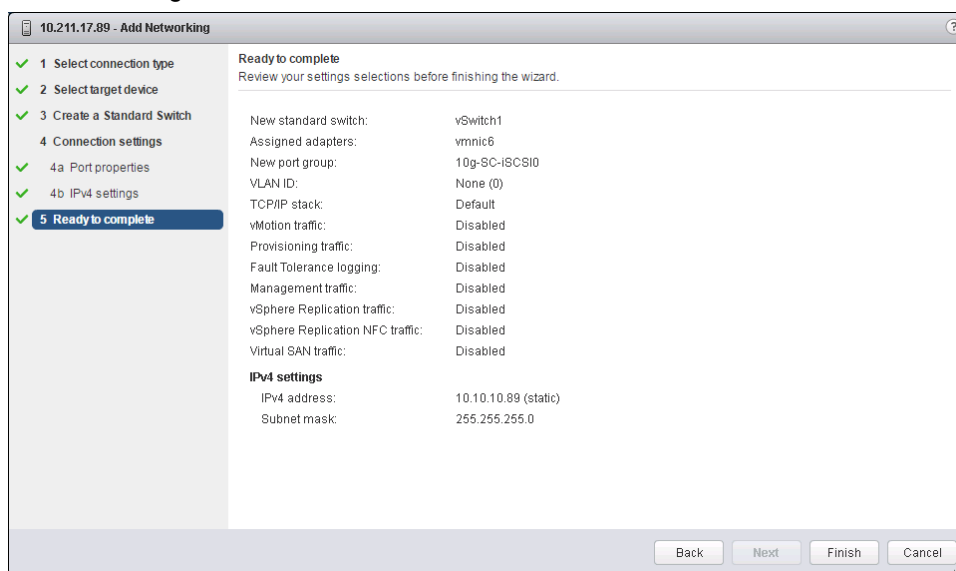
Subnet mask: 255 . 255 . 255 . 0

Default gateway for IPv4: 10.211.17.126

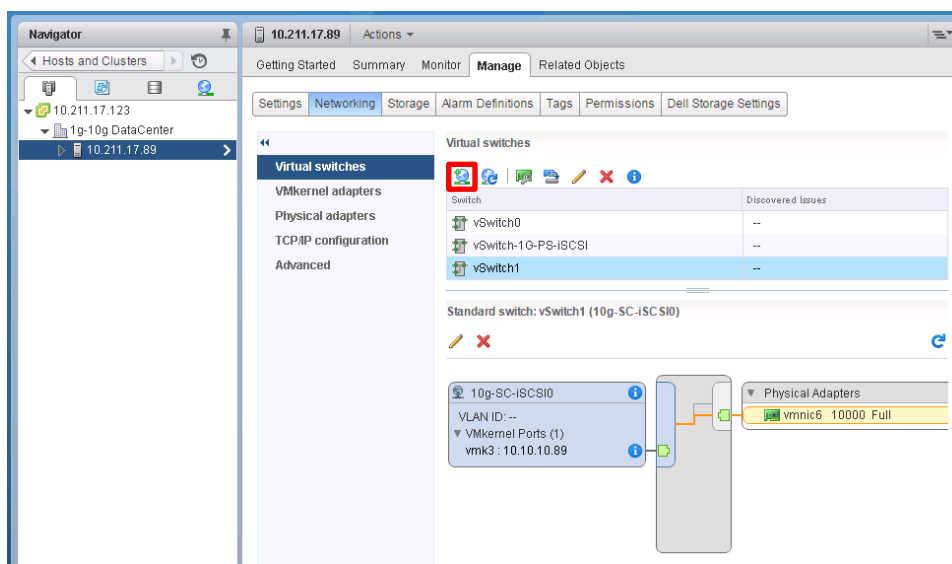
DNS server addresses: 10.211.18.4

Back Next Finish Cancel

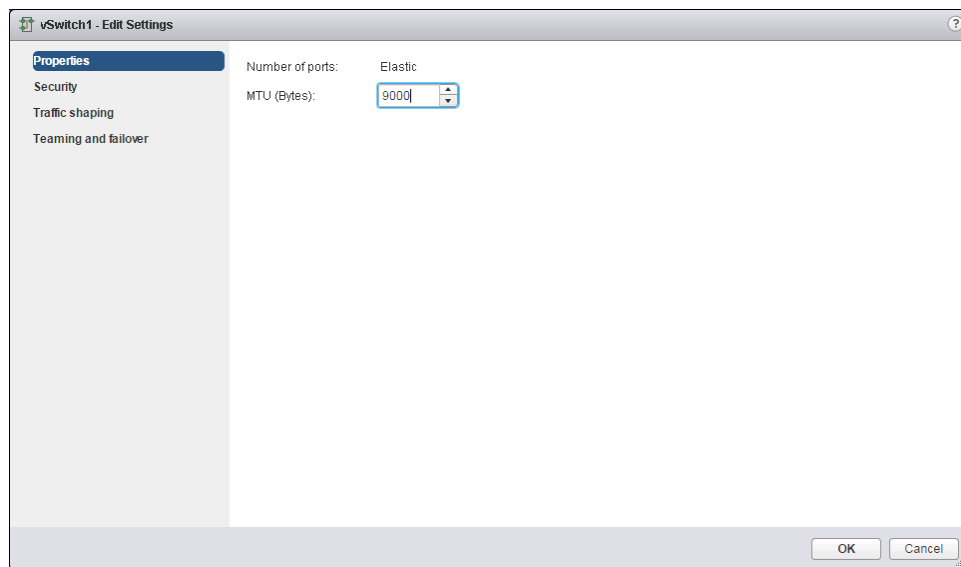
11. Confirm settings and click **Finish**.



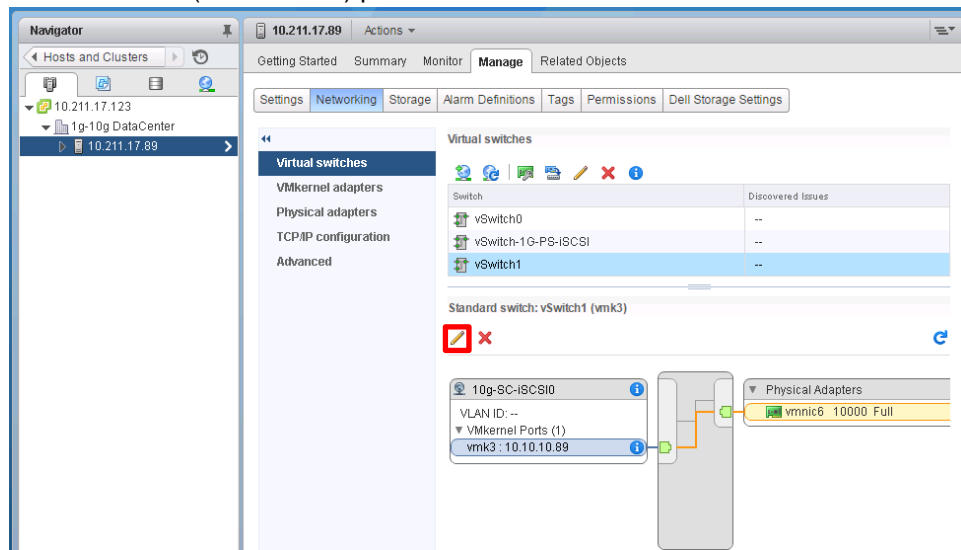
12. Select the newly created vSwitch (**vSwitch1/vSwitch2**) and click the **Edit** icon.



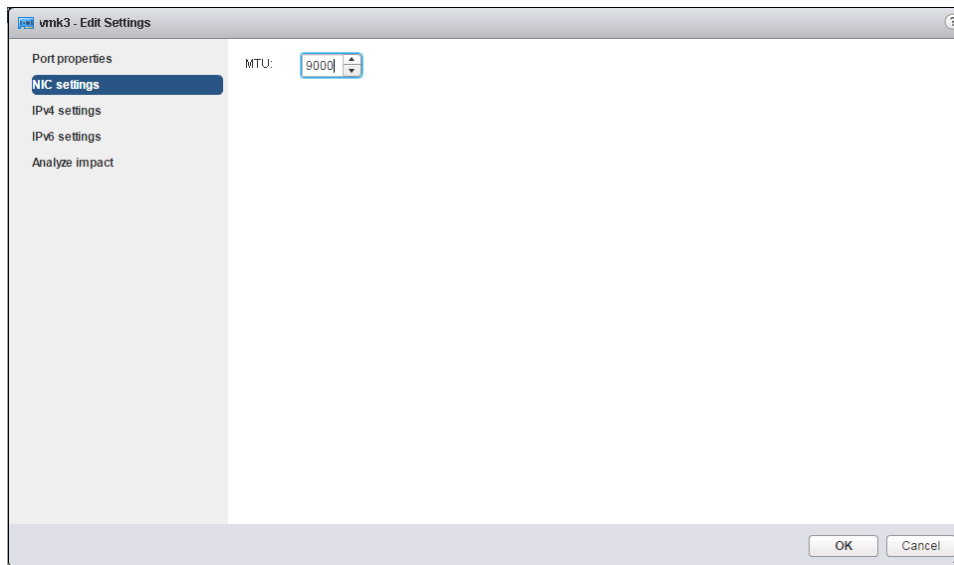
13. On the **Properties** tab, change the MTU to **9000** and click **OK**.



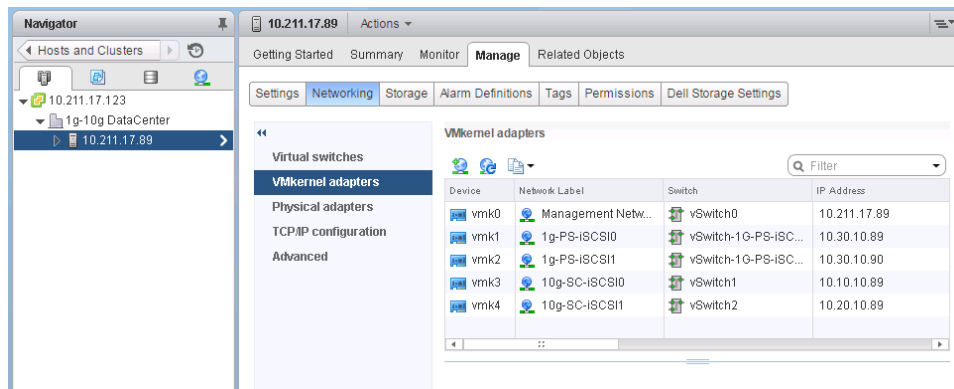
14. Select the vmk (**vmk3/vmk4**) port and click the **edit** icon.



15. In **NIC settings**, change the MTU to **9000** and click **OK**.



16. Repeat steps [1-15](#) above for the additional adapter(s) with appropriate settings – resulting in the following view of VMkernel adapters.



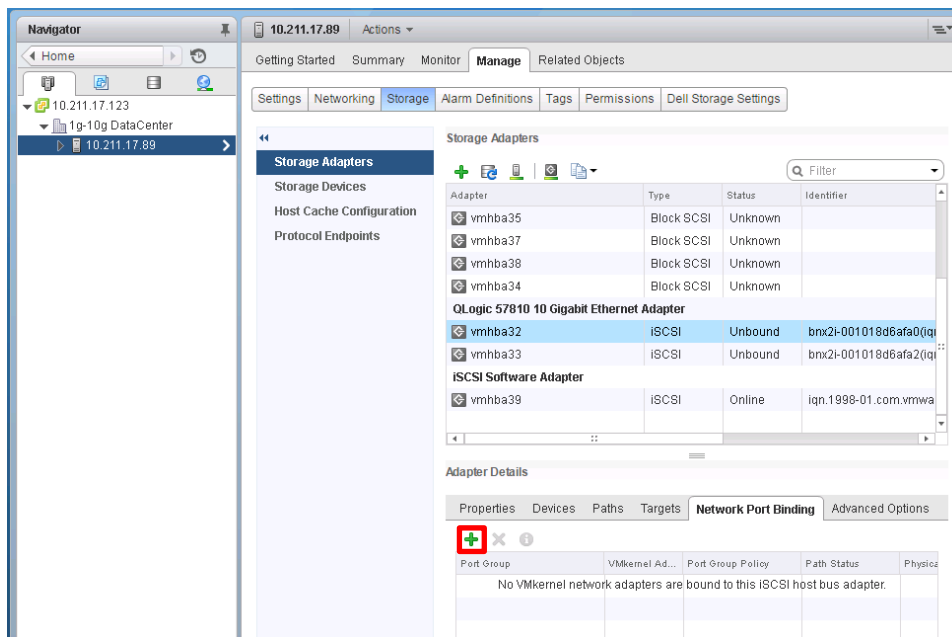
5.2 Manually configure iSCSI Dependent Hardware Adapter to access SC Series volumes

For SC Series storage, the VMware Dependent Hardware iSCSI adapters must be configured manually. Configuration includes binding the adapter to the proper vmk port and adding the dynamic discovery target IP address.

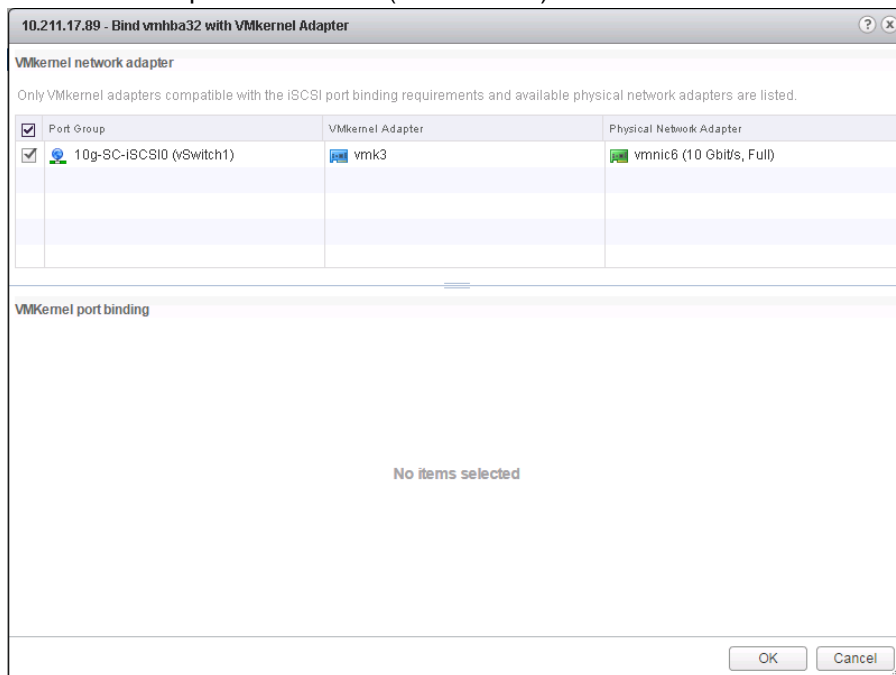
SC Series storage presents front-end target ports and each volume is presented as a unique LUN. Redundant connections are made by creating multiple sessions with each of the virtual iSCSI target ports on the array.

For the purpose of this discussion, 10.10.10.100 and 10.20.10.100 are used as the SC Series iSCSI SAN target discovery addresses.

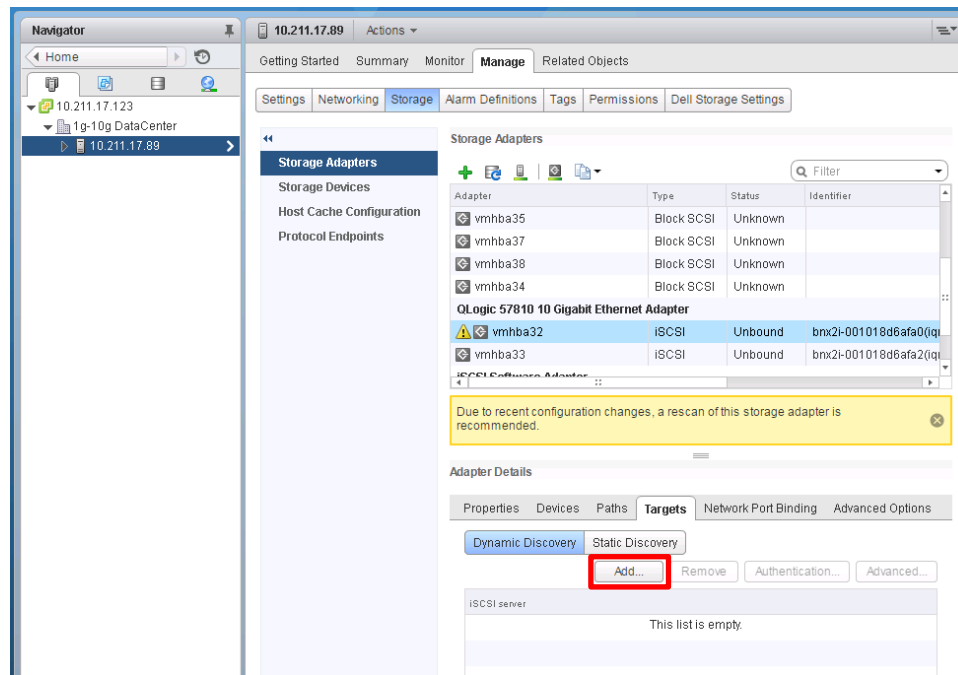
1. From the **Hosts and Clusters** view, select **Manage, Storage, Storage Adapters**, the first dependent hardware iSCSI adapter (**vmhba32/vmhba33**), **Network Port Binding** in **Adapter Details**, and click the **Add (+)** button.



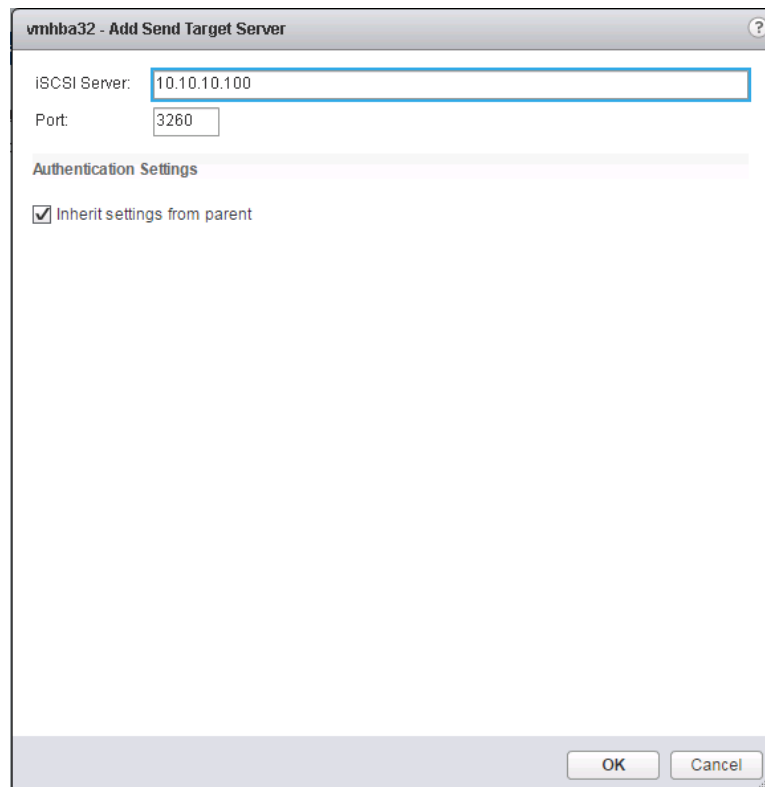
2. Select the vmk port from the list (**vmk3/vmk4**) and click **OK**.



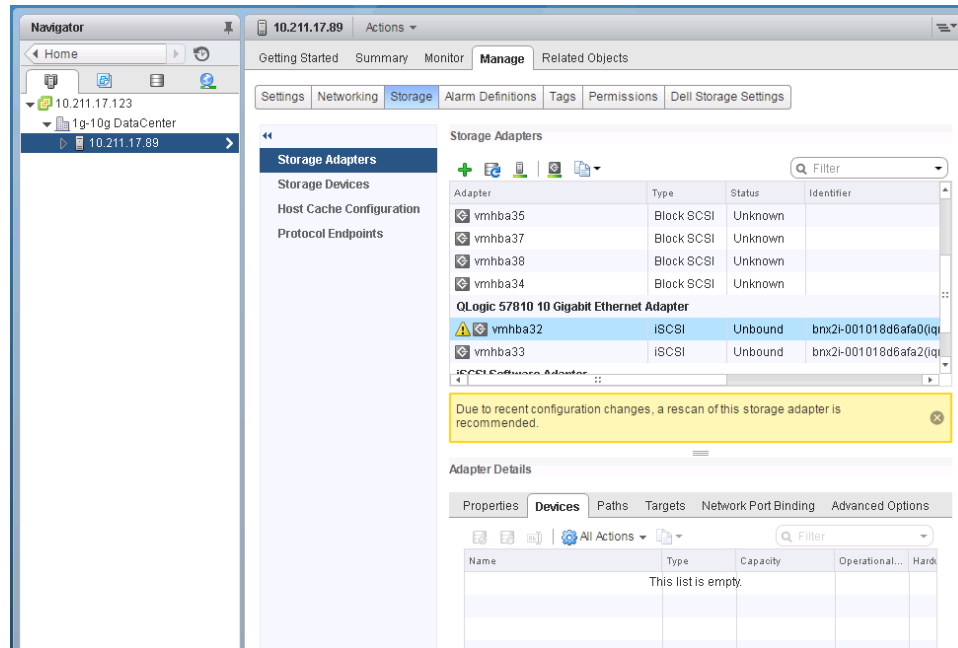
3. Select the **Targets**, **Dynamic Discovery**, and click **Add**.



4. Enter IP address for the appropriate SC Series Fault Domain Control Port (**10.10.10.100/10.20.10.100**) and click **OK**.



- Repeat steps [1-4](#) for additional dependent hardware iSCSI adapters used to connect to SC Series iSCSI storage.



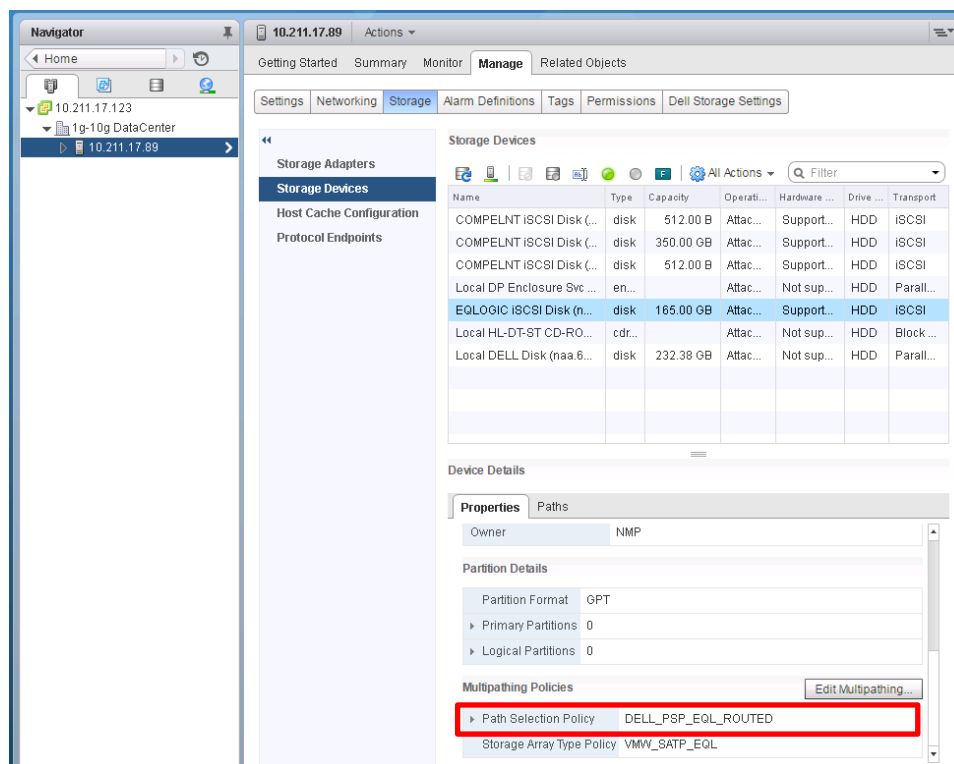
After all required dependent hardware iSCSI adapters have been configured, create a server object and volume(s) in Dell Storage Manager and map appropriate volumes to the server(s). A rescan of all appropriate hardware dependent iSCSI adapters may be required.

6 Configure vSphere host use of PS Series and SC Series storage volumes.

After configuring vSphere host access to PS Series and SC Series storage volumes, the newly presented storage devices can be configured for host use. Configuration for use includes setting (or verifying) the recommended multipath selection and creating a vSphere Datastore.

6.1 Confirm multipath for PS Series storage volumes

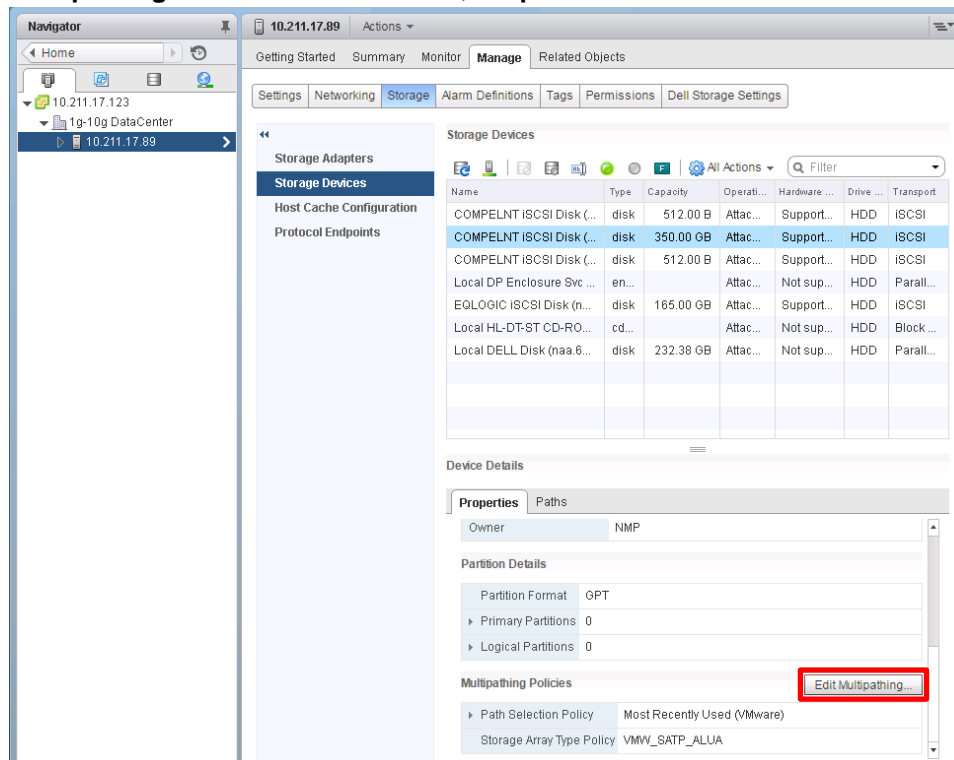
From the **Hosts and Clusters** view, select **Manage, Storage, Storage Devices**, iSCSI disk device presented from the PS Series array (**EQLOGIC iSCSI Disk**), in **Device Details, Properties** section, confirm the setting of: **DELL_PSP_EQL_ROUTED**.



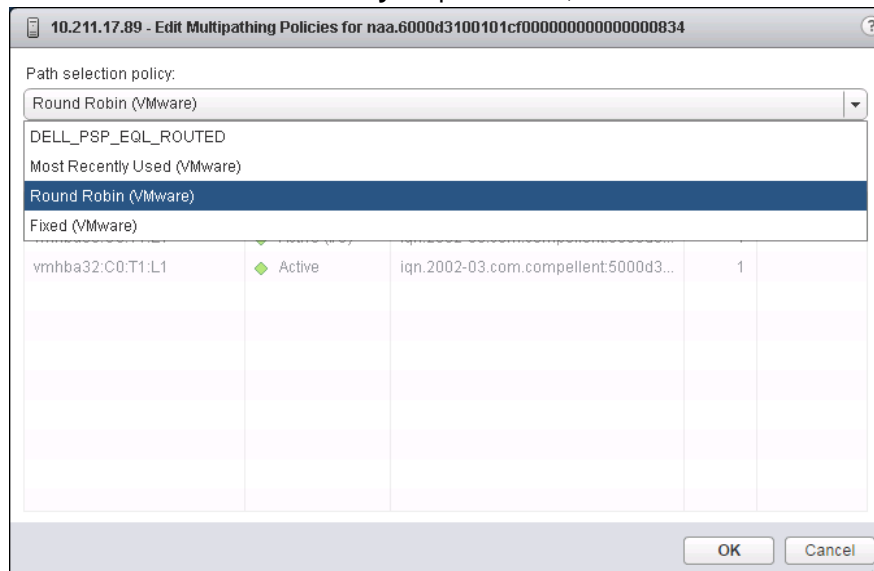
Note: PS Series volumes are automatically configured as part of the MEM configuration. If MEM is not available, path selection policy for PS Series volumes must be set to Round Robin to reflect [Best Practices for Implementing VMware vSphere in a Dell PS Series Storage Environment](#).

6.2 Configure multipath for SC Series storage volumes

1. From the **Hosts and Clusters** view, select **Manage, Storage, Storage Devices**, the iSCSI disk device presented from the SC Series array (**COMPELNT iSCSI Disk**), and click the **Edit Multipathing** from the **Device Details, Properties** section.



2. From the **Path Selection Policy** drop-down list, select **Round Robin** and click **OK**.

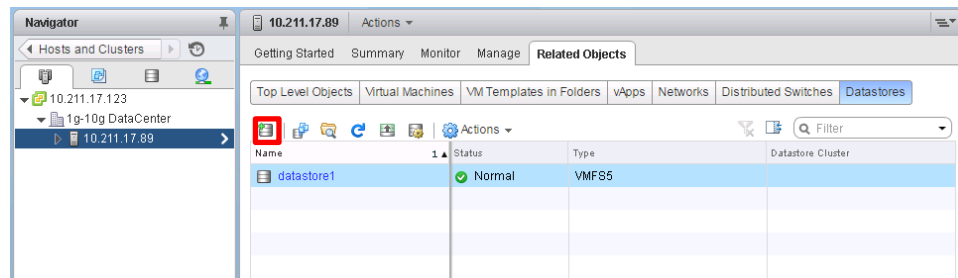


3. Perform steps [1-2](#) for each volume presented from the SC Series array.

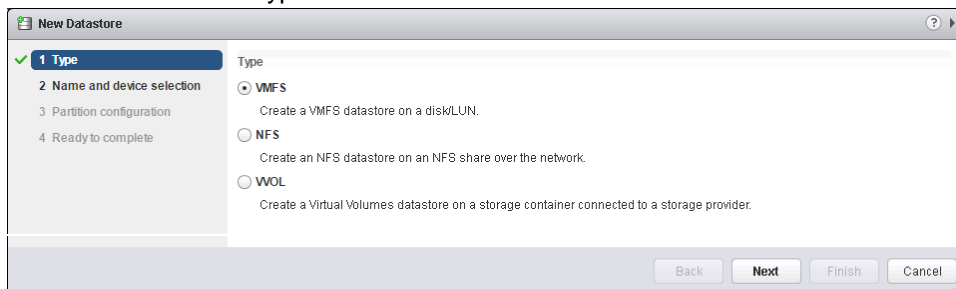
Note: Changing the default Path Selection Policy (PSP), setting the Round Robin PSP for all SC Series volumes for a cluster, and additional recommended settings can be accomplished using scripts provided in [Dell Storage SC Series Best Practices with VMware vSphere 5.x-6.x](#).

6.3 Create vSphere Datastores from PS and SC Series volumes

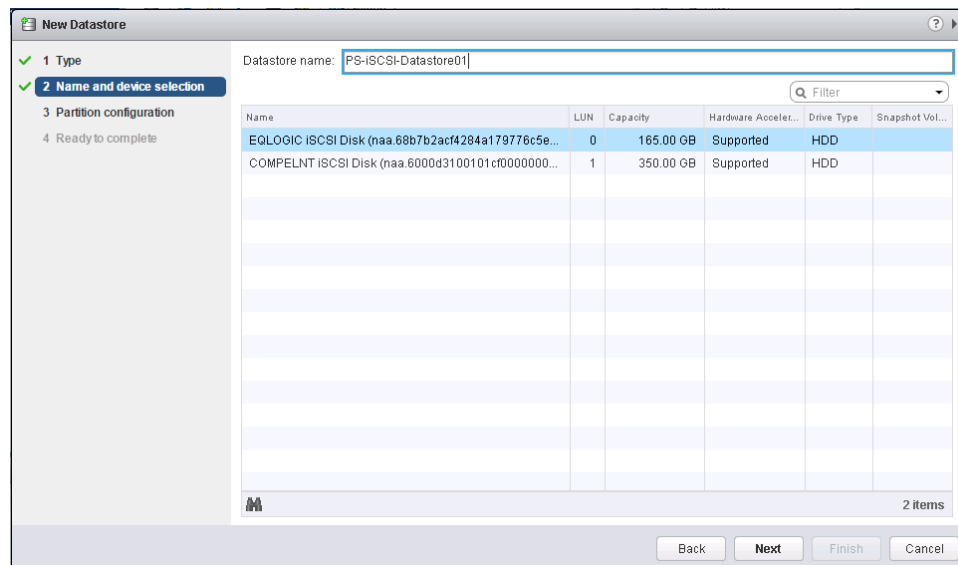
1. From the **Hosts and Clusters** view, select **Related Objects**, **Datastores**, and click the **Create New Datastore** button.



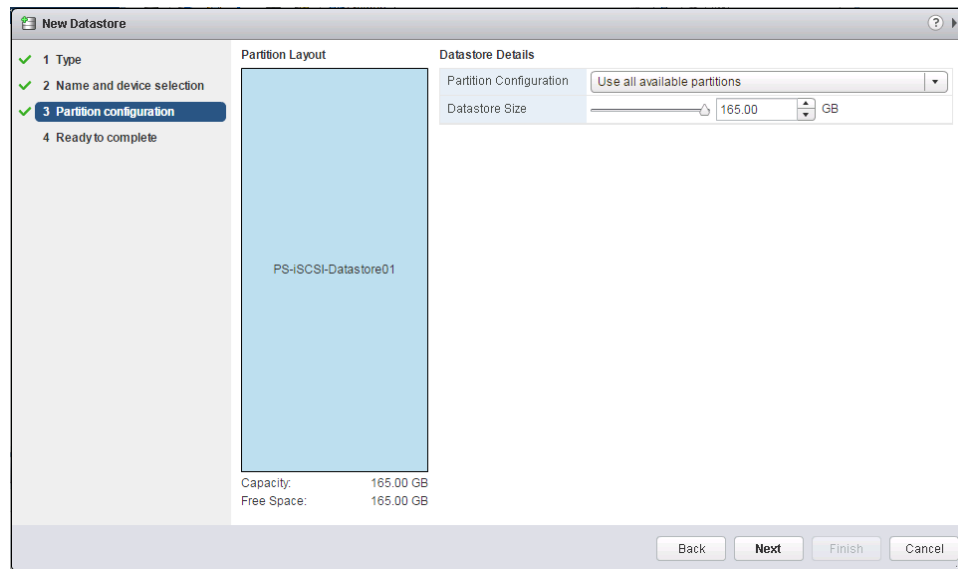
2. Select **VMFS** as the Type of Datastore to create and click **Next**.



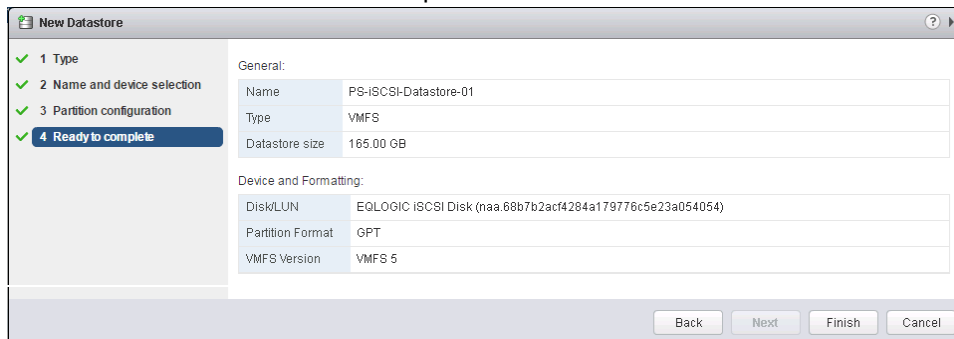
3. Enter the new **Datastore name** (descriptive name is recommended), select the volume for the new Datastore, and click **Next**.



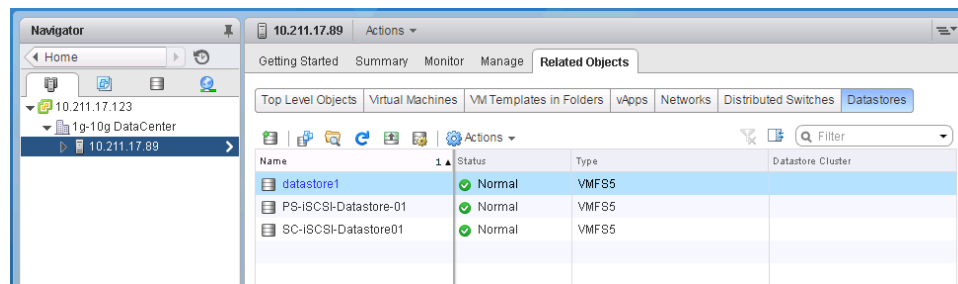
4. Accept the **defaults** on the Partition configuration page and click **Next**.



5. Confirm the entered and selected options and click **Finish**.



6. Repeat steps [1-5](#) for each additional PS Series and SC Series volume presented to the host. For this example, the resulting Datastore list is shown here.



A Technical Support and resources

Dell.com/support is focused on meeting customer needs with proven services and support.

[Dell TechCenter](#) is an online technical community where IT professionals have access to numerous resources for Dell software, hardware and services.

[Storage Solutions Technical Documents](#) on Dell TechCenter provide expertise that helps to ensure customer success on Dell Storage platforms.

A.1 Referenced or recommended documentation

Dell publications:

- Best Practices for Implementing VMware vSphere in a Dell PS Series Storage Environment
http://en.community.dell.com/techcenter/extras/m/white_papers/20434601
- Dell Storage SC Series Best Practices with VMware vSphere 5.x-6.x
http://en.community.dell.com/techcenter/extras/m/white_papers/20441056
- VMware ESXi 5.1, 5.5 or 6.0 Host Configuration Guide
<http://en.community.dell.com/dell-groups/dtcmedia/m/mediagallery/20094619>
- Dell Storage Compatibility Matrix
<http://en.community.dell.com/dell-groups/dtcmedia/m/mediagallery/20438558>
- Configuring and Installing the PS Series Multipathing Extension Module for VMware vSphere and PS Series SANs
<http://en.community.dell.com/dell-groups/dtcmedia/m/mediagallery/19991633/>
- Best Practices for Sharing an iSCSI SAN Infrastructure with Dell PS Series and Dell SC Series Storage using VMware
http://en.community.dell.com/techcenter/extras/m/white_papers/20441671
- Dell PS Series Configuration Guide
<http://en.community.dell.com/dell-groups/dtcmedia/m/mediagallery/19852516>
- Dell SC series storage technical content library (whitepapers, videos, best practices, etc.)
<http://en.community.dell.com/techcenter/storage/w/wiki/5018.compellent-technical-content>

VMware publications:

- VMware Knowledge Base Article (2038869): Considerations for using software iSCSI port binding in ESX/ESXi
https://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalid=2038869
- VMware Knowledge Base Article (2108416): Thumbprint error when running ESXCLI command as a vCLI command
https://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalid=2108416

VMware Knowledge Base for all VMware products:

- VMware Knowledge Base
<http://kb.vmware.com/selfservice/microsites/microsite.do>