

iSCSI Boot from SAN with Dell PS Series

For Dell PowerEdge 13th generation servers

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Revisions

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November 2012	Initial release
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Acknowledgements

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Executive summary

Dell™ Storage PS Series is an ideal solution providing reliable, high-speed, SAN-based disk storage using iSCSI. The iSCSI protocol leverages Ethernet to provide a network medium for storage area networks (SANs). The PS Series, used in conjunction with Dell PowerEdge™ 13th generation servers, can be coupled to provide a boot-from-SAN solution over iSCSI. This offers the flexibility and efficiencies of similar SAN-based booting solutions without the added expense of another SAN technology.

An administrator can configure PowerEdge 13th generation servers to use SAN-based volumes for booting the system. These steps are applicable to any common operating system installation, including Microsoft® Windows Server®, VMware® ESXi®, Red Hat® Enterprise Linux® (RHEL), and SUSE® Linux Enterprise Server (SLES).

1 Introduction

This document provides instructions for configuring PowerEdge 13th generation (13G) servers to boot from an iSCSI SAN-based boot image residing on PS Series storage. The demand for boot servers has developed due to the adoption of SAN-based storage in departmental and enterprise markets. Booting from a SAN-based volume (a Logical Unit Number or LUN) offers greater flexibility with increased power efficiency as well as easy reconfiguration and deployment. It is also non-operating-system specific, and a single server can utilize multiple volumes for booting, each with a different operating system.

With its unique peer storage architecture, PS Series arrays deliver high performance and availability in a flexible environment with a low total cost of ownership. PS Series solutions deliver the benefits of consolidated networked storage in a self-managing, iSCSI SAN that is affordable and easy to use, regardless of scale. By eliminating complex tasks and enabling fast and flexible storage provisioning, these solutions dramatically reduce the costs of storage acquisition and ongoing operations.

With the combination of PS Series arrays and a server host bus adapter (HBA) that supports boot from SAN, servers can boot directly from the storage network. PowerEdge 13G server onboard Ethernet supports boot from SAN, an operation that is similar to the traditional boot process except the cost of hardware is reduced and the network is used for boot instead of the traditional boot process.

Using boot from SAN provides a number of benefits:

- **Simplified backup process:** The PS Series provides several features that simplify backup procedures, including snapshots and replication.
- **Enhanced reliability:** Multiple paths to the boot disk eliminate a single point of failure to the operating system.
- **Centralized management:** Operating system images on an array can make management easier and more efficient.
- **Cost efficiency and reduced footprint:** Servers no longer need disks, reducing power and cooling needs.
- **Easier replacement:** When a server reaches its lifecycle end, it can be replaced, and the new server can use the old boot image.
- **Booting across an ubiquitous technology:** Ethernet is almost universally in place throughout companies today, and boot from SAN over iSCSI leverages this technology.

1.1 Audience

This document is intended for server and storage administrators who are involved in the design or implementation of servers that boot from PS Series iSCSI SAN volumes. This paper establishes best practices for PowerEdge servers in conjunction with PS Storage arrays and supported network interface cards. Readers should be familiar with PS Series iSCSI storage and PowerEdge servers along with their respective operating systems, as well as general concepts about SAN storage and Ethernet networking.

1.2 Scope

Using boot from SAN is possible with many different operating systems. The focus of this paper is to explore setting up PowerEdge 13G servers to boot from PS Series storage through iSCSI.

Component	Details
Operating system	<ul style="list-style-type: none">• Microsoft Windows Server 2008 and above• VMware ESXi 5.0 and above• Red Hat Enterprise Linux 5.0 and above• SUSE Linux Enterprise 11 and above
Servers	Dell PowerEdge servers (13G) (process validated on PowerEdge R730, system BIOS v1.5.4)
Network adapters	<ul style="list-style-type: none">• Broadcom® 1GbE BCM5720 (v7.10 firmware)• Broadcom 10GbE BCM57810 (v7.8 firmware)
Storage array	Dell 1GbE and 10GbE PS Series arrays with firmware 8.0 or greater
Multipath software	<ul style="list-style-type: none">• Host Integration Tools for Microsoft• Host Integration Tools for Linux• Host Integration Tools for VMware

1.3 Terminology

13G PowerEdge servers: Dell PowerEdge 13th generation servers.

Arrays: iSCSI-based Dell Storage PS Series arrays.

Initiator: An endpoint in an iSCSI connection. A server host typically is an initiator, in that it initiates a SCSI session to make use of a disk storage resource provided by a storage array (a target).

IQN (iSCSI Qualified Name): The IQN format is used to assign names for targets and initiators. The IQN format was defined in Request for Comment publications 3720 and 3721 by the Internet Engineering Task Force.

Storage area network (SAN): A network that connects storage arrays and host interfaces. A SAN often includes arrays, switches, and host interconnections as a single entity.

Target: A storage resource, such as a storage array, from which a host (an initiator) can make use of disk storage resources.

2 Process overview

The following overview describes the steps covered in this document for configuring iSCSI boot from SAN:

1. Use the [configuration worksheet](#) in appendix A to gather the necessary configuration details.
2. Configure the PS Series storage array and prepare the boot volume (iSCSI target).
3. Configure the server and network adapter(s) on the server (iSCSI initiator) to support the boot-from-iSCSI target.
4. Install the operating system onto the iSCSI target volume that was prepared for boot. Installation details are beyond the scope of this paper. Each operating system has slightly different considerations, but the allocation and use of the iSCSI volume for PowerEdge 13G servers remain common among all operating system installations.
5. Following the installation, other post-installation steps might be considered:
 - a. As applicable, configure redundant boot paths and multipath I/O for the boot volumes and any additional SAN volumes. For more information, see the *Dell EqualLogic Group Manager Administrator's Guide* at eqsupport.dell.com (login required).
 - b. Optionally, use the Dell Host Integration Tools for PS Series arrays, which provide a set of useful tools for multipath I/O (MPIO). Operating systems supporting these tools include Microsoft Windows, VMware ESXi, Red Hat Enterprise Linux, and SUSE Linux Enterprise Server. For more information, see the appropriate Host Integration Tools manual.

3 Pre-installation

Before starting, gather the following information and complete the following steps:

1. Use the [configuration tracking worksheet](#) in appendix A.
 - a. Note the IP address, IQN, subnet mask, and other details about the Ethernet adapter.

Note: The IQN name may also be known as the initiator name in the network adapter configuration.

- b. Note the Dell Storage PS Series group details and volume details as needed.
2. Follow all best practices related to storage, network switches, and servers. Refer to the following documents for more information:
 - a. The [Rapid Equallogic Configuration Portal](#) offers helpful information and guides for configuring a Dell Storage PS Series SAN network.
 - b. [Switch Configuration Guides for PS Series SANs](#) provide information for configuring network switches.
3. Update the Dell Storage PS Series array being used with the latest drivers and firmware. The software is available at eqsupport.dell.com.

4 Configuring the iSCSI target

Space and permissions must be allocated on the PS Series array to permit booting over the iSCSI SAN. Storage must be dedicated to a volume and the target volume must be made accessible to the storage host initiator.

To create a boot-from-SAN volume on the PS Series array using the Group Manager:

1. Log into the PS Series array through a web browser by entering the IP address of the group.
2. Once logged in, click the **Storage Pools** and select the desired pool in which the volume will be created. Once selected, under **Activities**, click **Create Volumes** to create volume on the PS array.
3. Give the volume a name and optionally enter a description. Use a storage pool with free space and click **Next**.
4. Assign a volume size that will meet the needs of the operating system.

Operating system demands vary. The size of the files that make up the operating system and swap space are crucial considerations. Refer to the recommendations of the operating system manufacturer. To create a thin volume, select the checkbox, **Thin volume provisioned**. The snapshot reserve defaults to 100%, but it can be altered as needed.

Note: For more information on the default allocation of snapshot reserves, see the white paper, [Equallogic Snapshots and Clones: Best Practices and Sizing Guides](#).

Storage pool default	Current	New	Change
Volume reserve	706.57 GB	806.57 GB	100 GB
Snapshot reserve	1.47 TB	1.57 TB	100 GB
Replication reserve	606.78 GB	606.78 GB	0 MB
Delegated space	15.48 TB	15.48 TB	0 MB
Free pool space	16.98 TB	16.78 TB	-200.01 GB
Available for borrowing	18.09 TB	17.99 TB	-100 GB

Figure 1 Configuring the volume size using the PS Series Group Manager

- Grant the host initiator access to the volume by providing the IP address, host initiator's IQN name, or CHAP authentication information. Any one of these methods is acceptable.

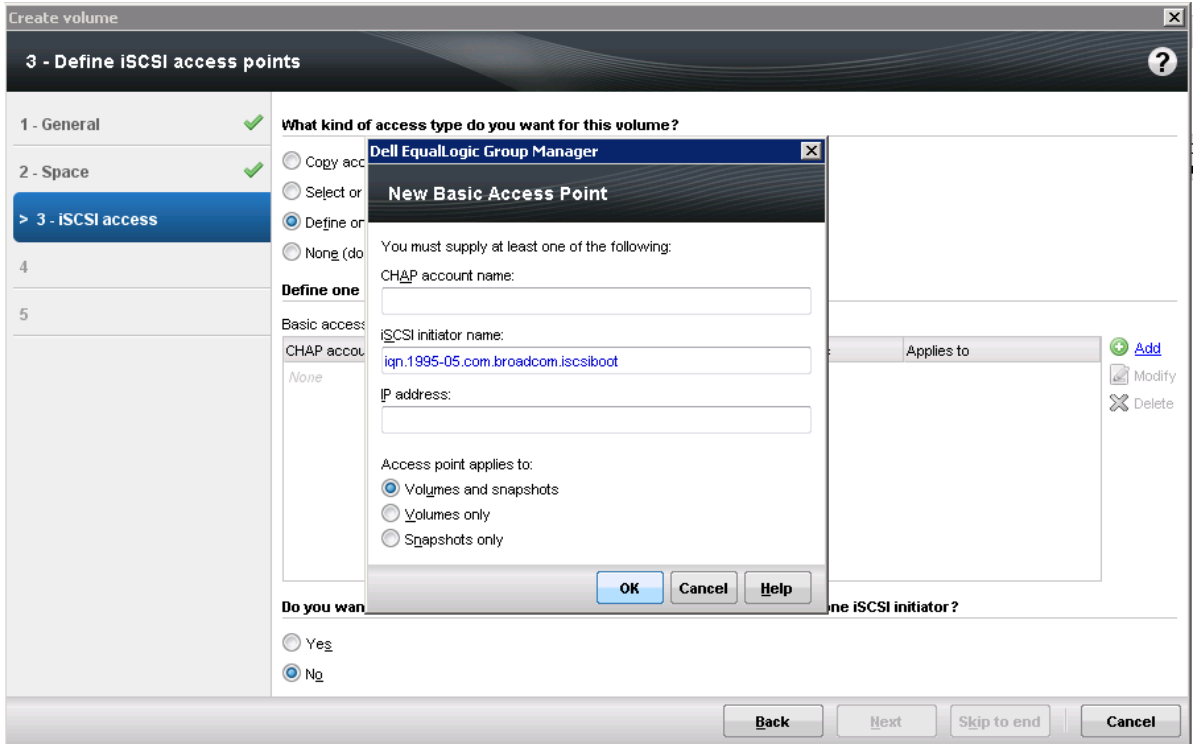


Figure 2 Choose the access type through the iSCSI access tab

- Keep the default access type of **read-write**. Click **OK**.
- When Group Manager displays the summary screen, verify the settings and click **Finish** to create the volume.
- Display the **Volumes** section of Group Manager by clicking the lower-left **Volume** button. Select the volume that was recently created and is listed under volumes. Choose the **Connections** tab, and note the iSCSI target name (listed in the configuration worksheet in appendix A).

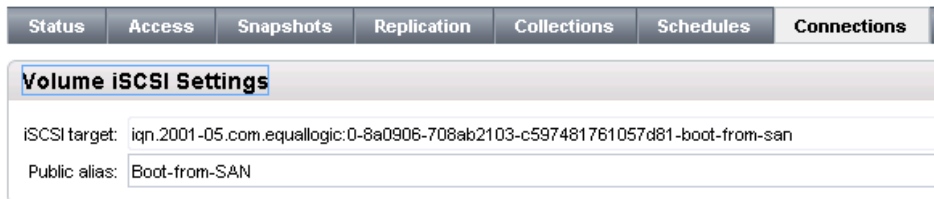


Figure 3 Example showing the Connections tab and the iSCSI target information

5 Configuring the iSCSI initiator

The onboard Broadcom BMC5720 interface, or another add-in network adapter, must be configured to act as an iSCSI initiator and connect to the newly created PS Series volume. After a connection is made, the operating system can be installed and the host subsequently booted off the iSCSI target volume.

To configure the iSCSI initiator:

1. Boot the host.
2. Press **[F10]** to enter the Dell Lifecycle Controller **Unified Server Configurator (USC)**.
3. Select **System Setup, Advanced Hardware Configuration**, and then **Device Settings**.

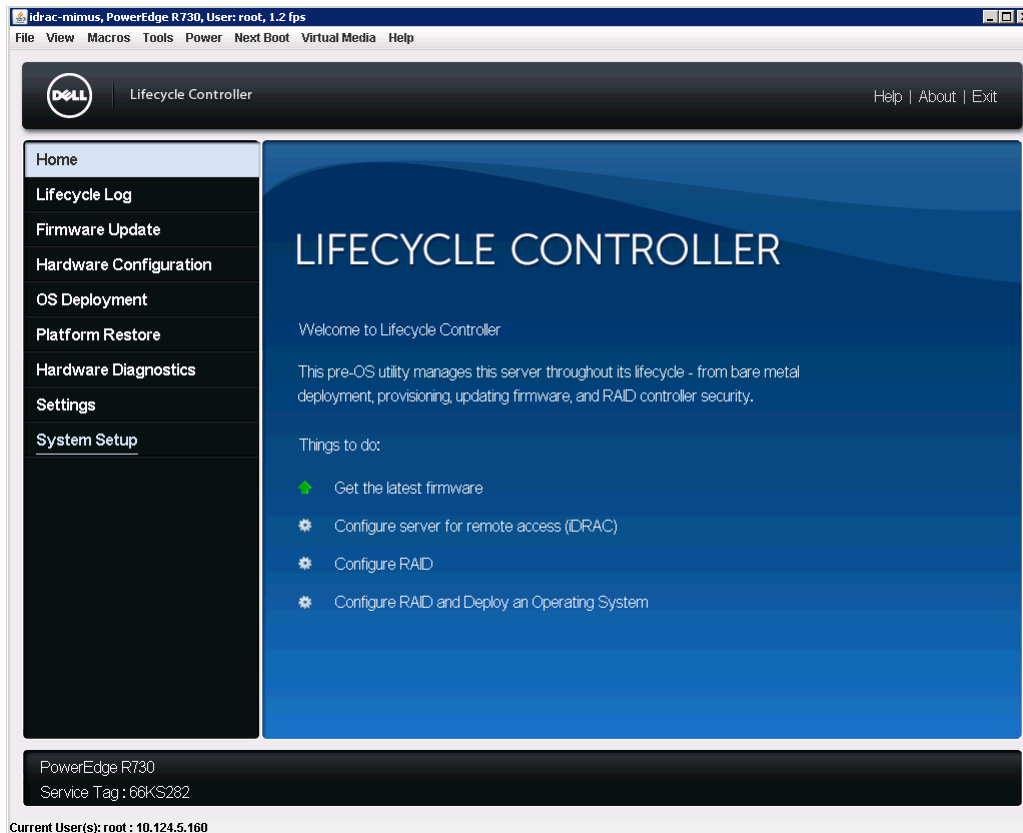


Figure 4 Dell Lifecycle Controller Unified Server Configurator (USC)

5.1 Configuring the onboard Broadcom NIC

The onboard Broadcom BCM5720 network adapter configuration is configured in the USC under Device Settings. NIC3 is used for iSCSI connectivity. Although any NIC can be used, some operating systems such as VMware ESXi require NIC1 be dedicated to management.

1. To use the onboard BCM5720 port 3, in the **Device Settings** menu, select **Integrated NIC 1Port 3: Broadcom Gigabit Ethernet BCM5720**.

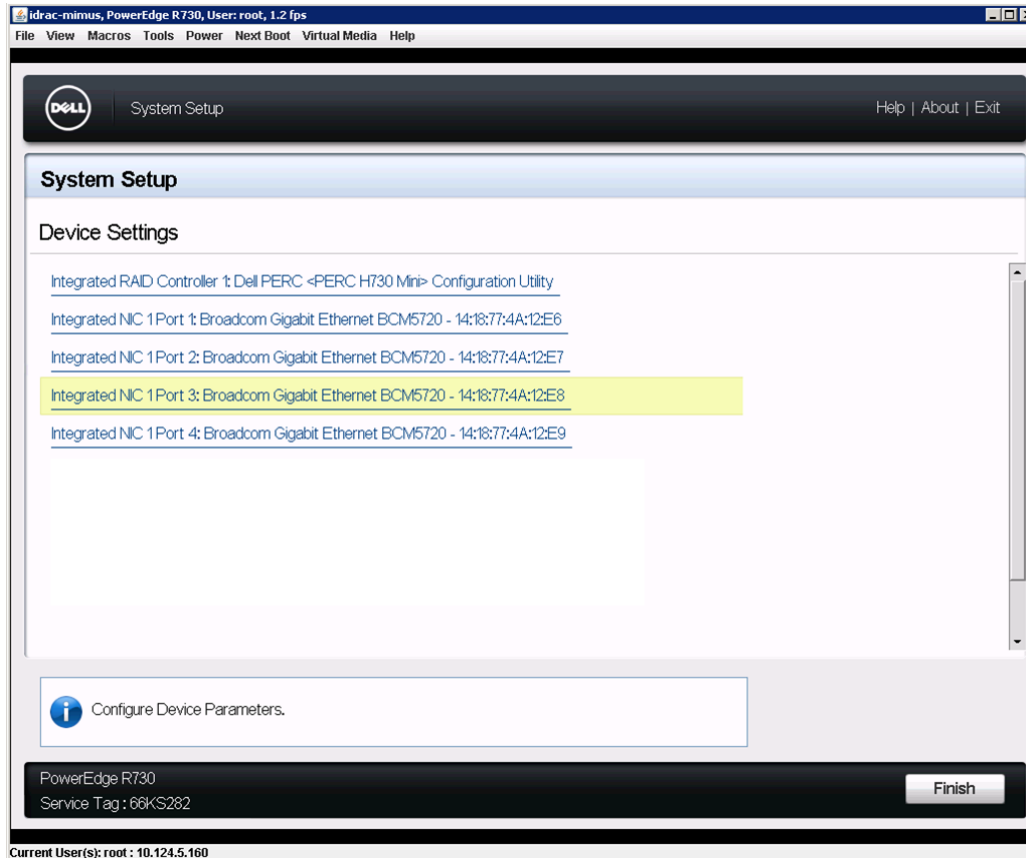


Figure 5 PowerEdge (13G) Device Settings menu

2. Select the **NIC Configuration** menu.

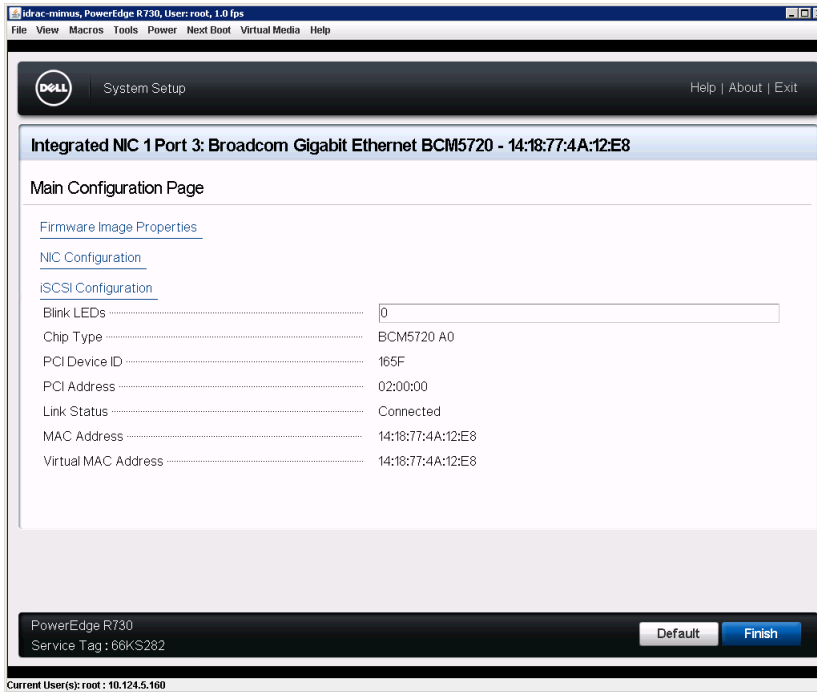


Figure 6 Top menu for NIC 1 Port 3 (Broadcom BCM5270)

3. Set the **Legacy Boot Protocol** to **iSCSI**.
4. To return to the **Main Configuration Page**, click **Back**.

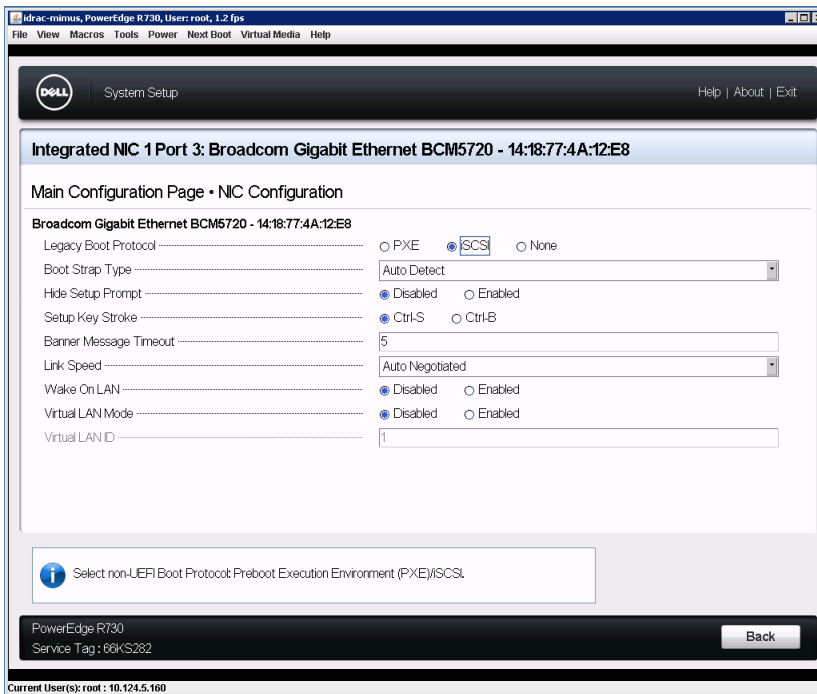


Figure 7 Broadcom BCM5270 NIC configuration menu

5. Select **iSCSI Configuration Menu** and **iSCSI General Parameters**.
6. To use a static IP address, disable **TCP/IP Parameters via DHCP** and **iSCSI Parameters via DHCP**. Leave this unchanged if the host will be using DHCP. DHCP can be useful for dynamically controlling any iSCSI parameters on the DHCP server rather than in the USC.
7. To return to the **iSCSI Configuration Menu**, click **Back**.

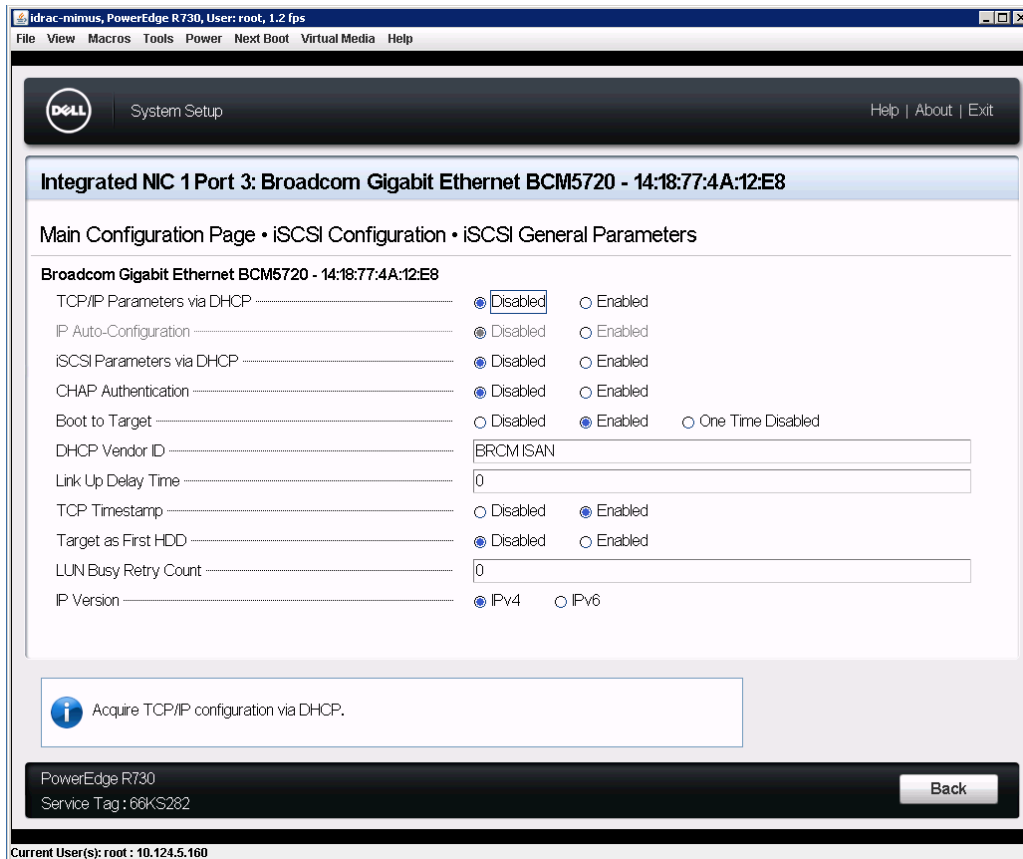


Figure 8 Broadcom BCM5720 iSCSI General Parameters menu

8. Select **iSCSI Initiator Parameters**.
9. Within the **iSCSI Initiator Parameters** menu, enter the **IP Address** of the host, **Subnet Mask**, and if required, the **Default Gateway**, **DNS**, **iSCSI IQN** of the initiator, **CHAP ID**, and **CHAP Secret** if applicable.
10. Click **Back** to exit from the iSCSI General Parameters to the iSCSI Configuration Menu.
11. Select **iSCSI First Target Parameters**.

12. Set **Connect** to **Enabled**.
13. Enter the **IP Address** of the PS Series group hosting the iSCSI volume to be used for booting from the SAN.
14. Set the **iSCSI Name** to the iSCSI IQN of the volume.
15. Set the **CHAP ID** and **CHAP Secret** if using CHAP authentication.
16. Click **Back** twice and click **Finish**.

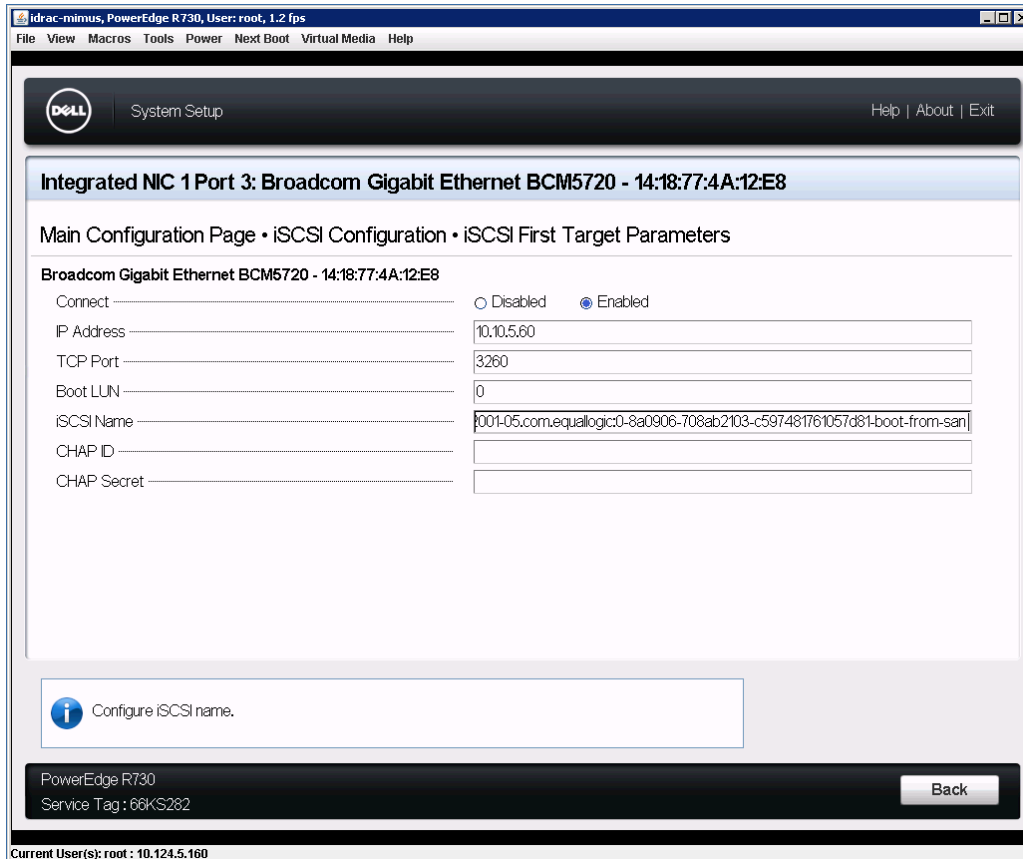


Figure 9 Broadcom BCM5720 iSCSI First Target Parameters menu

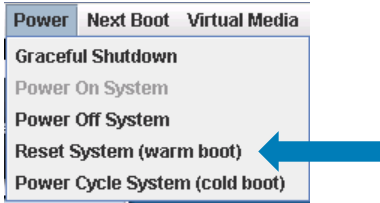
17. Save the changes when prompted.
18. Click **Finish** until returning to the **System Setup** menu.

In addition to the onboard Broadcom 1Gb BCM5720 NIC, other NIC options are available, including 1Gb and 10Gb NICs from Broadcom, Intel®, and QLogic®, all of which have very similar configuration menus within the USC.

5.2 Configuring the BIOS boot order

To install the operating system and boot from it, the BIOS boot order must be changed from the default setting.

Note: If the onboard or add-on interface was connected to the SAN network after the previous system reset, for the Lifecycle Controller USC to register the availability of the newly connected interface, the system will need to be reset again. This can be done in the iDRAC menu under the **Power** menu by selecting **Reset System (warm boot)**.



1. As with configuring the onboard Broadcom Ethernet NIC, reset the server and press [F10] to enter the Dell Lifecycle Controller **Unified Server Configurator (USC)**.
2. Select **System Setup** and select **Advanced Hardware Configuration**, which lists a menu with options including **System BIOS**, **iDRAC Settings**, and **Device Settings**.

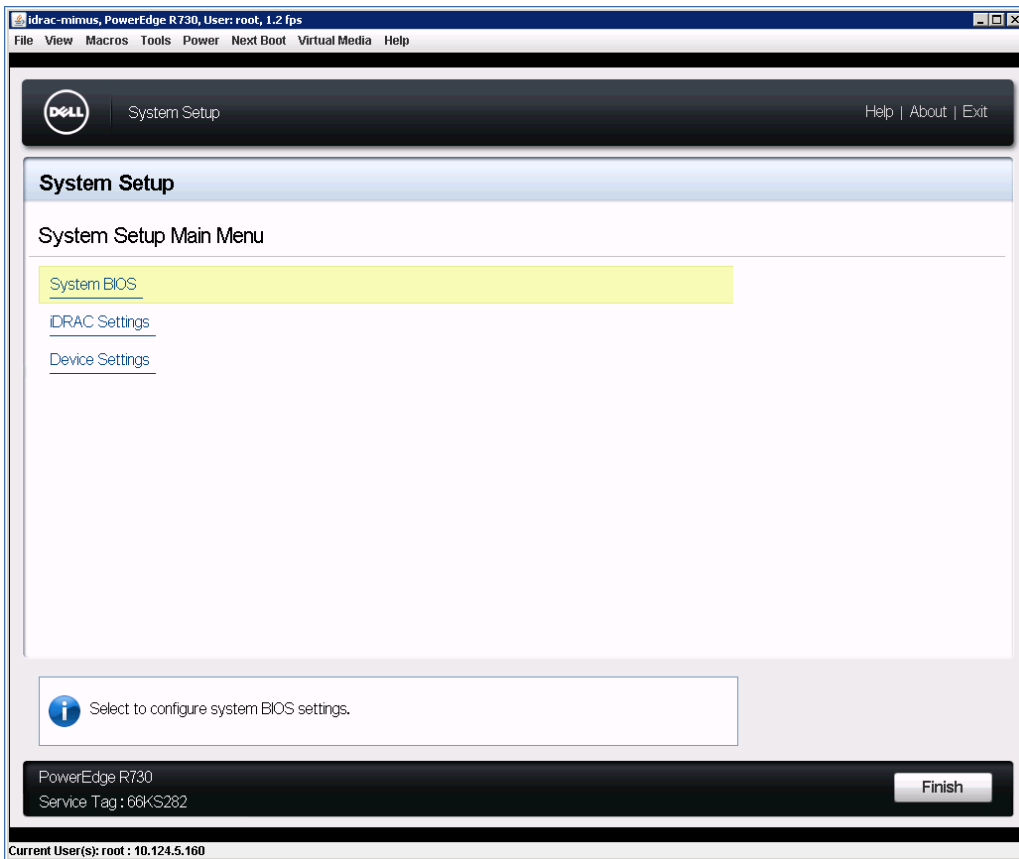


Figure 10 System Setup Main Menu

3. Select **System BIOS**, **Boot Settings**, and **BIOS Boot Settings**.

The **BIOS Boot Settings** menu provides a list of options and two clickable links. Among the list is **Integrated NIC 1 Port 3 Partition 1**, which is the onboard Ethernet connection that will give access to the volume on the PS Series array.

4. To place the third NIC first in the boot order, click **Boot Sequence**. Also, any device excluded from the list of boot options can be unchecked in the **Boot Option Enable/Disable** list. If the operating install is being performed from optical media, do not unclick the optical drive.

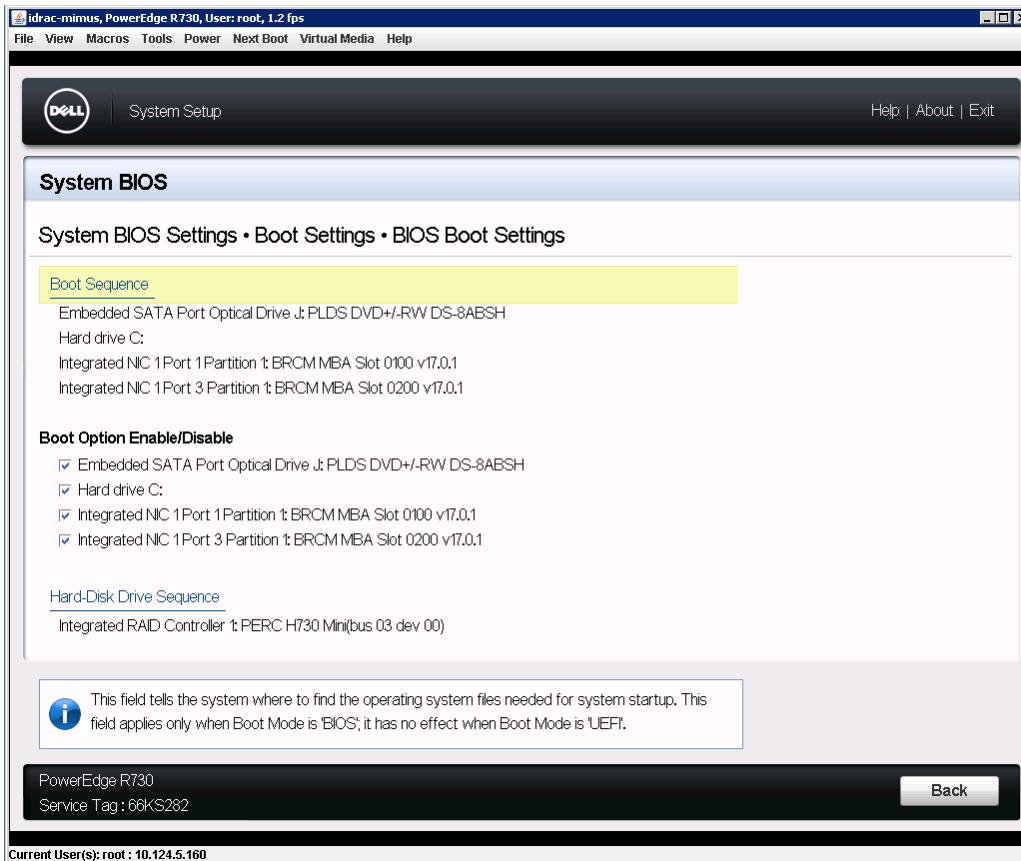


Figure 11 System BIOS Boot Settings menu

- In the **Change Order** menu, select **Integrated NIC 1 Port 3 Partition 1** and click the plus symbol until this item is first in the list. The optical drive should be listed second, assuming it is used for operating system installation. If installation will be performed through PXE-boot, **Integrated NIC 1 Port 1 Partition 1** must be the second boot device.

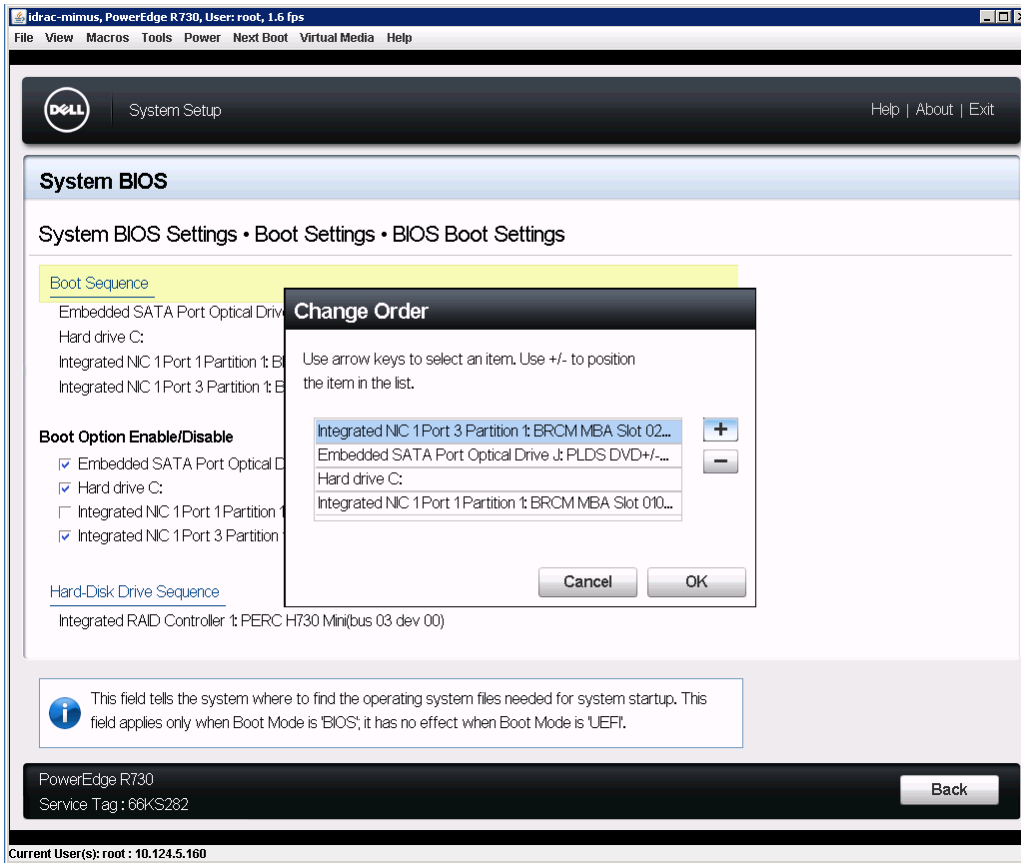


Figure 12 Setting the first boot option to NIC 1 Port 3 (Broadcom BCM5270)

- Click **Back** twice and click **Finish**. Be sure to confirm the changes made.

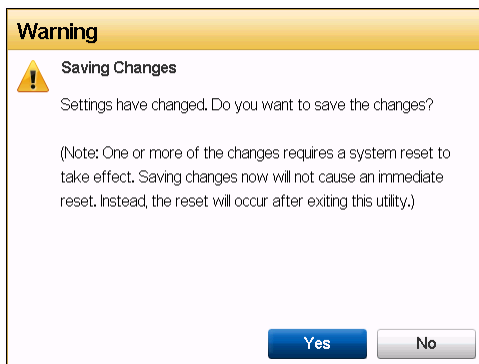


Figure 13 Save changes

At this point, disable the iSCSI boot for a single boot or the BIOS will attempt to boot the empty iSCSI boot target (which has no operating system) and will fail.

1. Select **Device Settings** to open the Device Settings menu.
2. Select **Integrated NIC 1 Port 3** to open the iSCSI Configuration menu.
3. Select **iSCSI Configuration** to open the iSCSI Configuration menu.
4. Select **iSCSI General Parameters**.
5. For the **Boot to Target** setting, select **One Time Disabled** to prevent a failed boot to the empty iSCSI target volume.
6. Click **Back** twice and click **Finish**.

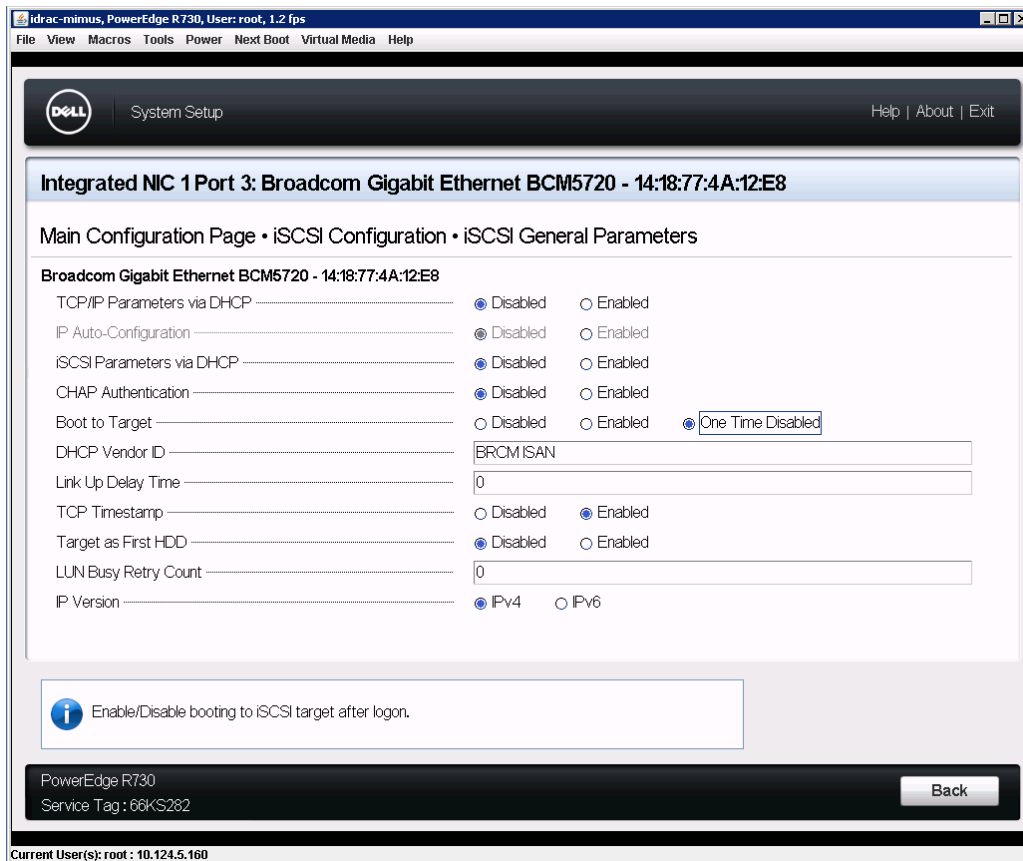
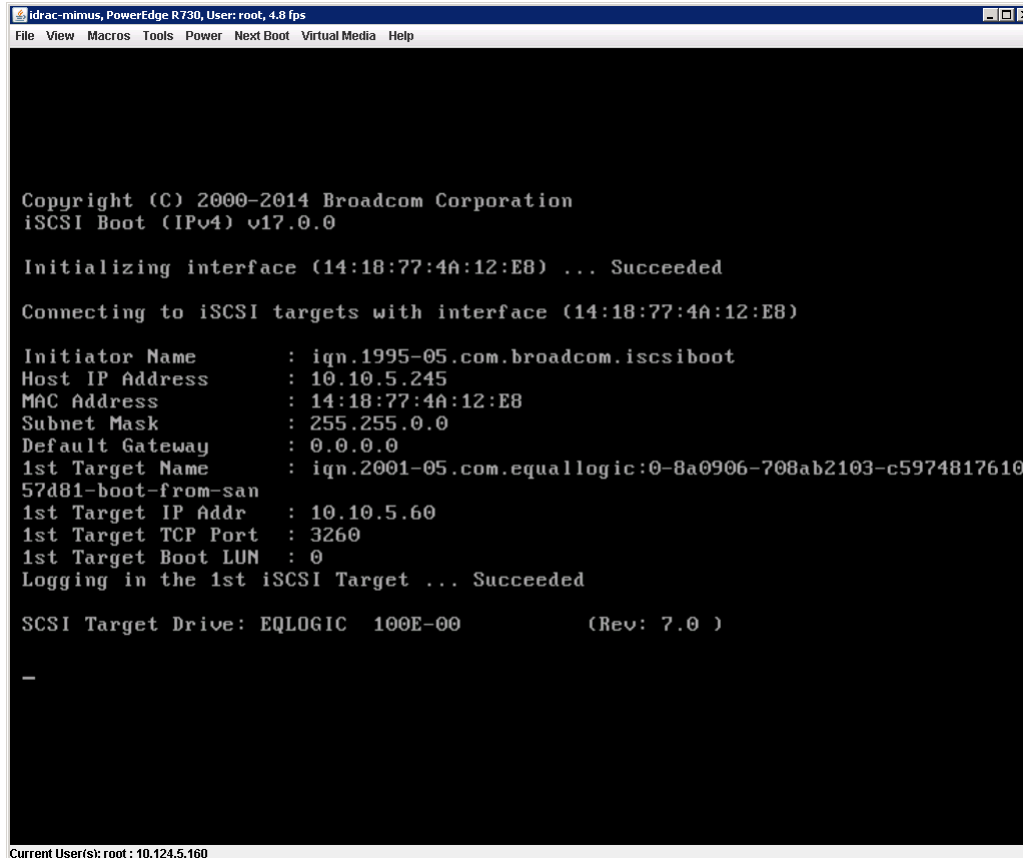


Figure 14 Broadcom BCM5720 iSCSI General Parameters

7. Save the changes by clicking **Yes** in the popup warning menu.
8. Click **Finish** twice and click **Yes** to exit and reboot.

At this point, the media for operating system installation needs to be available. The system will attempt to boot from the installation media and install the operating system on the iSCSI target volume.

When booting for the first time and each time following the configuration performed in the previous steps, prior to boot up, the following screen will appear showing the system is logging into the iSCSI target volume.

The image shows a terminal window titled "idrac-mimus, PowerEdge R730, User: root, 4.8 fps". The terminal output displays the following text:

```
Copyright (C) 2000-2014 Broadcom Corporation
iSCSI Boot (IPv4) v17.0.0

Initializing interface (14:18:77:4A:12:E8) ... Succeeded

Connecting to iSCSI targets with interface (14:18:77:4A:12:E8)

Initiator Name       : iqn.1995-05.com.broadcom.iscsiboot
Host IP Address      : 10.10.5.245
MAC Address          : 14:18:77:4A:12:E8
Subnet Mask          : 255.255.0.0
Default Gateway      : 0.0.0.0
1st Target Name      : iqn.2001-05.com.equallogic:0-8a0906-708ab2103-c5974817610
57d81-boot-from-san
1st Target IP Addr   : 10.10.5.60
1st Target TCP Port  : 3260
1st Target Boot LUN : 0
Logging in the 1st iSCSI Target ... Succeeded

SCSI Target Drive: EQLOGIC 100E-00          (Rev: 7.0 )

-

Current User(s): root: 10.124.5.160
```

Figure 15 The host NIC 1 Port 3 logs into the PS Series volume

Once the SAN-based volume is logged into, the system will boot off the optical media or PXE server, as configured. From this point, the operating system installation will proceed as usual (see section 3).

5.3 Configuring the Broadcom 10Gb Interface

The following procedure describes setting up the Broadcom Netxtreme II 10-Gb (BCM57810) interface as an example add-on interface. Compared to a 1Gb interface, the 10Gb interface provides excellent throughput to support increased I/O performance.

1. Similar to the onboard Broadcom BCM 5720, make changes in the Lifecycle Controller USC. Upon system power up, press **[F10]** to enter the USC and select **System Setup, Advanced Hardware Configuration, and Device Settings**.

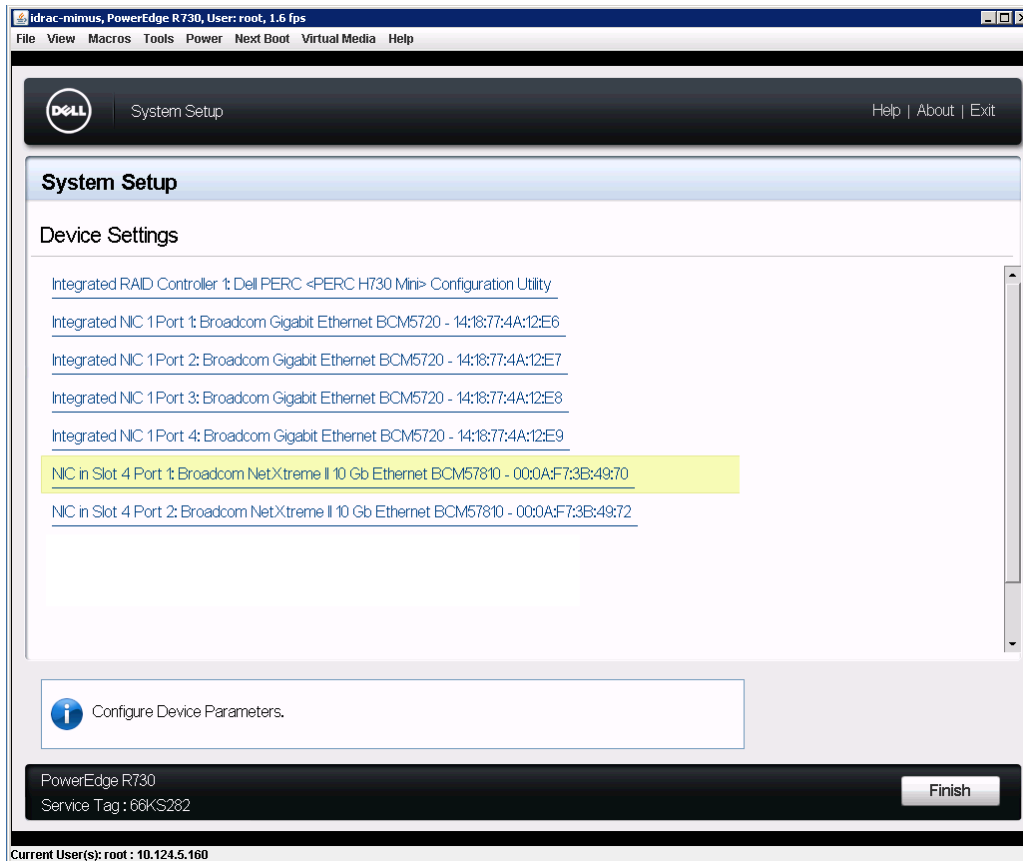


Figure 16 Device Settings menu, Broadcom BCM57810 Port 1 selected

2. For this example, in the **Device Settings** menu, select **NIC in Slot 4 Port 1: Broadcom NetXtreme II 10Gb** to use the BCM57810 in slot 4.
3. Select the **NIC Configuration Menu**. This menu is slightly different from that of the onboard NIC.

4. Select the **MBA Configuration Menu**. This menu has the same configurable information as the onboard NIC, only in a slightly different presentation. The **Legacy Boot Protocol** is a drop-down menu as opposed to radio buttons. In the drop-down menu, select **iSCSI** and click **Back**.

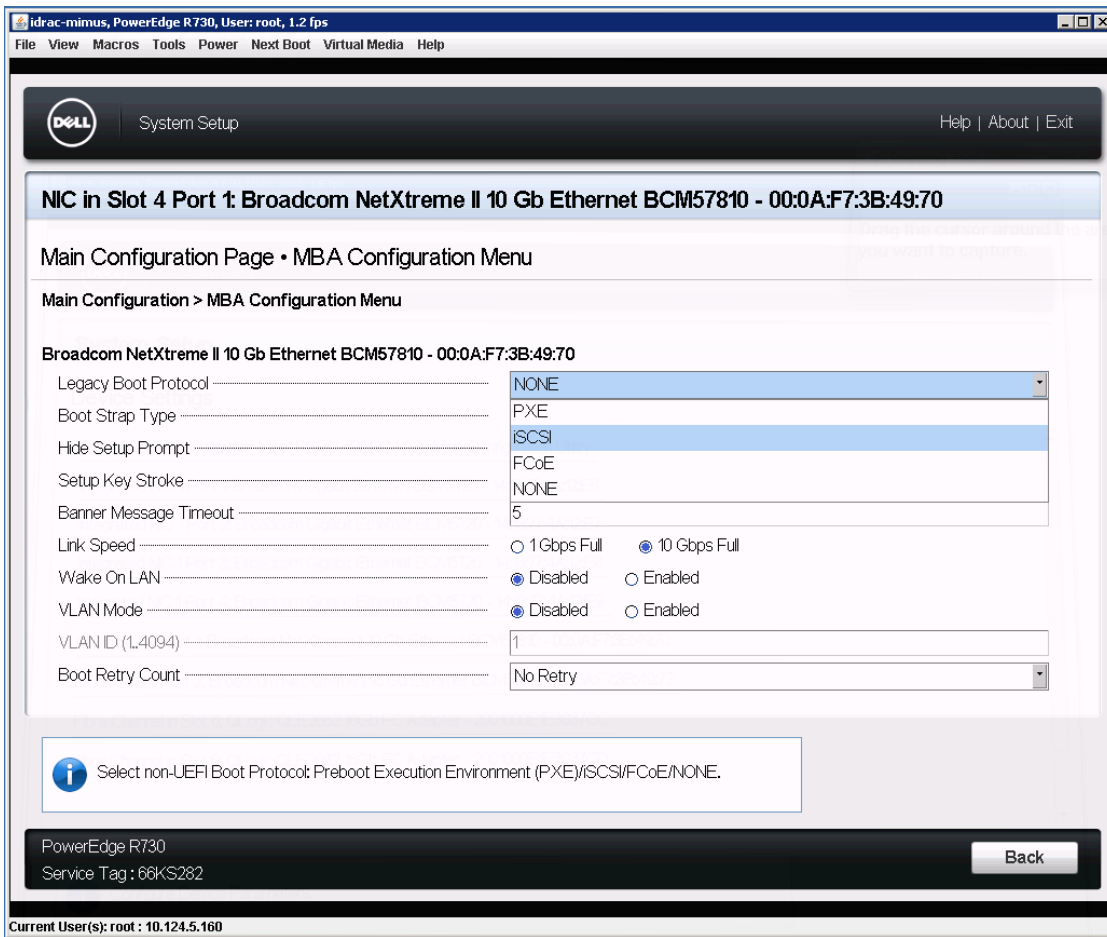


Figure 17 Broadcom BCM57810 MBA Configuration Menu

5. Select the **iSCSI Boot Configuration** menu and select the **iSCSI General Parameters** menu. If DHCP is not used in this case, next to **TCP/IP Parameters via DHCP** click the **Disable** button. Next to **Boot to Target**, select the **One Time Disable** radio button, and click **Back**.

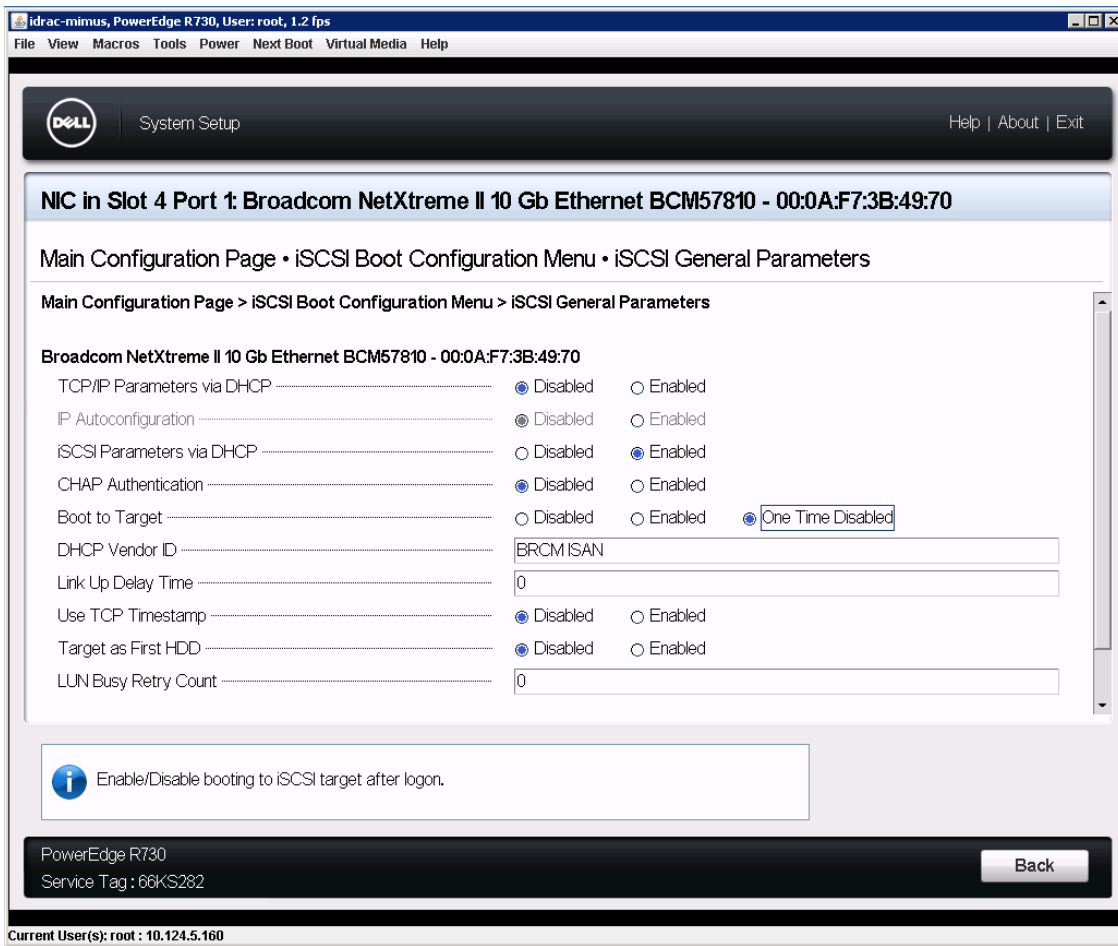


Figure 18 Broadcom BCM57810 iSCSI General Parameters menu

6. Click **iSCSI Initiator Parameters**. As before, enter the **IP Address** and **Subnet Mask** of the PS Series array, and optionally enter the **Gateway** and **DNS** servers. If the iSCSI target and the host are on the same subnet, the gateway is not necessary. The default **iSCSI Name** can be used or another can be assigned. Click **Back**.

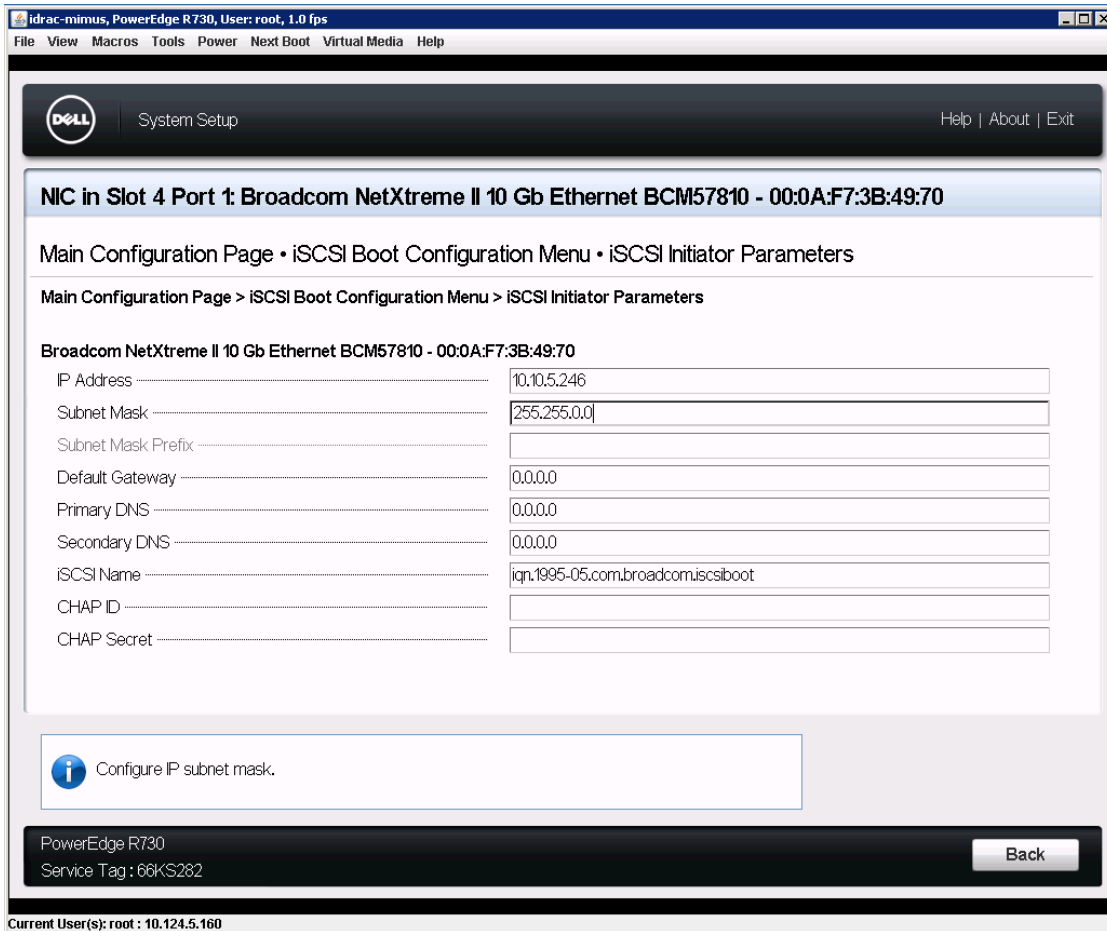


Figure 19 Broadcom BCM57810 iSCSI Initiator Parameters menu

7. Select the **iSCSI First Target Parameters** menu, enter the **IP Address** of the PS Series array, and enable the connection by clicking the **Enable** button. The default port number is 3260. Unless the port number is different from the default, leave this as is. Click **Back**, click **Finish**, and click **Yes** to save the changes.

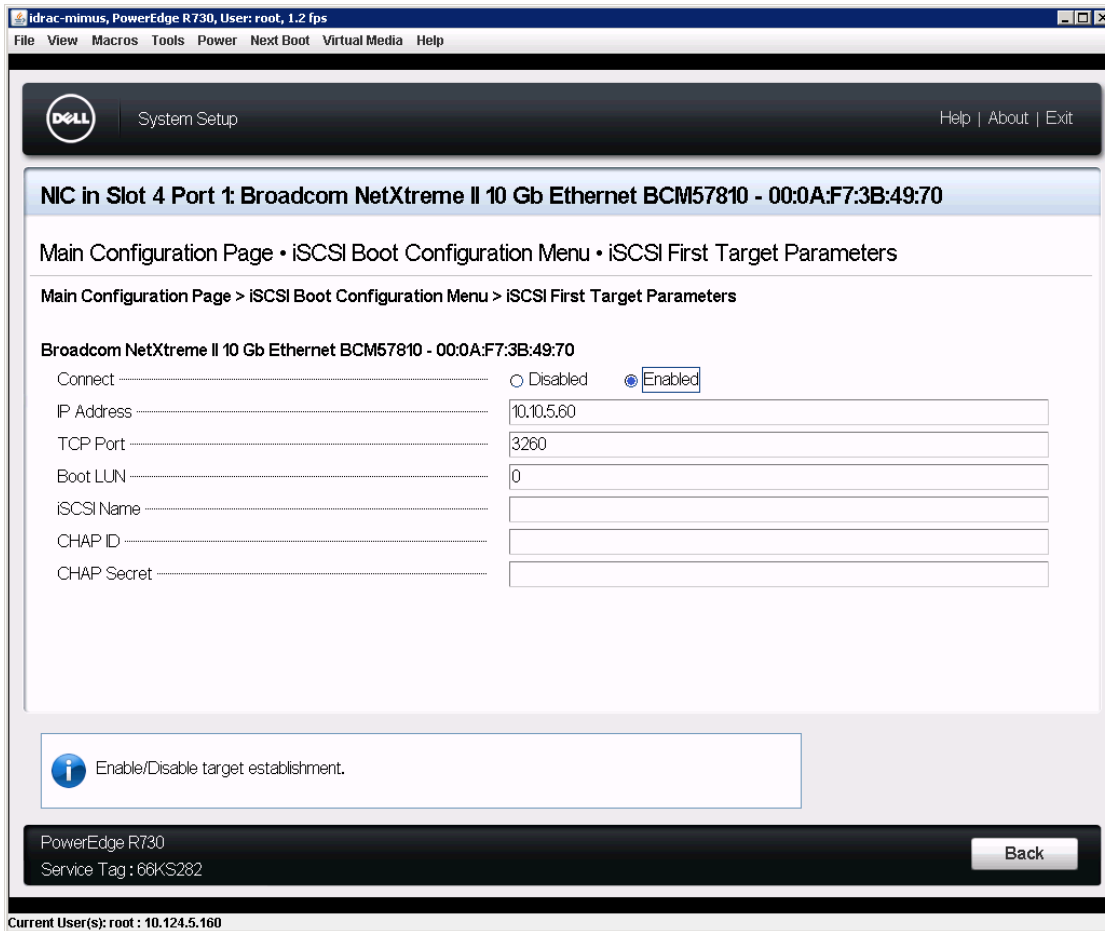


Figure 20 Broadcom BCM57810 iSCSI First Target Parameters Menu

8. To set the BIOS boot order, perform the procedure in section 5.2.

5.4 Configuring other interfaces

In addition to the onboard interfaces available to the PowerEdge 13G server family, a number of other options are available as add-on interfaces. Each interface has a slightly different menu setup, but the same parameters must be set in each case:

1. Configure the interface as an initiator using the same settings described in section 5.
2. Set the legacy boot protocol to iSCSI.
3. Enable Boot to Target in the general iSCSI parameters, and select One Time Disable so that the system will not attempt to boot from an empty iSCSI target volume.
4. Set the target parameters: IP address, port number, and iSCSI name for the target volume. If there is a CHAP ID and CHAP secret, set those as well.
5. Place the target volume for the interface in the BIOS boot order as described in section 5.2.

6 Operating system installation

Once the PowerEdge 13G server has logged into the target volume on the PS Series array, most modern operating systems will perceive the volume as a local resource upon which the operating system can be installed.

iSCSI boot-from-SAN volumes are supported by many different operating systems. Among them are later versions of Microsoft Windows Server, VMware ESXi, Red Hat Enterprise Linux, and SUSE Linux Enterprise. For compatibility information, see the [Dell Storage Compatibility Matrix](#).

6.1 Microsoft Windows Server

6.1.1 Windows Server 2008 and Windows Server 2008 R2

It is recommended to review the [Microsoft iSCSI Boot Step-by-Step Guide](#) which gives details about boot from SAN for Windows Server 2008 R2 environments, and general information about boot from SAN for Windows Server.

Additional considerations include:

- The target should be on the same subnet as the initiator, as recommended in Microsoft Knowledge Base article [KB960104](#).
- NIC teaming is not supported for iSCSI boot.
- Windows Server 2008 R2 includes drivers for the onboard Broadcom interfaces only. Other interfaces require a slipstreamed image. See Microsoft knowledge base article [KB974072](#).

6.1.2 Windows Server 2012

The Broadcom network drivers included on the Windows Server 2012 media do not support booting from an iSCSI SAN volume for Broadcom. When booting from an iSCSI SAN using Broadcom network adapters, a slipstreamed image of Windows Server 2012 is required. For more information on creating a slipstreamed Windows image, see the Microsoft knowledge base support article [KB974072](#). While the article refers to Windows Server 2008 R2 only, the information also applies to Windows Server 2012.

6.1.3 Windows Server 2012 R2

Installation considerations include:

- To install using the onboard Broadcom BCM 5720 drivers, the drivers must be slipstreamed into the Windows image. Refer to Microsoft knowledge base article [KB974072](#).
- Only a single path can be used for the initial install. Multipathing can be configured after installation.
- The Windows Server 2012 R2 media does include drivers for the Intel X520 adapter.

6.2 Red Hat Enterprise Linux

The Red Hat Enterprise Linux (RHEL) installer (version 6 or 7) should find the target volume, which can be set to **Install Target Devices**. The version 6.2 and later RHEL installer has drivers for the onboard Broadcom BCM 5720 interface, as well as the most common Broadcom, Intel, and QLogic Ethernet adapters.

6.3 SUSE Linux Enterprise

The SUSE Linux Enterprise version 12 and version 12SP1 installer should find the target volume. Version 12 and 12SP1 have driver support for the onboard Broadcom BCM 5720 interface, as well as the most common Broadcom, Intel, and QLogic Ethernet adapters.

6.4 VMware ESXi

Configuration considerations include:

- Do not configure the first onboard NIC as the boot-from-SAN interface. This interface is discovered as vmk0 and is reserved as the management network.
- NIC teaming is not supported for iSCSI boot.
- VMware ESXi v5.1 and v.5.5 do not support IPv6 networks. For more information, see the VMware document, [Best Practices for Running VMware vSphere on iSCSI](#).
- SAN boot volume traffic should be isolated. Dell recommends using one NIC exclusively for the SAN ESXi boot volume and another interface for the SAN data volumes.

7 Host Integration Tools

PS Series Host Integration Tools (HIT) for Microsoft, Linux, and VMware provide a collection of applications and utilities to simplify the configuration and administration of PS Series storage arrays. The Multipath I/O (MPIO) software included with the Host Integration Tools provides the ability to easily configure redundant network paths from the host to the PS Series boot volume. When configured, the MPIO software can create and manage an optimal number of iSCSI sessions to the boot-from-SAN volume. The MPIO software can also enhance performance by directing each I/O to the proper PS Series group, reducing the amount of I/O forwarding by the group members.

7.1.1 Windows Server

The HIT for Microsoft includes a device-specific module for PS Series storage that is installed on the Windows Server systems to create redundant connection paths from the host system to PS Series arrays. HIT also installs other utilities and configures the host system according to the best practices for PS Series arrays.

For more information the HIT kit, see *Dell EqualLogic Host Integration Tools for Microsoft Installation and User's Guide* at <http://eqsupport.dell.com> (login required). The latest version of the HIT kit is also available at this site.

7.1.2 Linux

The HIT kit for Linux (HIT/Linux) is available for RHEL and SUSE Linux Enterprise Server. HIT/Linux manages multiple paths to subsequently connected iSCSI volumes. HIT/Linux actively manages iSCSI volume sessions and load balances across host SAN ports.

Additional resources include:

- *Dell EqualLogic Host Integration Tools for Linux and User's Guide* at <http://eqsupport.dell.com> (login required). The latest version of the HIT kit is also available at this site.
- [Using HIT/Linux and ASM/LE with Dell PS Series Storage](#) (deployment and configuration guide)
- [Red Hat Enterprise Linux Configuration Guide for Dell Storage PS Series Arrays](#) (deployment and configuration guide)

7.1.3 VMware ESXi

Multipathing Manager for ESXi (MEM) is the PS Series multipath manager for VMware ESXi. The paths that it manages are the paths connected to the non-bootable SAN volumes.

Dell recommends using one set of NICs to connect to the SAN ESXi boot volume and another to connect to the SAN data volume. MEM should be configured to use only the NICs connected to the non-bootable SAN volumes.

In a boot-from-iSCSI-SAN configuration, the MEM installation is a typical installation. For detailed information about how to install MEM, see the guide, [VMware ESXi 5.1, 5.5, or 6.0 Host Configuration](#).

A Configuration worksheet

The following worksheet may be helpful to capture configuration information for the boot-from-SAN iSCSI environment.

Note: Always use the fully-qualified IQN format: <iqn><yyyy-mm>.com.<company name>:<server name>. For example: iqn.1984-04.com.dell:server-name. For more information see RFC3720 and RFC3721 at <http://rfc.net/>.

Dell PowerEdge server (host/initiator)	
Primary boot NIC	Secondary boot NIC (optional)
IQN:	IQN (Optional: if different from the Primary)
IP Address:	IP Address:
Subnet Mask:	Subnet Mask:
Gateway:	Gateway:
Slot Location:	Slot Location:
Dell Storage PS Series (target)	
IQN:	
iSCSI Port: (default 3260)	
PS Series Group IP Address:	

B Technical support and resources

[Dell.com/support](https://dell.com/support) is focused on meeting customer needs with proven services and support.

[Dell TechCenter](https://dell.com/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.

The Dell Storage PS Series Networking Performance Guidelines can be found at <https://eqsupport.dell.com/WorkArea/DownloadAsset.aspx?id=5229>

Request for Comment publications by the Internet Engineering Task Force are located at <http://tools.ietf.org/>.