

STORAGE SIMPLIFIED: INTEGRATING DELL EQUALLOGIC PS SERIES  
STORAGE INTO YOUR HP BLADE SERVER ENVIRONMENT

Dell™ EqualLogic™ PS6110E  
in your HP blade server environment



A Principled Technologies reference architecture commissioned by Dell Inc.

# TABLE OF CONTENTS

<b>Table of contents</b> .....	<b>2</b>
<b>Introduction</b> .....	<b>4</b>
Why upgrade to EqualLogic storage? .....	4
Dell EqualLogic storage functions with existing blade environments .....	5
About the Dell EqualLogic PS6110E .....	6
<b>We show you how – Adding the Dell EqualLogic PS6110E</b> .....	<b>7</b>
Installing the Dell EqualLogic PS6110E .....	9
Integrating storage into your existing network infrastructure.....	11
Configuring the existing chassis networking .....	13
Adding a dedicated storage network to your configuration .....	14
Installing the blade server mezzanine cards .....	16
Installing and configuring additional Ethernet modules .....	17
Configuring the dedicated chassis networking .....	18
Configuring your blade servers to connect with the Dell EqualLogic PS6110E storage array.....	20
Configuring the blade servers .....	20
Configuring the Dell EqualLogic PS6110E storage array .....	21
Enabling the management interface and configuring RAID on the PS6110E.....	21
Creating a volume .....	22
Connecting the storage volumes to your blade servers or VMs .....	22
<b>Summing it all up</b> .....	<b>23</b>
<b>Appendix A – Integrating Storage into your existing network infrastructure</b> .....	<b>24</b>
Enabling flow control on the Flex-10 uplink ports .....	24
Adding the iSCSI network to your Shared Uplink Set in HP Virtual Connect Manager .....	24
Editing your server profiles and creating additional FlexNICs .....	27
<b>Appendix B – Integrating storage using a dedicated iSCSI network</b> .....	<b>29</b>
Enabling flow control on the dedicated iSCSI Flex-10 modules.....	29
Creating a virtual network for iSCSI .....	29
Creating new FlexNICs on the newly installed mezzanine card.....	31
<b>Appendix C – Setting up the Dell EqualLogic PS6110E Array</b> .....	<b>35</b>
Installing and configuring the Dell EqualLogic PS6110E.....	35
Configuring the blade server network adapters .....	36
Installing Dell EqualLogic Host Integration Tools Kit 4.5.0.....	36
Enabling the management interface and initializing the array.....	36
Creating a volume .....	37
<b>Appendix D – Connecting storage volumes to the blade servers</b> .....	<b>40</b>
Connecting to the volume with iSCSI Initiator .....	40

Bringing a volume online.....	42
Binding the volume in iSCSI Initiator .....	42
<b>Appendix E – Additional steps for connecting iSCSI storage directly to a virtual machine.....</b>	<b>43</b>
Creating an iSCSI virtual switch .....	43
Attaching the virtual switches to the VM .....	44
<b>About Principled Technologies .....</b>	<b>45</b>

# INTRODUCTION

Upgrading the storage arrays in your existing HP blade infrastructure is an excellent strategy to increase performance in your datacenter. The great news is that you don't have to limit yourself to a single brand as long as the storage you chose supports industry standards. It can be just as straightforward to incorporate storage from other vendors into your infrastructure, and having more options means you can choose the best fit for your organization to maximize performance, simplify management, and even lower costs.

With the Dell EqualLogic PS Series family of storage, Dell offers a number of storage solutions with the goal of simplifying the deployment and administration of your environment. Dell EqualLogic PS Series arrays are designed to enhance your datacenter through self-optimized, automated load-balancing across drives, I/O pathways, controllers, and cache. Additionally, the arrays promote efficient scalability in performance and capacity through peer storage architecture without the need for entire storage system overhauls.

Part of the EqualLogic PS Series, the Dell™ EqualLogic™ PS6110E storage array is based on industry-standard 10Gb iSCSI technology and can fit right into your existing blade environment, regardless of vendor. With Dell Fluid Data™ architecture for data optimization, 24-drive capacity, and dual 10Gb controllers, the EqualLogic PS6110E can provide you with a robust storage solution to replace your legacy storage.

In this guide, we take you step by step through the process of adding a Dell EqualLogic PS6110E array to an existing HP ProLiant blade infrastructure. We set up a sample HP environment in the Principled Technologies labs and added in the new EqualLogic array using two different networking options. First, we show you how to integrate the EqualLogic PS6110E directly into an existing 10Gb network in your HP environment. Then, we detail how to add a PS6110E to your HP blade environment via a separate 10Gb iSCSI network, which requires some additional hardware.

## Why upgrade to EqualLogic storage?

Dell EqualLogic storage uses a combination of features which are designed to improve performance, uptime, scalability, and manageability. Featuring multiple connectivity options, the EqualLogic PS6110E is capable

of integrating into your 10GbE environment, using an SFP+ module for fiber or twin-ax copper, or 10GBASE-T. With large capacity options, the PS6110E supports up to 72 TB of storage using near-line serial attached SCSI (NL-SAS) storage. As your business grows, you can expand your PS6110E by connecting with other units to form up to a SAN group of up to 16 members.

## Dell EqualLogic storage functions with existing blade environments

To show that the Dell EqualLogic PS6110E can interoperate with non-Dell servers and switches using the industry-standard iSCSI protocol, we set up a representative HP environment and added the array.

Our HP environment used three blade server models: the HP ProLiant BL460c G6, BL460c G7, and BL460c Gen8 in an HP BladeSystem c7000 blade server chassis and an HP StorageWorks EVA 4000. These represent the most recent three generations of HP blade server hardware using a legacy storage solution, in this case the HP StorageWorks EVA 4000.

We evaluated the functionality of the HP blade servers when paired with both the legacy HP storage solution and the Dell EqualLogic PS6110E, using HP Virtual Connect Flex-10 10Gb Ethernet Modules. We tested the solution using a virtualized environment running on Microsoft® Windows Server® 2012 Hyper-V™ to confirm its ability to function in a virtualized environment.

After we finished configuring the new Dell EqualLogic PS6110E storage array we ran a standard Iometer workload to demonstrate that the storage successfully integrated into the existing HP environment. Please note that these results don't indicate maximum performance for the storage. We were merely using Iometer as a tool to ensure that the storage was functioning correctly. We chose two Iometer tests—a small-block, read-write mixed test and a large-block, read test to simulate two types of typical I/O patterns—and ran each test on three blade servers and three VMs simultaneously. For our small-block test, each blade server/VM maintained over 700 average IOPS. For the large-block test, each blade server/VM maintained over 50MBps throughput. Figure 1 shows the detailed parameter specifications for our Iometer workload.

	Block size	Reads/writes	Random/sequential	Outstanding I/Os	Data set size
Small-block test	8 KB	80/20	100/0	64	20 GB
Large-block test	512 KB	100/0	100/0	64	20 GB

Figure 1: Settings for our Iometer tests.

## About the Dell EqualLogic PS6110E

According to Dell, the Dell EqualLogic PS6110E is a 10GbE iSCSI array that provides high-performance and highly scalable, cutting-edge rack storage, capable of supplying both the I/O and storage needed for your datacenter. Its benefits include the following:

- **Reliability.** Hot-swap, incremental expansion options, dual power and network controllers, and port sharing for failover scenarios all ensure increased uptime.
- **Connectivity.** Connect via 10GbE SFP+ module or 10GBASE-T copper.
- **Capacity.** Each array supports up to 24 hot-swappable 3.5" 7,200 RPM NL-SAS drives, for up to a maximum of 72 TB of storage.
- **Performance.** The PS6110E has a 6G SAS backplane to maximize disk I/O, and 10GbE technology maximizes throughput to and from the array.
- **Management.** EqualLogic Group Manager and Host Integration Tools ease configuration and enhance communications between array and host.

In addition to enterprise-class storage hardware, Dell EqualLogic PS Series arrays include the necessary software features to enable full control over EqualLogic storage. This includes the EqualLogic Group Manager, SAN Headquarters (SAN HQ) monitoring and analysis tools, and Host Integration Tools for VMware®, Microsoft, and Linux® platforms. All of this software functionality is included at no extra charge, and updates are available free of charge as they are released, providing value for storage functionality.

**EqualLogic Group Manager** is a management tool integrated with the EqualLogic PS Series firmware that can provide detailed information on your storage configuration, and allows for storage provisioning, replication scheduling, and array management.

**Dell EqualLogic Host Integration Tools for Microsoft (HIT/Microsoft)** is a software toolkit that ships free with all Dell EqualLogic iSCSI SANs that facilitates the deployment, ongoing management, and protection (via space-efficient snapshots) of Dell EqualLogic iSCSI SANs for Microsoft Windows environments, including integration with Microsoft SQL Server®, Microsoft Exchange Server, Microsoft SharePoint®, and Hyper-V support.

Additionally, Dell EqualLogic also offers Host Integration Tools

software for VMware (HIT/VMware 3.5) and Linux (HIT/Linux 1.2).  
HIT/VMware 3.5.

**Dell EqualLogic Host Integration Tools for VMware (HIT/VE)** is a software toolkit that allows tighter EqualLogic integration into VMware environments and allows you to manage your storage directly from VMware vCenter. HIT/VE enables multipath I/O and integrates SAN features such as snapshots, clones, and replicas.

**Dell EqualLogic Host Integration Tools for Linux (HIT/Linux)** provides applications and utilities to administer EqualLogic PS series arrays in Linux environments. Features of HIT/Linux include EqualLogic iSCSI Multipathing, Auto-Snapshot Manager/Linux Edition, and usability enhancements for simplified management.

**Dell EqualLogic SANHQ** monitors one or more PS Series groups, and allows storage administrators to obtain a centralized view of the health and status of multiple groups, monitor and analyze capacity usage for groups, generate alerts and email notifications based on the health status of the groups, and more.

## **WE SHOW YOU HOW – ADDING THE DELL EQUALLOGIC PS6110E**

For this guide, we assume you have an existing blade server infrastructure and older external storage running on Windows Server 2012 that you are looking to replace with the Dell EqualLogic PS6110E storage array. For our testing purposes, we used a representative HP infrastructure, which Figure 2 shows and Figure 3 details.

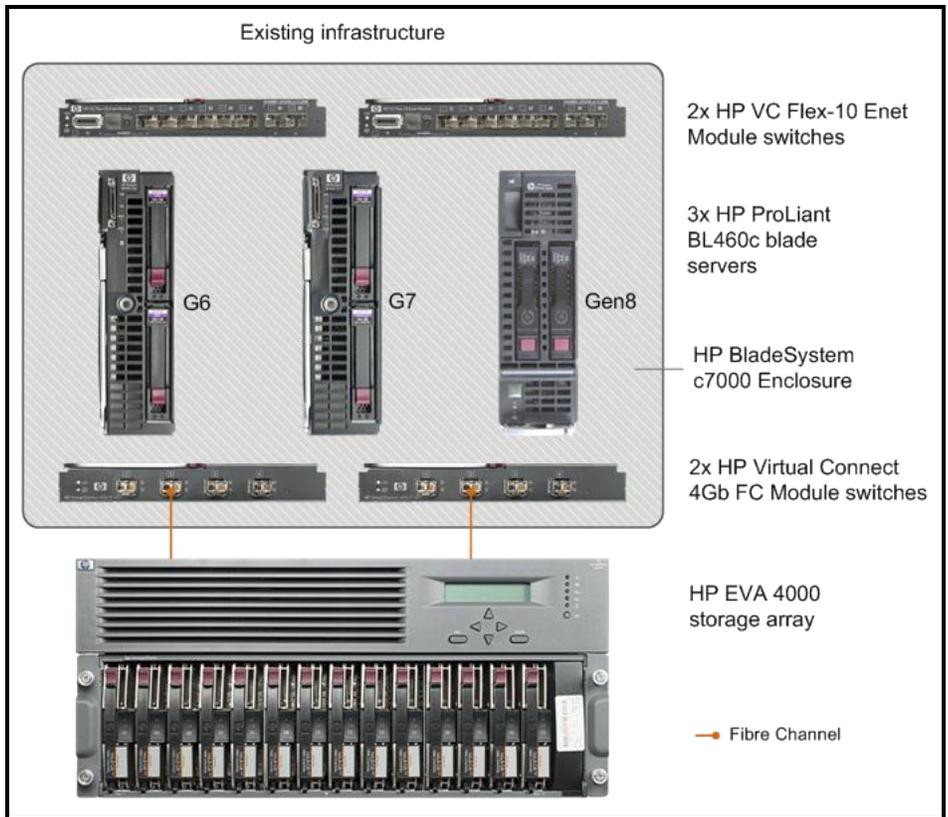


Figure 2: The representative HP infrastructure we used for testing.

Quantity	Name	Function
1	HP BladeSystem c7000 Enclosure	Chassis
1	HP ProLiant BL460c G6	Blade server
1	HP ProLiant BL460c G7	Blade server
1	HP ProLiant BL460c Gen8	Blade server
1	HP StorageWorks 4000 Enterprise Virtual Array (EVA 4000) array with two drive enclosures containing 28 x 146GB drives	Legacy storage
2	HP Virtual Connect Flex-10 10Gb Ethernet modules	Interconnect module
2	HP Virtual Connect 4Gb Fibre Channel modules	Interconnect module

Figure 3: Components of the existing HP infrastructure we used for testing.

Figure 4 outlines the hardware components we use throughout the setup process. The additional hardware configuration shows the HP server hardware we added to our test configuration to set up a dedicated 10Gb iSCSI network.

Quantity	Name
1	Dell EqualLogic PS6110E
2	10G SFP+ network cables
2	Ethernet cables
2	Power cables
<b>Additional hardware configuration</b>	
2	HP VC Flex-10 Ethernet modules
3	10GbE mezzanine cards
2	External 10GbE switches

Figure 4: Components we used for adding a Dell EqualLogic PS6110E array.

## Installing the Dell EqualLogic PS6110E

To install your Dell EqualLogic PS6110E into your HP environment, start with the following steps:

1. Download the latest Dell EqualLogic software. Dell EqualLogic arrays come with free access to the EqualLogic support Web site, where you can download the latest software and firmware.
2. Check for and install any Windows Updates.
3. Update your hardware drivers and firmware, including HP Onboard Administrator and HP Virtual Connect Manager.
4. Plan accordingly for downtime. Adding the Dell EqualLogic PS6110E will require a restart of each server or VM after installation of the Dell Host Integration Tools, which means that each server (and any VMs hosted on it if they are not in a failover cluster) will have a brief downtime. Also, installing hardware for a dedicated iSCSI network will require additional downtime. Depending on the size and complexity of your environment, your planned downtime may vary.
5. Select your IP scheme for the iSCSI network, including IP addresses for blade and VM network adapters, storage I/O ports, and storage management ports. We recommend that this IP scheme be on a different subnet as your corporate or management IP scheme. Figure 5 shows the IP scheme we used for testing. For our testing, the corporate and management

ports shared the same IP scheme and network.

Device	IP Address
<b>Management/corporate network IP addresses</b>	
<b>Dell EqualLogic PS6110E</b>	
PS6110E RJ45 for management (eth1)	192.168.1.100
<b>HP ProLiant BL460c G6</b>	
NIC 1	192.168.1.61
NIC 2	192.168.1.62
VM NIC 1	192.168.1.63
VM NIC 2	192.168.1.64
<b>HP ProLiant BL460c G7</b>	
NIC 1	192.168.1.71
NIC 2	192.168.1.72
VM NIC 1	192.168.1.73
VM NIC 2	192.168.1.74
<b>HP ProLiant BL460c Gen8</b>	
NIC 1	192.168.1.81
NIC 2	192.168.1.82
VM NIC 1	192.168.1.83
VM NIC 2	192.168.1.84
<b>iSCSI network IP addresses</b>	
<b>Dell EqualLogic PS6110E</b>	
Storage group IP address	192.168.10.100
PS6110E SFP+ for I/O (eth0)	192.168.10.101
<b>HP ProLiant BL460c G6</b>	
NIC 3	192.168.10.61
NIC 4	192.168.10.62
VM NIC 3	192.168.10.63
VM NIC 4	192.168.10.64
<b>HP ProLiant BL460c G7</b>	
NIC 3	192.168.10.71
NIC 4	192.168.10.72
VM NIC 3	192.168.10.73
VM NIC 4	192.168.10.74
<b>HP ProLiant BL460c Gen8</b>	
NIC 3	192.168.10.81
NIC 4	192.168.10.82
VM NIC 3	192.168.10.83
VM NIC 4	192.168.10.84
VM NIC 4	192.168.10.84

Figure 5: Our IP scheme for testing.

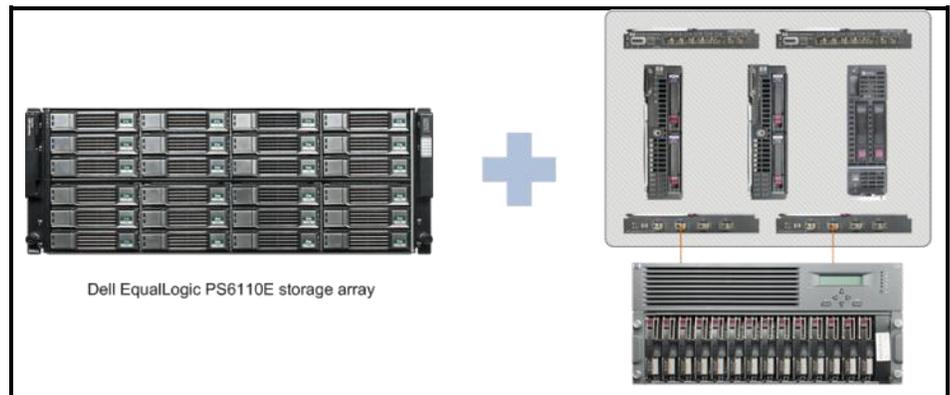
We detail how to complete your upgrade in two ways: by integrating storage into your existing network and by adding a dedicated storage network with your upgrade. The approach we use in both cases is to

attach the storage to a network switch that is connected to one or more blade enclosures. Depending on your desired configuration, select one of the following options:

- If you are integrating your storage into your existing network infrastructure, continue reading.
- If you are adding a dedicated storage network to your network infrastructure, skip to the Adding a dedicated storage network to your configuration section on page 14.

## Integrating storage into your existing network infrastructure

In this section, we walk you through installing your Dell EqualLogic PS6110E storage array using the existing network infrastructure. We show you how to connect the storage array to your network and configure access to it via the HP Virtual Connect Manager. Figure 6 presents an overview.



**Figure 6: Integrating storage into your existing network infrastructure.**

As you prepare for your EqualLogic integration, make sure you consider the following:

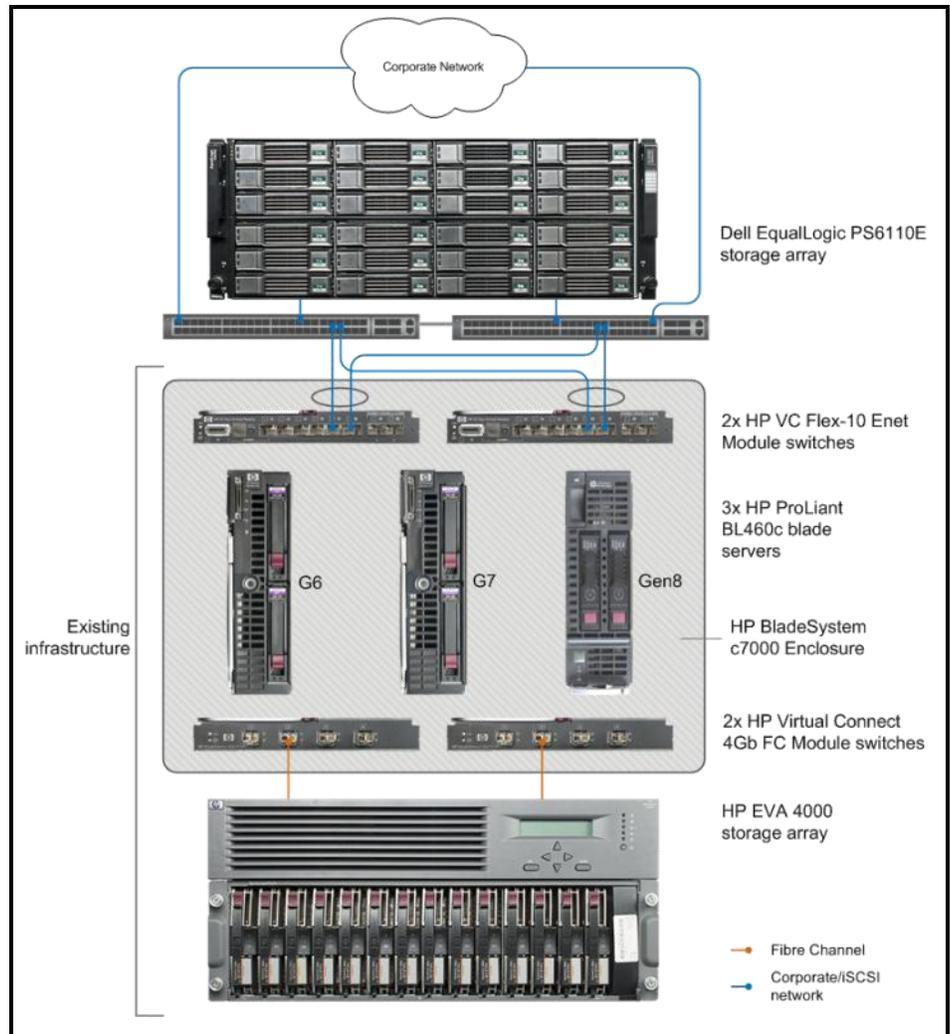
- Integrating the storage array into your existing network infrastructure is the most cost-efficient way to add storage because you do not need to add hardware components to your blade infrastructure. However, you may see performance degrade during times when your corporate network and storage network are both under high load.
- We assume that, for this scenario, you have your Virtual Connect Flex-10 modules configured with in a shared uplink set with a corporate Ethernet network that is using VLAN tagging to subdivide your network traffic types. This will be key to logically dividing the iSCSI traffic from the existing corporate network traffic.

- You will need to designate at least one virtual port, called a FlexNIC on each blade in your environment for iSCSI access. In our representative configuration, each HP ProLiant BL460c blade (G6, G7, and Gen8) included an embedded 10GbE dual-port NIC. The onboard NICs use Flex-10 technology to allow each physical port to be divided into up to four virtual ports, called FlexNICs (for a total of eight FlexNICs). For our testing purposes, we divided each of the two physical ports into two virtual ports and designated one for the corporate network, and the other for the iSCSI network on each.

## NOTE

Although you can directly attach your Dell EqualLogic storage to an individual blade enclosure via the HP Virtual Connect Flex-10 modules, we advise connecting your storage to your network instead. This allows you to connect your storage array to multiple blade enclosures, and lets you easily integrate additional Dell EqualLogic storage arrays in the future.

Figure 7 shows a sample network diagram of what we will be demonstrating in the following steps.



**Figure 7: Network diagram of a shared iSCSI and Corporate network configuration.**

### Configuring the existing chassis networking

To expand your existing corporate-traffic-only Shared Uplink Set to include a virtual network for iSCSI traffic, complete the following steps. For more detailed steps, see [Appendix A](#).

1. Create an SSH connection to each blade switch module (you can find the IP addresses in the HP Onboard Administrator), and use the following command to enable flow control:
 

```
Set advanced-networking FlowControl=on
```
2. Connect to the HP Virtual Connect Manager via a Web browser, and edit each applicable Shared Uplink Set to add an associated network for iSCSI. Enable Native and Smart Link for this network.

## NOTE

For our testing purposes, our corporate network traffic is all VLAN tagged, which allowed us to set the iSCSI network to be native. Dell EqualLogic PS-series arrays do not support VLAN tagging. If you have an existing network that is running natively (untagged) in your Shared Uplink Set, you will need to set the physical ports on the switch where the Dell EqualLogic storage is attached to be access ports belonging to that VLAN only.

3. Edit the blade server profiles to assign the new iSCSI virtual network. For our testing, we divided each onboard port in our HP ProLiant BL460c servers into two FlexNICs so that we could assign a connection to each network on each port. This provides added redundancy and allows you a wider selection of total bandwidth for each network (0 – 20 Gb).

## NOTE

To divide LOM ports into FlexNICs, power down your blade servers. In Virtual Connect Manager, the FlexNICs are labeled according to which physical port and physical NIC they are on. For example, LOM1:2-c is the third FlexNIC on Port 2 of LOM1 (LOM stands for LAN Over Motherboard, and LOM1 in this case is the first physical onboard NIC). MEZZ2:1-d is the fourth FlexNIC on Port 1 of MEZZ2 (the second mezzanine card).

Virtual Connect Manager attempts to map ports in a way that maximizes the bandwidth available to each active FlexNIC. When you assign a virtual network to a server, Virtual Connect Manager looks for an unused port. If all ports are in use, Virtual Connect Manager uses the port with the most unmapped FlexNICs. In this way, Virtual Connect Manager allocates all active FlexNICs evenly across available physical ports.

4. Once your iSCSI network is configured in the HP Virtual Connect Manager, skip to page 20 to configure the Dell EqualLogic PS6110E storage array.

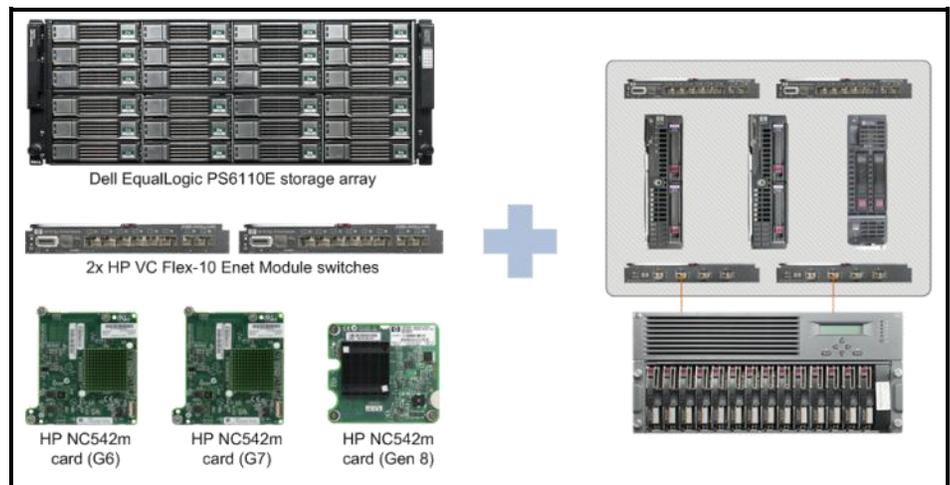
## Adding a dedicated storage network to your configuration

There are a few things to consider before you begin your storage upgrade while adding a dedicated storage network to your configuration:

- Adding a dedicated storage network requires more planned

downtime to install and configure additional mezzanine cards into the blade servers and add the HP Virtual Connect Flex-10 modules. See figure 8 for an overview of the hardware we added to our configuration.

- When you install mezzanine cards and add the Flex-10 modules for the dedicated iSCSI network, keep in mind that the mezzanine connectors in each blade server map with a particular interconnect bay. For the BL460c blade servers in a c7000 enclosure, the mapping is as follows:
  - Embedded NIC corresponds with Bays 1 and 2
  - Mezzanine connector 1 corresponds with Bays 3 and 4
  - Mezzanine connector 2 corresponds with Bays 5 and 6



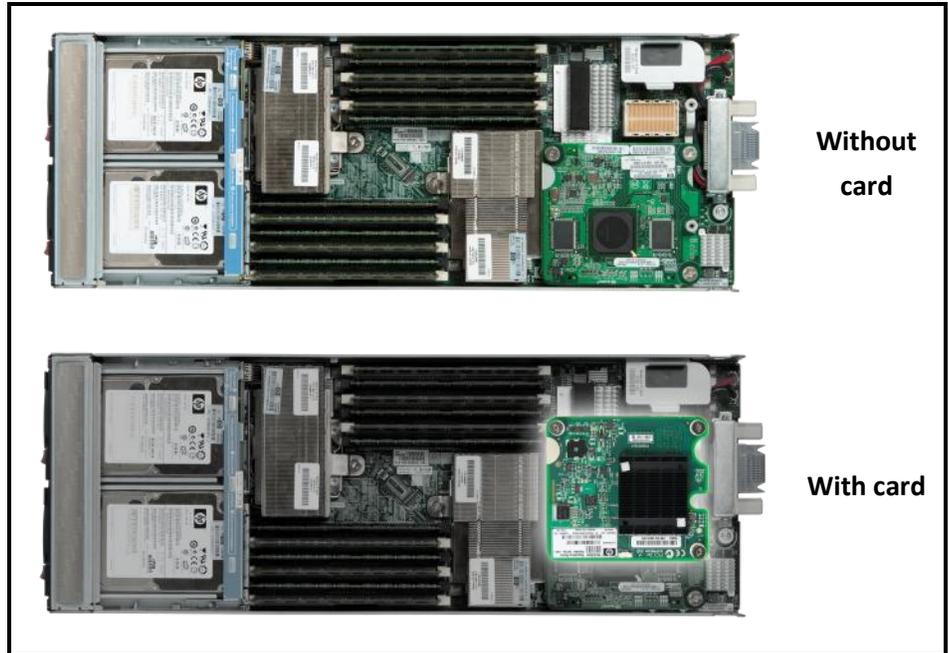
**Figure 8: Sample additional hardware required for a dedicated iSCSI network.**

## NOTE

As with the integrated network configuration, you can directly attach your Dell EqualLogic storage to an individual blade enclosure via the HP Virtual Connect Flex-10 modules. However, we advise connecting your new Dell EqualLogic storage and blade enclosures to dedicated iSCSI switches. This allows you to connect your storage array to multiple blade enclosures, and lets you easily integrate additional Dell EqualLogic storage arrays in the future.

### Installing the blade server mezzanine cards

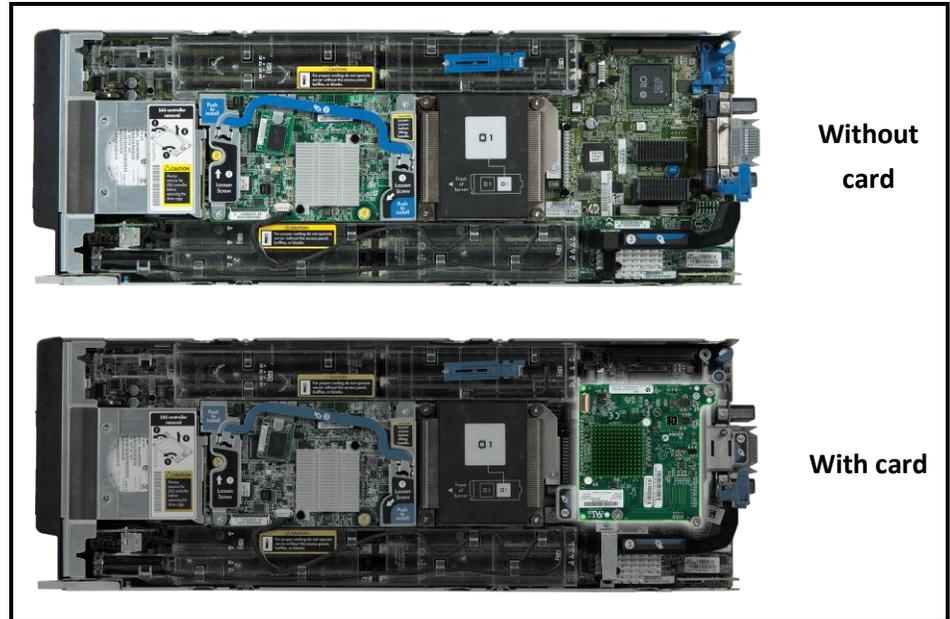
Install mezzanine cards on the HP ProLiant BL460c G6, G7 and Gen8 servers for the dedicated iSCSI network. To install the card on the HP ProLiant BL460c G6 or G7 server, complete the steps below. Figure 9 shows the BL460c G7 without and with the mezzanine card to show proper placement. Please note that the BL460c G6 will look very similar to the BL460 G7.



**Figure 9: View of the HP ProLiant BL460c G7 with and without the mezzanine card.**

1. Remove the blade server from the chassis and remove the cover.
2. Press the mezzanine card into the appropriate connector as Figure 9 shows. We inserted the mezzanine card into connector 2 to correspond with Bays 5 and 6.
3. Tighten the two screws closest to the rear of the blade server.
4. Replace the cover.

The HP ProLiant BL460c Gen8 server looks quite different from the G7. Figure 10 shows the BL460c Gen8 without and with the mezzanine card to show proper placement. Follow the steps below to install the card.



**Figure 10: View of the HP ProLiant BL460c Gen8 with and without the mezzanine card.**

1. Remove the HP ProLiant BL460c Gen8 from the chassis and remove the cover.
2. Lift the plastic blue lever labeled 1.
3. Remove the mezzanine card cradle labeled 2.
4. Install the mezzanine card into the cradle.
5. Replace the cradle, and press the mezzanine card firmly into the appropriate connector, as Figure 10 shows. We inserted the mezzanine card into connector 2 to correspond with Bays 5 and 6.
6. Close the plastic blue lever.
7. Replace the cover.

### **Installing and configuring additional Ethernet modules**

To install and configure the additional Ethernet modules for dedicated iSCSI networking, complete the following steps:

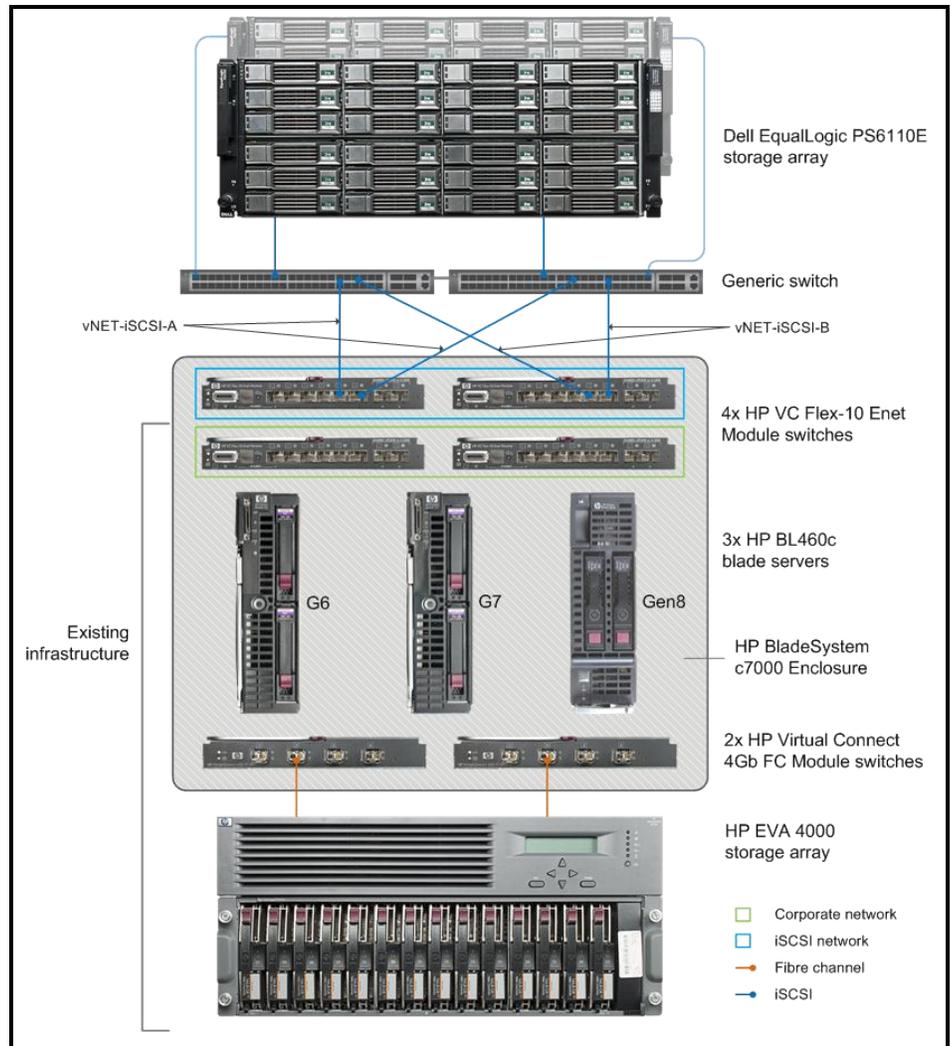
1. Push the interconnect modules into the appropriate bays, horizontally adjacent to one another. We installed the HP Virtual Connect Flex-10 Ethernet modules into interconnect bays 5 and 6.

2. Close the lever on each switch. This will seat the connection to the chassis.
3. Verify the switches are installed correctly by waiting for the green power LED to come on. An amber LED indicates an error.

### Configuring the dedicated chassis networking

Because we are adding blade switch modules, you need not alter your existing virtual networks. You simply create new virtual networks on the added modules and assign them to the mezzanine cards you added. We assume that your dedicated iSCSI network has external redundant switches to allow for high availability, and use them in our test infrastructure.

To configure the networking, assign four uplink ports (two from each Flex-10 module) and connect them to redundant external switches on the dedicated iSCSI network. Split these uplink ports into two virtual networks: iSCSI-A and iSCSI-B. Each virtual network corresponds to one external switch and will be split across the new blade switch modules. Figure 11 illustrates this setup.



**Figure 11: The representative HP infrastructure we used for testing with the dedicated storage network.**

For detailed instructions on configuring the chassis networking, see [Appendix B](#).

1. SSH to each Flex-10 module (you can find the IP addresses in the HP Onboard Administrator) and use the following command to enable flow control:  

```
Set advanced-networking FlowControl=on
```
2. Create a new virtual network using the two of the uplink ports selected for iSCSI. We called this iSCSI-A. Choose one port from each of the Flex-10 modules. Cable these ports to one external switch.

3. Create another new virtual network using the remaining two uplink ports selected for iSCSI, again using one port from each of the Flex-10 modules. We called this iSCSI-B. Cable these ports to the additional external switch (redundant switch for high availability).
4. Edit the existing server profiles to assign the two newly created iSCSI virtual networks to the newly installed mezzanine cards on the BL460c blade servers.

## NOTE

If the new mezzanine cards are Converged Network Adapters (CNAs), such as the NC551i/m or the NC553i/m, offload TCP/IP operations from the CPU by assigning the iSCSI network to ports under iSCSI HBA Connections when editing the server profile in the HP Virtual Connect Manager. For more information, see page 38 of the HP Virtual Connect with iSCSI Cookbook.<sup>1</sup>

## Configuring your blade servers to connect with the Dell EqualLogic PS6110E storage array

Now, it's time to configure the Dell EqualLogic storage array and connect it to your blade servers and virtual machines. For step-by-step instructions, see [Appendix C](#).

### Configuring the blade servers

1. Log into Windows Server 2012 using an administrator account.
2. Provide an IP address and enable jumbo frames for each network adapter connected to the iSCSI network.
3. Install the latest available Dell EqualLogic Host Integration Tools software. Enable all installation features and restart the server after the installation completes.
4. Repeat steps 1 through 3 for each remaining blade server that you plan to connect to your new Dell EqualLogic storage.

If you plan to connect volumes directly to virtual machines using iSCSI initiator, you must complete the following additional steps, which you must briefly shut down your virtual machines to complete. For step-by-step instructions, see [Appendix E](#).

1. Use Microsoft Hyper-V Manager to create an external virtual switch for each iSCSI network adapter on the host. Be sure to allow the host to share the connection. We created two virtual

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<sup>1</sup><http://bizsupport1.austin.hp.com/bc/docs/support/SupportManual/c02533991/c02533991.pdf>

switches, one to correspond with each iSCSI NIC on the host server.

2. Edit the virtual hardware settings for the VMs you wish to connect. Add virtual network adapters (in our case, two) to each VM and connect them to the iSCSI virtual switches.
3. Power your VMs back on, and complete steps 1 through 4 outlined above in the Configuring the blade servers section on each virtual machine.

### Configuring the Dell EqualLogic PS6110E storage array

1. Install the storage array into the rack. Connect the management and appropriate iSCSI ports to their respective networks.
2. Power on the storage array, and connect a serial cable to the active controller.
3. Use a terminal application to access the PS-series CLI. Log in with the appropriate credentials. By default, the username is `grpadmin` and the password is also `grpadmin`. Run the `setup` command and follow the on-screen instructions to set the following values:
  - Member name
  - iSCSI interface name
  - iSCSI interface IP address, subnet mask, and default gateway
  - Group name
  - Group IP address, subnet mask, and default gateway.
  - Password for group membership
  - Password for group administration

### Enabling the management interface and configuring RAID on the PS6110E

Complete the following steps from one of the blade servers that physically connects to the storage array via the iSCSI network. Ensure that you have the latest version of Java Runtime Environment installed and that your iSCSI IP address or addresses are set on the iSCSI NICs.

1. Open a Web browser, and enter the group IP address. Enter the previously set credentials to log into the Dell EqualLogic Group Manager Web GUI.
2. Use the group network settings to enable the management interface and provide a management IP address. This will allow

you to access the Dell EqualLogic Group Manager Web GUI from your management network.

3. Use the group general settings to configure a RAID policy for the array. We selected RAID 10.

### Creating a volume

1. Access the Dell EqualLogic Group Manager Web GUI.
2. Create a volume with an appropriate size and snapshot reserve. Snapshot space requirements depend on your organization's Recovery Time Object/Recover Point Object (RTO/RPO ). For more information, see the Dell Tech Report "EqualLogic Snapshots and Clones: Best Practices and Sizing Guidelines."<sup>2</sup>
3. Add the first IQN of the first server or VM to restrict volume access. You can find the IQN of your server or VM in Windows iSCSI initiator on each respective system. Be sure to enable multiple simultaneous connections when creating the volume if you plan to have multiple servers or VMs connect to the same volume.
4. If necessary, use the volume access settings after creating the volume to provide access to additional servers or VMs by adding their respective IQNs.

## Connecting the storage volumes to your blade servers or VMs

Complete the following steps to connect to the storage volumes using the Dell EqualLogic ASM, iSCSI initiator and Windows disk management. For more detailed information, see [Appendix D](#).

1. Log into your Windows Server 2012 server or virtual machine using an administrator account.
2. Open the Dell EqualLogic ASM (Auto-Snapshot Manager). Click Settings→MPIO Settings, and exclude any subnets not used for iSCSI.
3. Open iSCSI Initiator, and enter the Dell EqualLogic group IP address to connect iSCSI initiator with the storage and display the available iSCSI target volumes. If you do not see the correct volume, verify that you have entered the correct IQN in the

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<sup>2</sup> <http://www.dellstorage.com/WorkArea/DownloadAsset.aspx?id=2750>

access settings for that volume in the Dell EqualLogic Group Manager.

4. Connect to the appropriate volume, and enable multipathing. Once iSCSI initiator has established a connection to the volume, you can verify that multipathing is functional on the Dell EqualLogic MPIO tab.
5. Use Microsoft Disk Management to online, initialize and format the iSCSI volume.
6. Once the volume is formatted and has a drive letter assigned in Disk Management, bind the volume in iSCSI Initiator by using the Auto Configure button in the Volumes and Devices tab. This keeps the iSCSI service from showing as started until all volumes are connected.

Now, your HP infrastructure should be fully functional with the new included Dell PowerEdge EqualLogic PS6110E array and a dedicated network for storage traffic.

## SUMMING IT ALL UP

Upgrading your existing infrastructure's storage arrays with hardware that incorporates newer technology has the potential to increase performance, simplify management, and more. Many organizations wrongly assume that they must stick with offerings from the same vendor as their existing servers, and can miss out on the right fit if it comes from another vendor. As we demonstrated in our tests, integrating Dell EqualLogic PS6110E storage using standard iSCSI protocols into an existing HP blade server environment is not only possible – it's straightforward and works just like storage from the same vendor.

Adding the Dell EqualLogic PS6110E into your HP environment lets you take advantage of the benefits of the new storage array to improve your datacenter.

For more information on Dell PS Series storage and the Dell Fluid Data architecture please see [www.dellstorage.com](http://www.dellstorage.com).

## APPENDIX A – INTEGRATING STORAGE INTO YOUR EXISTING NETWORK INFRASTRUCTURE

In this appendix, we show you how to assign adapters in your blade servers and how to configure the HP Virtual Connect Flex-10 modules to support the iSCSI network and the internal network for corporate traffic. Please note that implementing this configuration may require powering the servers down.

### Enabling flow control on the Flex-10 uplink ports

1. From a management server, open an SSH session to the IP address of the Flex-10 module in Bay 1. To find the IP address, access the HP Onboard Administrator, click Enclosure Information→Enclosure Bay IP Addressing, and click the Interconnect Bays tab.
2. Log in with appropriate credentials.
3. Type `set advanced-networking FlowControl=on` and press Enter.
4. Type `yes` and press Enter.
5. Exit the SSH session.
6. Repeat steps 1 through 5 for Bay 2.

### Adding the iSCSI network to your Shared Uplink Set in HP Virtual Connect Manager

In this section, we show you how to expand your existing Shared Uplink Set currently in use for corporate traffic to also include a virtual network for iSCSI traffic. The iSCSI traffic will use the native VLAN ID (untagged). Implementing this configuration requires powering the servers down.

1. From the management server, open a Web browser and navigate to the IP address of the HP c7000 Onboard Administrator (OA).
2. Enter the appropriate credentials and log into the OA.
3. In the left pane of the Onboard Administrator, click Virtual Connect Manager.
4. Enter the appropriate credentials and log into the Virtual Connect Manager.
5. In the left pane of the Virtual Connect Manager, click Shared Uplink Sets. (See Figure 12.)

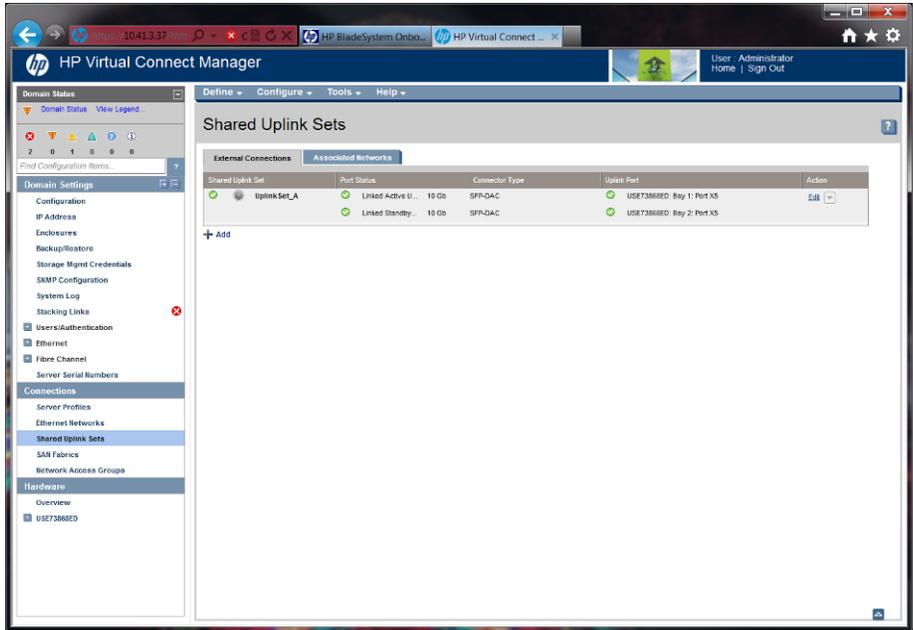


Figure 12: The Shared Uplink Sets screen.

- Click Edit for the Shared Uplink Set to which you wish to add the iSCSI network. (See Figure 13.)

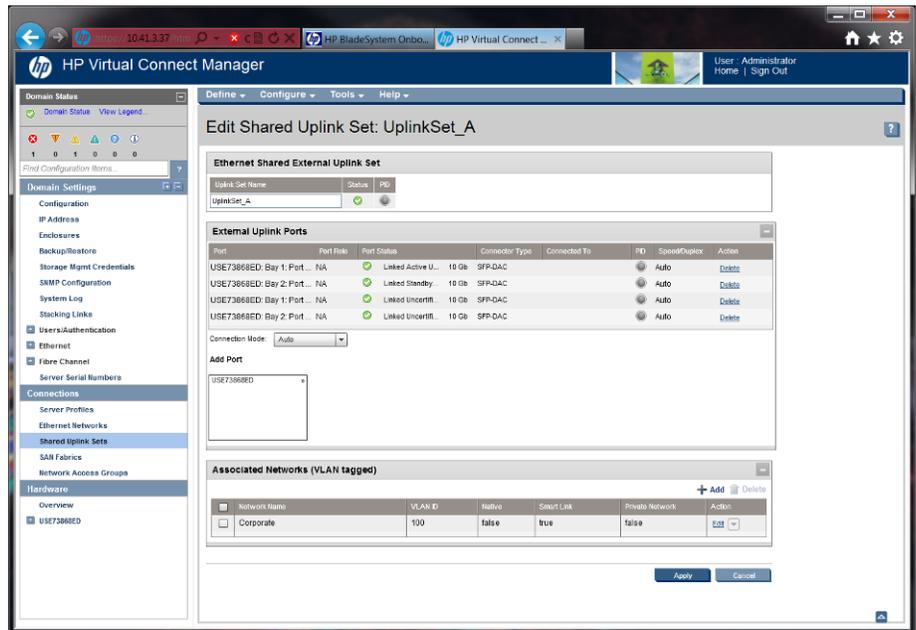


Figure 13: Editing a Shared Uplink Set.

- Under Associated Networks (vLAN tagged), click Add. (See Figure 14.)

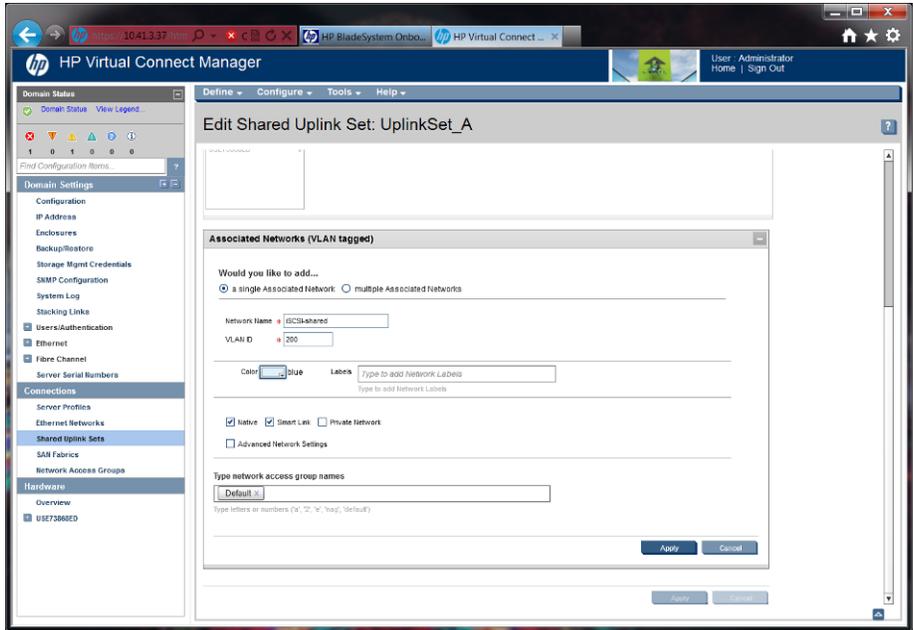


Figure 14: Adding a VLAN-tagged network.

8. Enter a network name.
9. Enter a VLAN ID.
10. Select the Native checkbox. Because this sets the associated network as native, network traffic on this vLAN will not be tagged with a VLAN ID.
11. Select the Smart Link checkbox, and click Apply. (See Figure 15.)

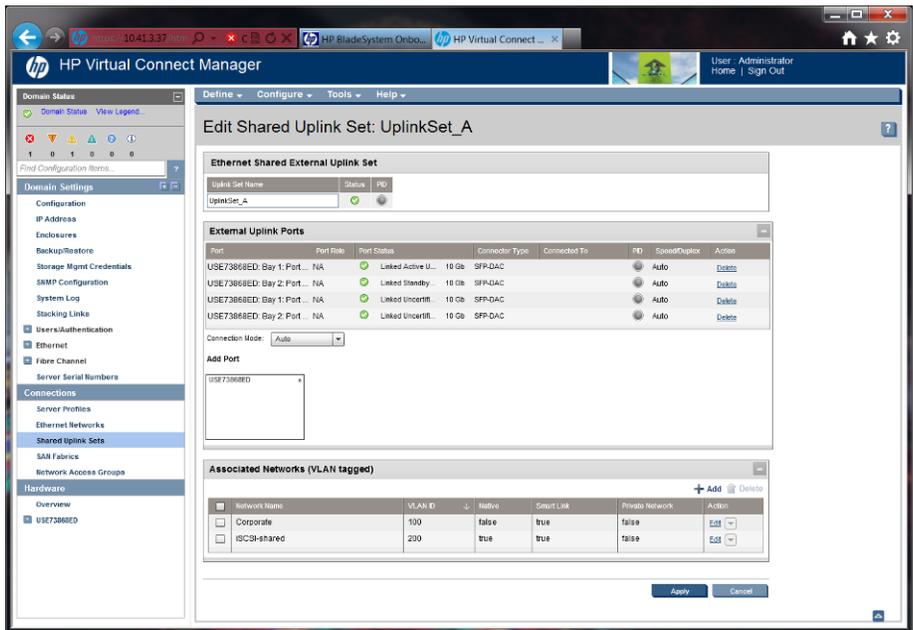


Figure 15: Applying settings.

## Editing your server profiles and creating additional FlexNICs

Shut down the server to add FlexNIC ports to any of the physical ports. To create additional FlexNICs, complete the following steps:

1. In the left pane of the Virtual Connect Manager, click Server Profiles. (See Figure 16.)

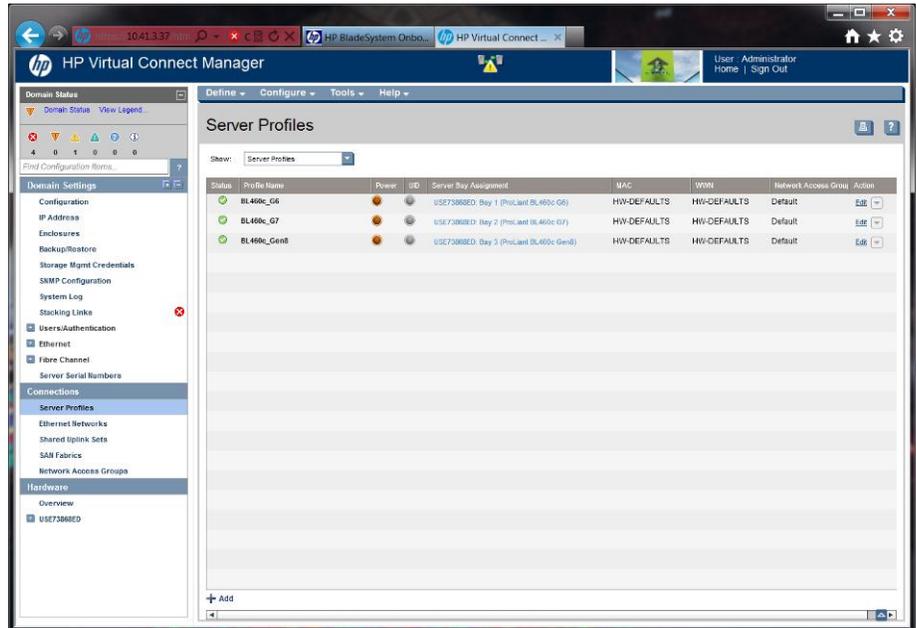


Figure 16: The Server Profiles screen.

2. On the profile assigned to the BL460c G6 (or the first blade server you wish to edit), click Edit.
3. Click Add until there are four entries available.
4. From the Entry 1 drop-down menu, click Select a Network.
5. In the pop-up, choose the corporate network, and click OK.
6. Repeat steps 4 and 5 for the remaining entries, with the following assignments:
  - Entry 2: iSCSI
  - Entry 3: iSCSI
  - Entry 4: Corporate (See Figure 17.)

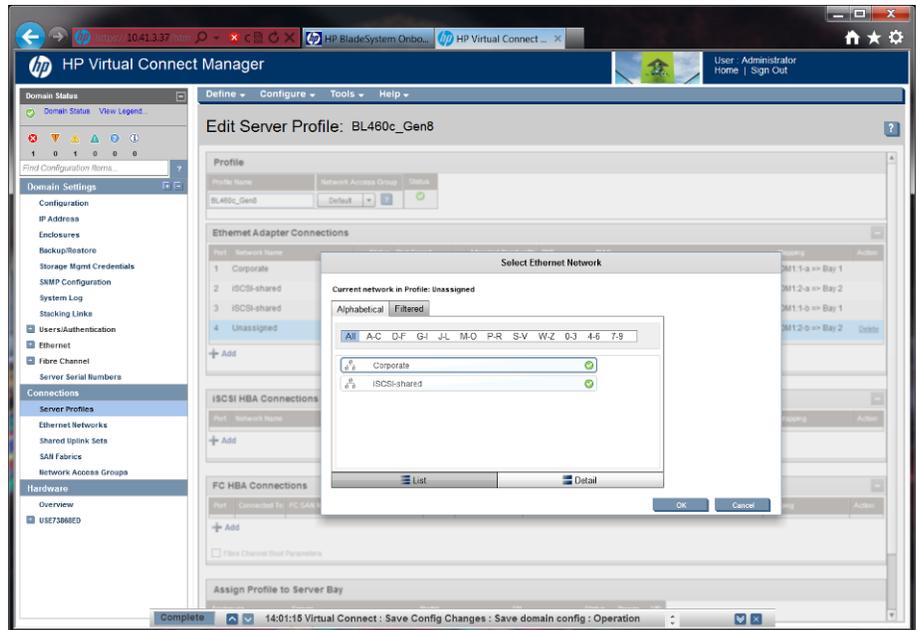


Figure 17: Editing the server profile.

7. At the bottom of the Edit Server Profile screen, click Apply.
8. Repeat steps 2 through 7 for the remaining blade servers.

## APPENDIX B – INTEGRATING STORAGE USING A DEDICATED ISCSI NETWORK

In this appendix, we show you how to configure your newly installed mezzanine cards and HP Virtual Connect Flex-10 modules when you add a Dell EqualLogic PS6110E storage array.

### Enabling flow control on the dedicated iSCSI Flex-10 modules

We assume that you are using interconnect bays 5 and 6 for your dedicated iSCSI Flex-10 modules. Complete the following steps to enable flow control:

1. From a management server, open an SSH session to the IP address of the Flex-10 module in Bay 5. To find this IP address, access the HP Onboard Administrator, click Enclosure Information→Enclosure Bay IP Addressing, and click the Interconnect Bays tab.
2. Log in with appropriate credentials.
3. Type `set advanced-networking FlowControl=on` and press Enter.
4. Type `yes` and press Enter.
5. Exit the SSH session.
6. Repeat steps 1 through 5 for Bay 6.

### Creating a virtual network for iSCSI

In this section, we show you how to create a virtual network for your dedicated iSCSI infrastructure. You will need to complete these steps twice if you have redundant switches for high-availability. For our testing, we created two virtual networks, iSCSI-A and iSCSI-B, and assigned one port from each VC Flex-10 module (two ports total) for each virtual network.

1. From a management server, open a Web browser and navigate to the IP address of the HP c7000 Onboard Administrator.
2. Enter the appropriate credentials and log into the OA.
3. In the left pane of the Onboard Administrator, click Virtual Connect Manager.
4. Enter the appropriate credentials, and log into the Virtual Connect Manager.
5. Click Ethernet Networks. (See Figure 18.)

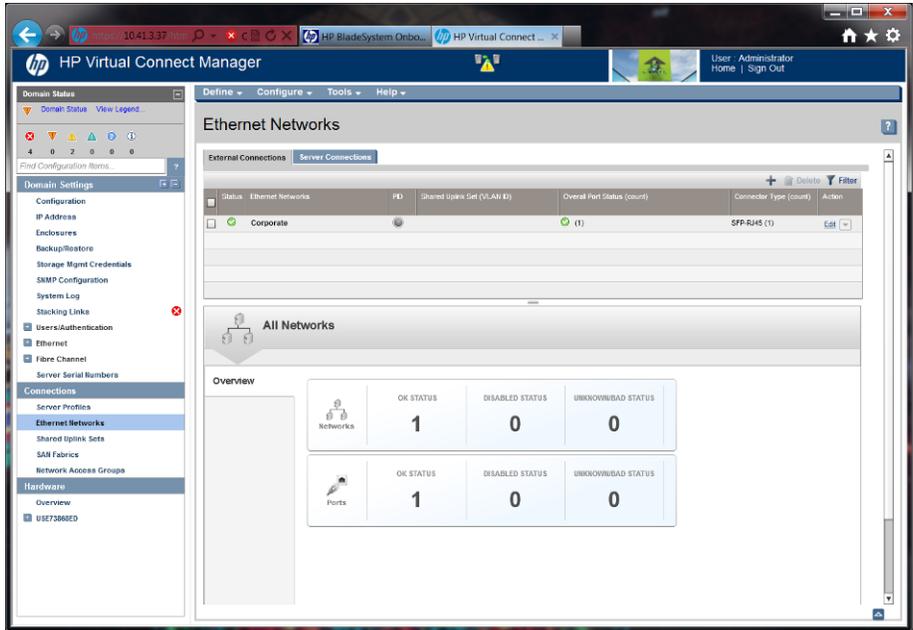


Figure 18: The Ethernet Networks screen.

6. Click the plus-sign symbol (+) to create a new network.
7. In the Network Name field, enter a name for the iSCSI network. In our testing, we named our iSCSI networks `iSCSI-A` and `iSCSI-B`.
8. Under Add Port, click the enclosure name, click Bay 5, and click the port or ports that you wish to dedicate to iSCSI traffic. (See Figure 19.)

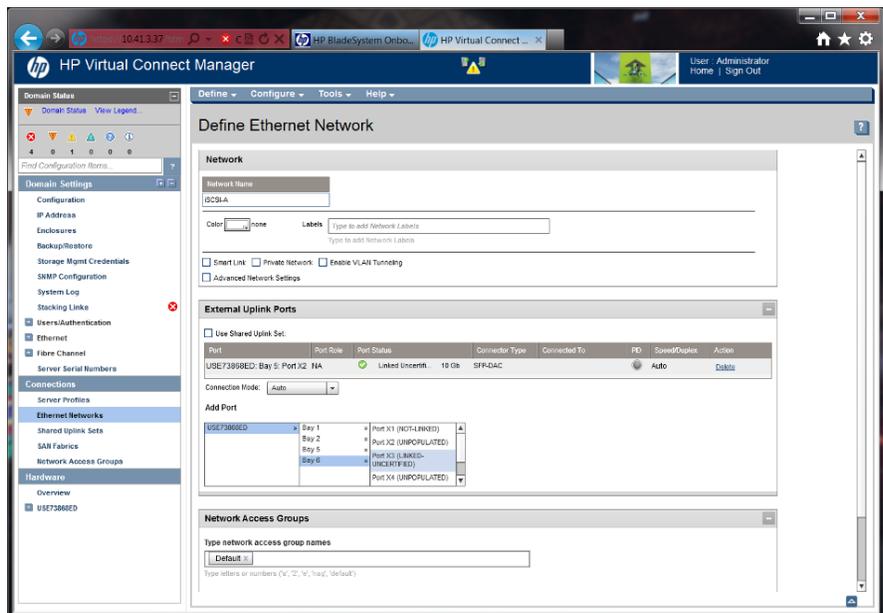


Figure 19: Creating a new Ethernet network.

9. Repeat step 8 for the matching port or ports in Bay 6.
10. Click Apply.

### Creating new FlexNICs on the newly installed mezzanine card

Complete the steps below while the blade servers are powered down after installing the mezzanine card. Please note that if you are using Converged Network Adapters, you will need to complete these steps under iSCSI HBA connections. For more information, see the page 38 of the HP Virtual Connect with iSCSI Cookbook.<sup>3</sup>

1. In the left pane of the Virtual Connect Manager, click Server Profiles. (See Figure 20.)

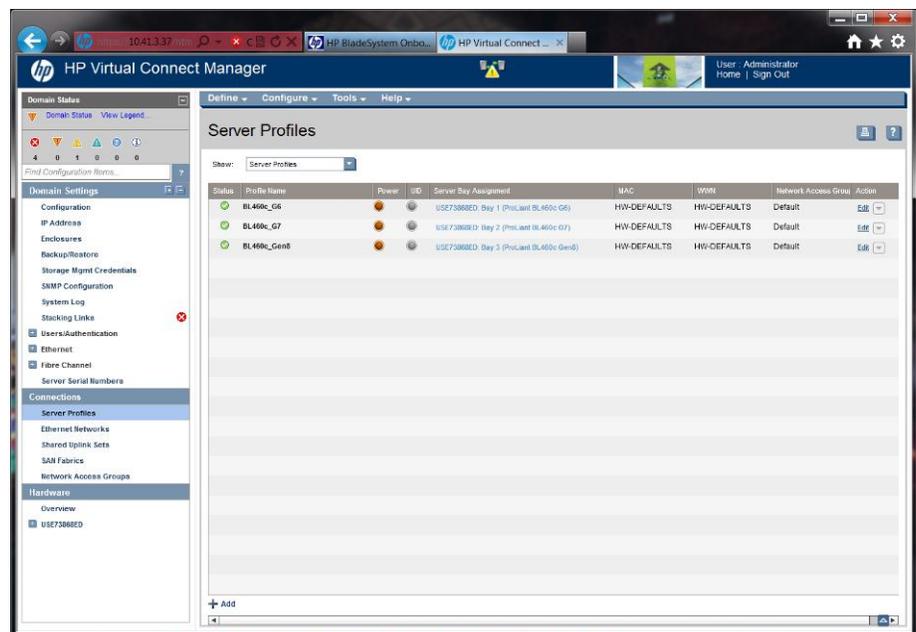


Figure 20: The Server Profiles screen.

2. On the profile assigned to the BL460c G6 (or the first blade server you wish to edit), click Edit. (See Figure 21.)

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<http://bizsupport1.austin.hp.com/bc/docs/support/SupportManual/c02533991/c02533991.pdf>

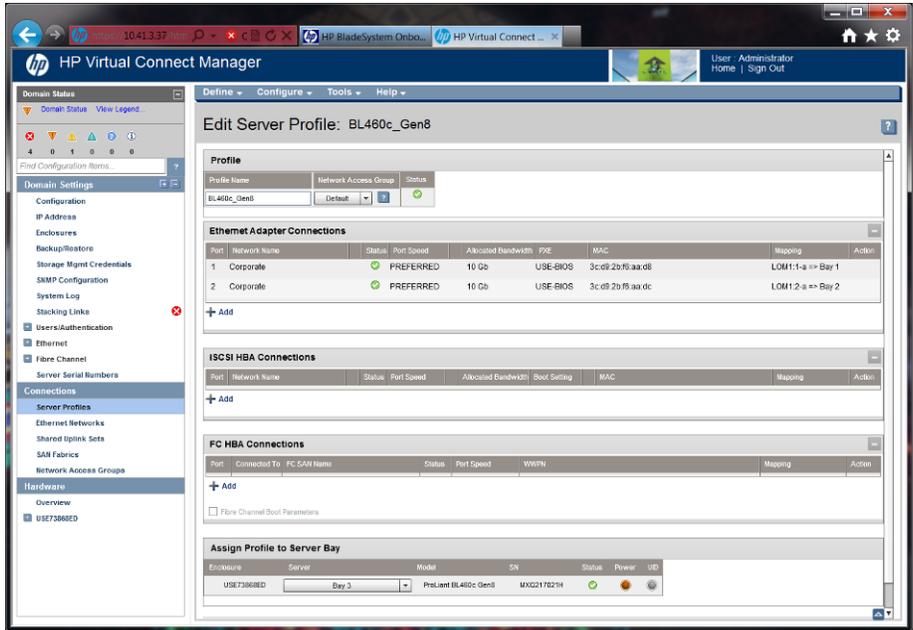


Figure 21: Editing the server profile.

- Each entry in the table is a mapped FlexNIC. Click Add twice to include two more ports. (See Figure 22.)

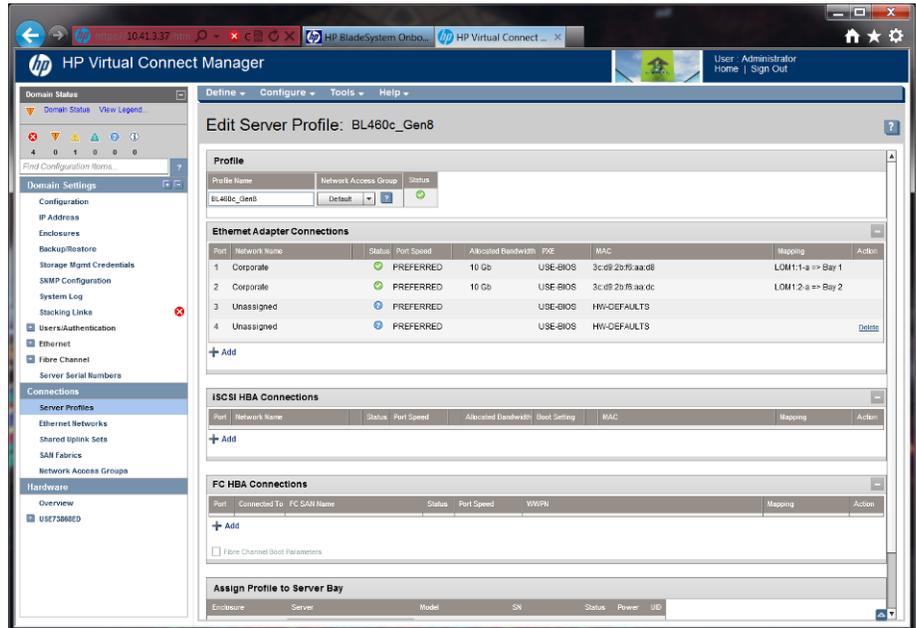


Figure 22: Adding ports.

- On the first added port, click Unassigned→Select a network. (See Figure 23.)

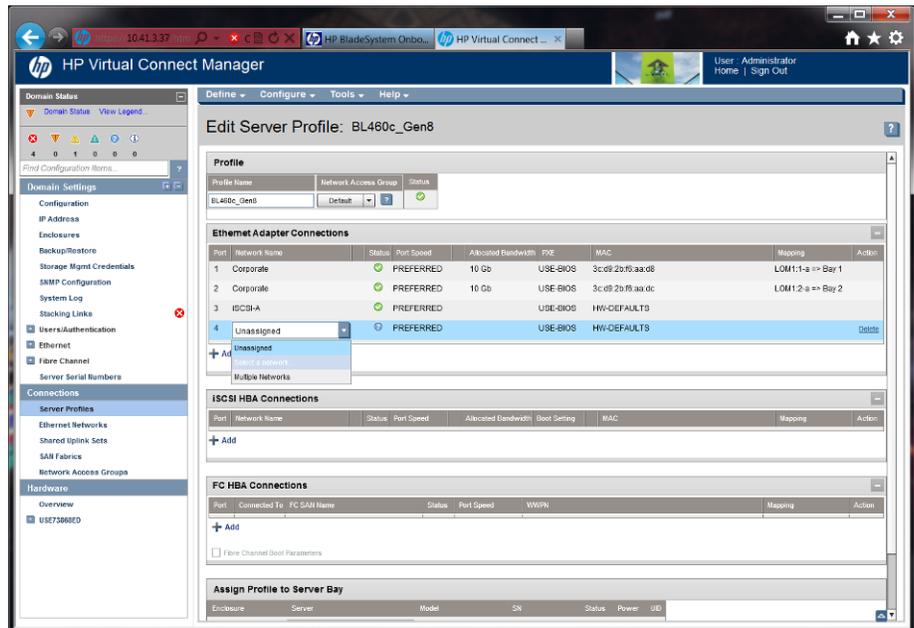


Figure 23: Selecting a network.

- Select the appropriate iSCSI network, and click OK. In our testing, we assigned the first FlexNIC to iSCSI-A. (See Figure 24.)

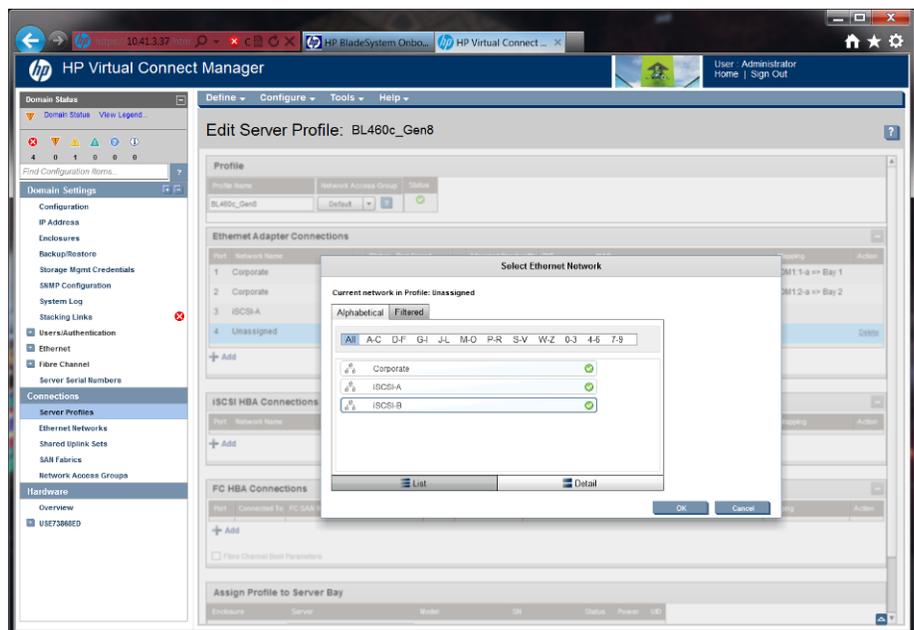


Figure 24: Assigning a network.

- Repeat steps 4 and 5 for the second added port. In our testing, we assigned the second FlexNIC to iSCSI-B. (See Figure 25.)

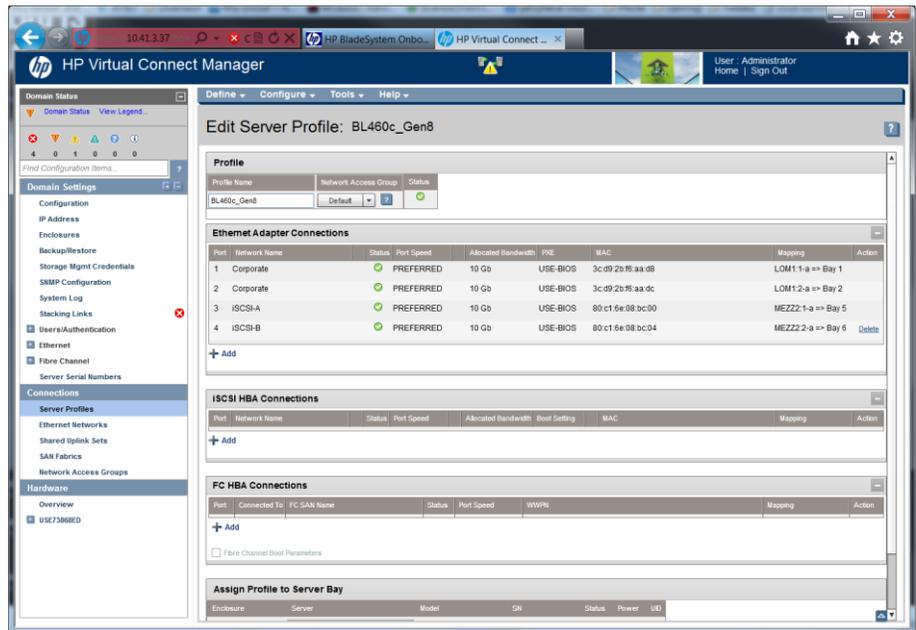


Figure 25: Assigning the second port.

- At the bottom of the Edit Server Profile screen, click Apply.
- Repeat steps 2 through 7 for the remaining blade servers.

## APPENDIX C – SETTING UP THE DELL EQUALLOGIC PS6110E ARRAY

In this appendix, we show you how to install your new Dell EqualLogic PS6110E array, how to configure the IP addressing, and how to install the Dell EqualLogic Host Integration Tools software on your server blades. Installing the Dell EqualLogic Host Integration Tools software will require a restart of the blade server.

### Installing and configuring the Dell EqualLogic PS6110E

1. Install the storage array into the rack.
2. Connect the management and appropriate iSCSI ports on each controller to the appropriate network switches.
3. Power on the storage array.
4. Connect a serial cable from the active controller (indicated by a green light on the controller) on the Dell EqualLogic PS6110E to the management server or any system with a terminal application.
5. Open a serial connection to the PS6110E, and press Enter.
6. Enter the appropriate credentials. By default, both the username and password are `grpadmin`
7. At the Would you like to configure the array now prompt, type `y` and press Enter.
8. At the Do you want to proceed prompt, type `yes` and press Enter.
9. Enter a member name for the storage array. We used `PS6110E-1`
10. Enter a name for the iSCSI network interface. We used the default of `eth0`
11. Enter an IP address for `eth0`. We used `192.168.10.101`
12. Enter a netmask for `eth0`. We used `255.255.255.0`
13. Enter a default gateway for `eth0`. We left this blank.
14. Enter a group name. We used `PSGRP-1`
15. Enter a group IP address. We used `192.168.10.100`
16. Enter a netmask for the group. We used `255.255.255.0`
17. At the Do you want to create a new group prompt, type `yes` and press Enter.
18. At the Do you want to use the group settings shown above prompt, type `yes` and press Enter.
19. Enter a password for managing group membership, and press Enter.
20. Re-enter the password, and press Enter.
21. Enter a password for group administration, and press Enter.
22. Re-enter the password, and press Enter.

### Configuring the blade server network adapters

1. Log into an administrator account on the first blade server you wish to edit.
2. Press the Windows key, type `ncpa.cpl` and press Enter.
3. Find the first network adapter connected the iSCSI network. Right-click it, and select Properties.
4. Select Internet Protocol Version 4 (TCP/IPv4), and click Properties.
5. Select the Use the following IP address radio button, and enter an IP address and Subnet mask appropriate to the iSCSI subnet.
6. Click OK.
7. Click Close.
8. Right-click the same adapter, and click Properties.
9. Click Configure.
10. Click Advanced.
11. Choose Jumbo Packet from the list on the left and select a value greater than or equal to 9000.
12. Repeat steps 2 through 11 for any other network adapters that you plan to use for the iSCSI network.
13. Repeat steps 1 through 12 for the remaining blade servers.

### Installing Dell EqualLogic Host Integration Tools Kit 4.5.0

1. Run Setup64.exe either from the Dell EqualLogic Host Integration Tools Kit 4.5.0 CD or the latest downloaded version from Dell EqualLogic support.
2. At the welcome screen, click Next.
3. At the License Agreement screen, accept the terms in the license agreement, and click Next.
4. At the Destination Folder screen, supply an installation directory, and click Next.
5. At the Setup Type screen, leave the Complete radio button selected, and click Next.
6. At the Ready to Install the Program screen, click Install.
7. Wait until the program features are installed, and click Finish.
8. Click Yes to restart the server.
9. Repeat steps 1 through 8 for the remaining blade servers.

### Enabling the management interface and initializing the array

1. From one of the blade servers that has iSCSI network adapters connected to the same network as the Dell EqualLogic storage array, open a Web browser and navigate to the group IP address. Install Java Runtime Environment if the system prompts you.

2. Enter the appropriate group administration credentials, and click OK.
3. In the left pane, expand Members, and click the name of your Dell EqualLogic PS6110E. (For our testing, this was PS6110E-1.)
4. At the RAID configuration warning, click No.
5. Click Network.
6. Right-click eth1 and select Modify IP settings.
7. Enter an appropriate IP address and subnet mask. Check the Enable interface checkbox, and click OK.
8. At the Enable network interface screen, click Yes. The Web management interface is now accessible through the management network.
9. In the left pane, expand Members, and click the name of your Dell EqualLogic PS6110E. (For our testing, this was PS6110E-1.)
10. At the RAID configuration warning, click Yes.
11. The Configure member wizard appears. At the General Settings screen, click Next.
12. At the RAID Configuration screen, select a RAID policy and Initial RAID capacity, and click Next.
13. At the Summary screen, review the selection, and click Finish.

### Creating a volume

1. In the left pane, expand Storage Pools, and click default.
2. Click Create volume.
3. Enter a name for the volume.
4. Click Next.
5. Enter a volume size and snapshot reserve percentage. We created a volume with 2 TB of space and 20 percent snapshot reserve. For best practices, see the Dell Tech Report.<sup>4</sup>
6. Select an iSCSI access method appropriate to your environment. We restricted access to each specific volume by the iSCSI initiator name and entered the IQN of the appropriate HP ProLiant BL460c blade server. Check the Allow simultaneous connections from initiators with different IQNs box for any volumes you plan on sharing with multiple blade servers or VMs. Click Next. (See Figure 26.)

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<sup>4</sup> <http://www.dellstorage.com/WorkArea/DownloadAsset.aspx?id=2750>

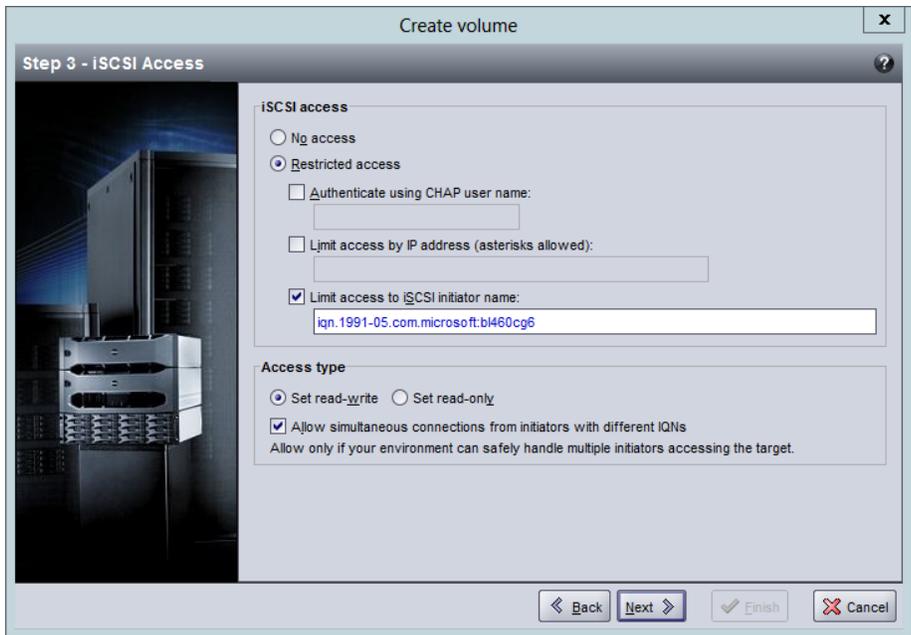


Figure 26: Selecting an iSCSI access method.

7. Review the selections, and click Finish.

If you plan to allow access to the volume from other servers or VMs, complete the following steps:

1. Right-click the volume, and select View iSCSI Settings. (See Figure 27.)

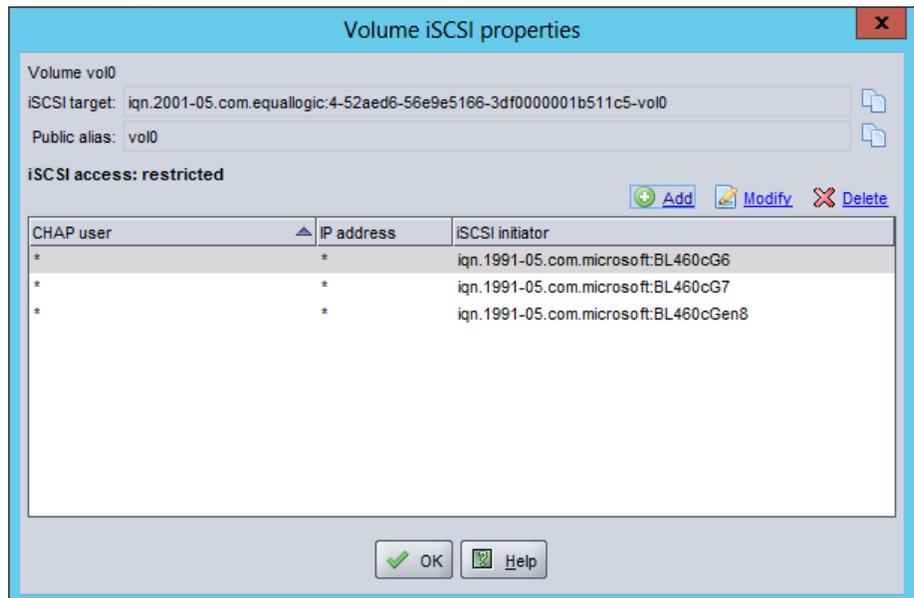


Figure 27: iSCSI settings.

2. Click Add.
3. Check the box for Limit access to iSCSI initiator name, and enter the IQN of another server that you wish to connect to this volume.
4. Click OK.
5. Repeat steps 2 through 4 for any other IQNs that need access to this volume.

## APPENDIX D – CONNECTING STORAGE VOLUMES TO THE BLADE SERVERS

### Connecting to the volume with iSCSI Initiator

1. Log into your first blade server using an administrator account.
2. Press the Windows key, and type `iscsi initiator`
3. Click iSCSI Initiator.
4. Click the Dell EqualLogic MPIO tab.
5. Click MPIO Settings. This will launch the Dell EqualLogic Auto-Snapshot Manager.
6. When the GUI has loaded, select any subnet that is not used for iSCSI, and click Exclude.
7. Repeat step 6 for all subnets that are not used for iSCSI. (See Figure 28.)

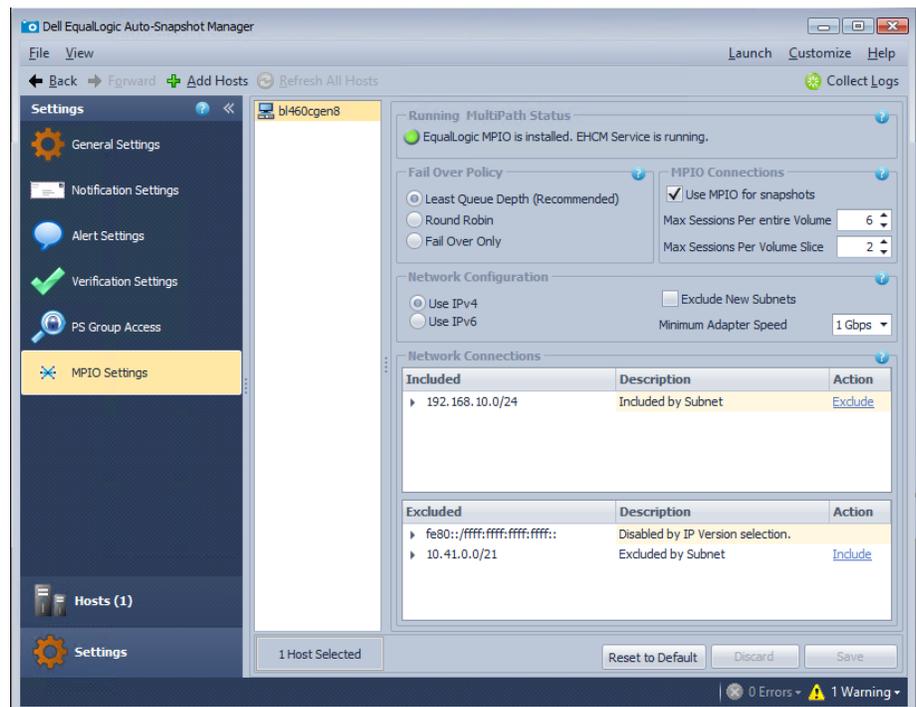
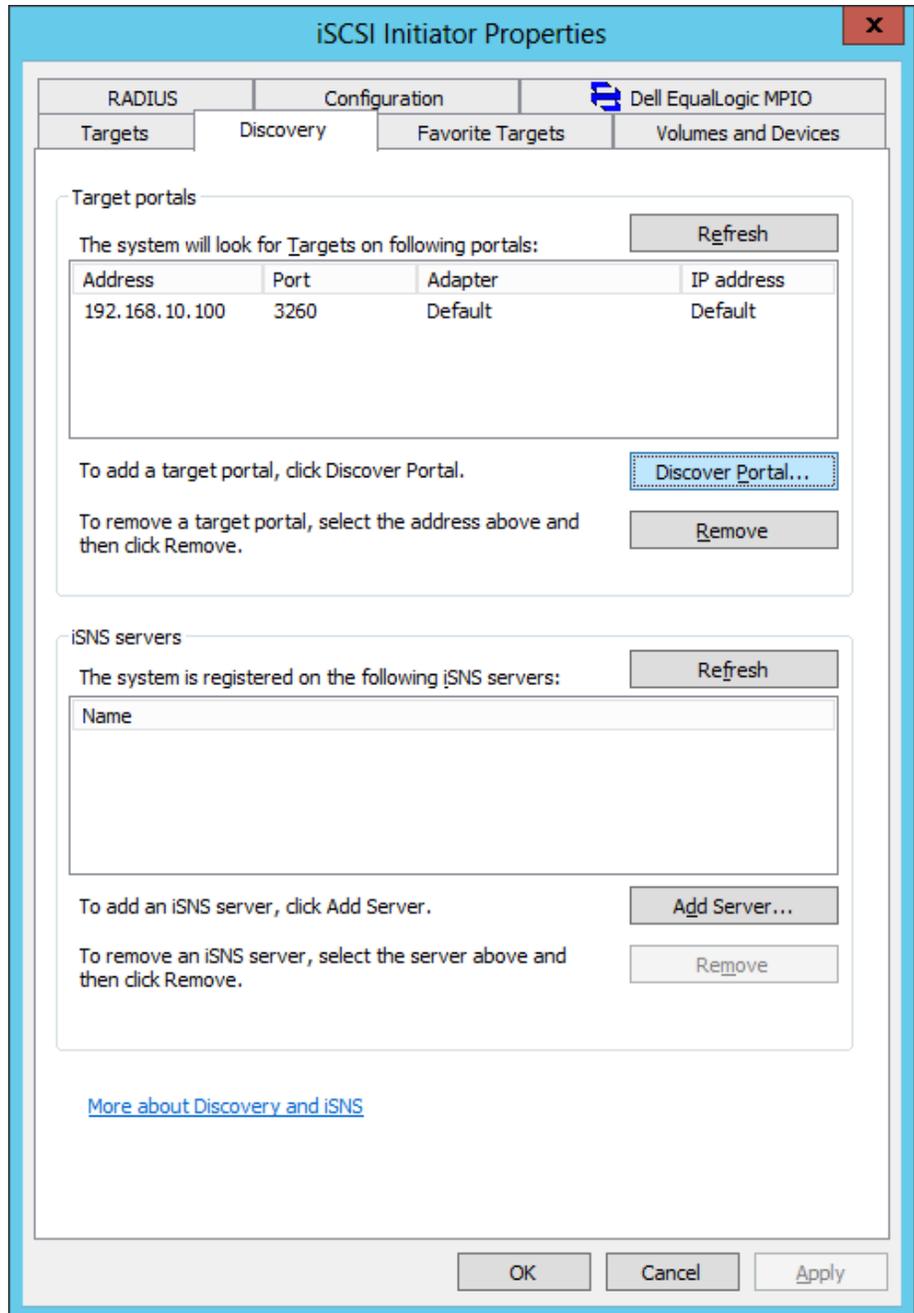


Figure 28: Auto Snapshot Manager.

8. Click Save.
9. Close the GUI.
10. In iSCSI Initiator, click the Discovery tab. (See Figure 29.)



**Figure 29: iSCSI Initiator Properties.**

11. Click Discover Portal.
12. In the IP address or DNS name field, enter the group IP address.  
Leave the default port as 3260 and click OK.
13. Click the Targets tab.
14. Click Refresh.
15. When the iSCSI target appears, select it, and click Connect.
16. Check the Enable multi-pathing checkbox, and click OK.

17. Close the iSCSI Initiator window.
18. Repeat steps 1 through 17 for the remaining blade servers.

### Bringing a volume online

1. Log into your first blade server using an administrator account.
2. Press the Windows key, and type `computer management`.
3. Click Computer Management.
4. From the left pane, select Disk Management.
5. Right-click the name of the offline disk, and click Online.
6. Right-click the name of the disk, and click Initialize Disk.
7. Select an appropriate partition style for the disk, and click OK.
8. Right-click the shaded region of the disk, and click New Simple Volume.
9. Click Next.
10. Choose an appropriate simple volume size, and click Next.
11. Choose an appropriate drive letter, and click Next.
12. Choose appropriate formatting, and click Next.
13. Click Finish.
14. Close the Computer Management window.
15. Repeat steps 1 through 14 for the remaining blade servers.

### Binding the volume in iSCSI Initiator

1. From the BL460c G6, open iSCSI Initiator.
2. Click the Volumes and Devices tab.
3. Click Add.
4. Enter the drive letter of the newly online iSCSI disk.
5. Click OK.
6. Click OK.
7. Repeat steps 1 through 6 for the remaining blade servers.

## APPENDIX E – ADDITIONAL STEPS FOR CONNECTING ISCSI STORAGE DIRECTLY TO A VIRTUAL MACHINE

In this section, we describe how to create the iSCSI virtual network using Hyper-V Manager so that you can connect virtual machines directly to volumes on your Dell EqualLogic PS6110E storage array. Once the iSCSI virtual networking is completed, adding storage volumes to VMs is the same as adding storage volumes directly to a blade server.

### Creating an iSCSI virtual switch

1. From the host server, open Hyper-V Manager.
2. Click Virtual Switch Manager.
3. Leave New virtual network switch and External selected, and click Create Virtual Switch.
4. In the Name field, enter a name for the virtual switch.
5. In the External network drop-down menu, select the first adapter connected to the iSCSI network.
6. Check the Allow management operation system to share this network adapter checkbox. (See Figure 30.)

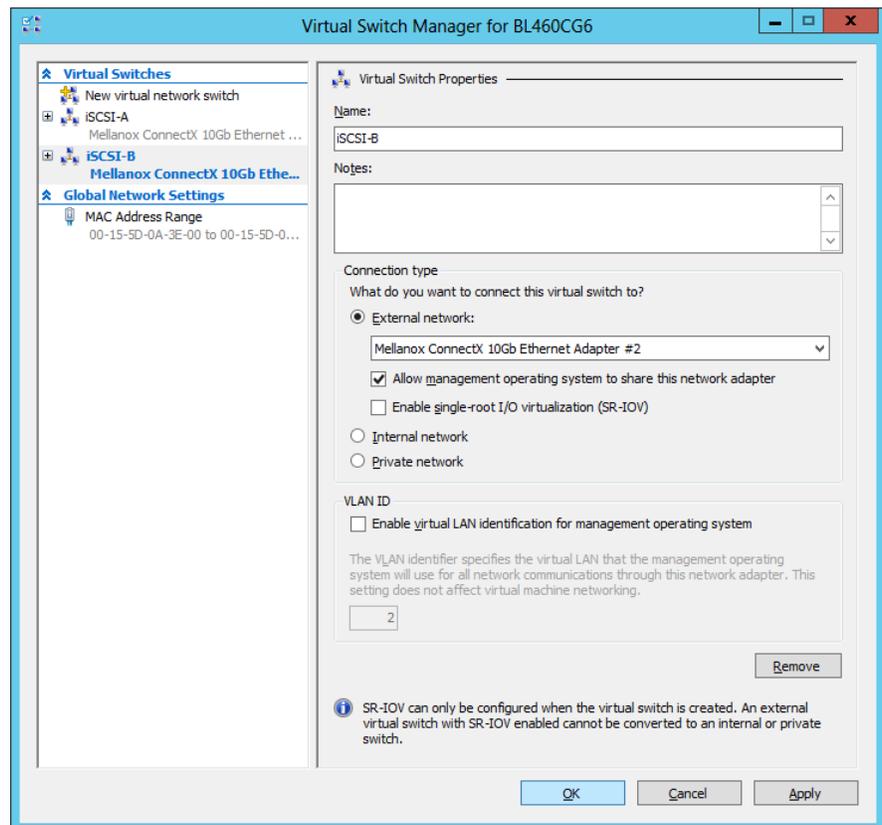


Figure 30: Virtual switch properties screen.

7. Click OK.
8. Repeat steps 2 through 7 for the remaining adapter or adapters connected to the iSCSI network.

### Attaching the virtual switches to the VM

1. In Hyper-V Manager, right-click the VM, and click Shut down.
2. At the warning screen, click Shut down.
3. After the VM is off, right-click the VM, and click Settings.
4. Select Add Hardware and Network Adapter.
5. Click Add.
6. From the drop-down menu, choose an iSCSI virtual switch. (See Figure 31.)

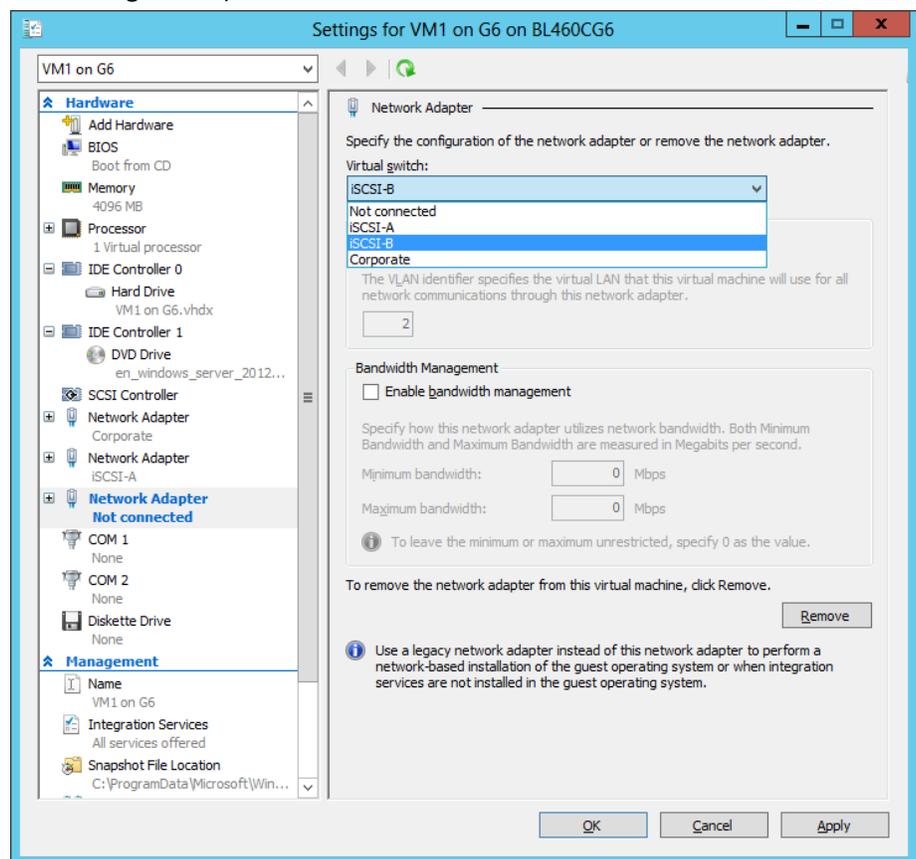


Figure 31: Attaching the virtual switch.

7. Repeat steps 4 through 6 for each iSCSI virtual switch.
8. Click Apply.
9. Click OK.
10. Power on the VM.

## ABOUT PRINCIPLED TECHNOLOGIES



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1007 Slater Road, Suite 300  
Durham, NC, 27703  
[www.principledtechnologies.com](http://www.principledtechnologies.com)

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