



# Configuring Windows Server 2012 for iSCSI SAN Boot with EqualLogic Storage

A Dell EqualLogic Best Practice

Dell Storage Engineering  
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## Revisions

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## Feedback

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## Executive summary

This technical paper includes:

- Best Practices for using Dell™ EqualLogic™ storage as the storage device for iSCSI boot from SAN using Microsoft® Windows Server® 2012.
- Guidelines for configuring volumes on Dell EqualLogic storage, Dell™ PowerEdge™ servers, and supported network adapters for iSCSI SAN boot from EqualLogic arrays.
- Deployment guide for 1 Gigabit and 10 Gigabit Ethernet iSCSI boot from SAN environments with EqualLogic storage arrays and supported network adapters.



# 1 Introduction

This paper demonstrates Dell best practices for implementing iSCSI boot from SAN with Dell EqualLogic storage arrays and the 12<sup>th</sup> generation (12G) PowerEdge servers running Windows Server 2012.

With its unique peer architecture, EqualLogic PS Series storage delivers high performance and availability in a flexible environment and low total cost of ownership. These storage 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, EqualLogic solutions dramatically reduce the costs of storage acquisition and ongoing operations.

With the combination of EqualLogic PS Series arrays and network adapters that support boot from SAN, it is now possible to boot Windows Server 2012 directly from the storage network. While the network boot operation is similar to the traditional boot process, the cost of hardware is lower.

In most cases, all that's needed is a supported network adapter on a standard server platform to enable the boot process over the network. EqualLogic PS Series arrays support several network adapters, as outlined in this paper.

With the EqualLogic PS Series arrays, iSCSI boot from SAN enhances the reliability and performance of a Windows server by leveraging the SAN to improve data protection. In addition, it enables centralized storage management and advanced features such as disk image cloning, snapshots, and disaster replication.

Now Windows Server 2012 boot images can be managed consistently and efficiently. As a result, servers can be easily repurposed to improve business continuity. If a server malfunctions, simply boot another server using the original boot image, to bring the network back into operation immediately. This method is simple, straight-forward, and efficient for large and small deployments.

Some additional benefits of using iSCSI Boot from SAN in a Windows environment:

**Diskless servers:** Eliminate the need for each server to boot from its own disks. This allows the deployment of diskless servers that consume less facility space, power, and budget.

**Centralized management:** All operating system (OS) images are stored on the EqualLogic PS Series array and can be centrally managed.

**Simplified recovery:** Server failures can be quickly recovered by booting a spare server from the SAN.

**Rapid disaster recovery:** With the boot volumes and production data being replicated to a remote site, the recovery time objective (RTO) can be reduced by having standby servers that are preconfigured to boot from SAN.

**Rapid deployment:** If there is a period of high workloads, then a new server can be imaged from the clone of the boot image. This allows deployment of more servers to support the increased workload.



## 1.1 Objective

This paper provides:

- Guidelines for configuring Dell PowerEdge servers and supported network adapters for iSCSI SAN boot from EqualLogic arrays.
- A lab tested and validated SAN architecture to support high availability by implementing multi-path I/O and redundant components.
- Reference architectures for 1 GB and 10 GB Ethernet iSCSI boot from SAN environments with Dell supported network adapters from QLogic<sup>®</sup> and Intel<sup>®</sup>.

### 1.1.1 Audience

This paper is intended for server and storage administrators that are involved in the design or implementation of servers that boot from an EqualLogic iSCSI SAN volume. This white paper establishes best practices for Dell PowerEdge servers, Dell EqualLogic storage arrays, and several supported network interface cards. Readers should be familiar with EqualLogic iSCSI storage and Dell PowerEdge servers with Windows Server 2012, as well as general concepts around SAN storage and Ethernet networks.

### 1.1.2 Scope

The configuration process for boot from SAN environments can vary considerably based on the components used in the solution. This document focuses on the steps required to configure the following components for iSCSI boot from SAN.

**Note:** Data Center Bridging (DCB) configuration for iSCSI boot from SAN is not included in the scope of this paper.

Table 1 Components covered by this document

Component	Component details
OS	Windows Server 2012
Servers	Dell PowerEdge Servers (12G Family)
Network Adapters	Intel 10GbE x520 Server Adapter Intel 10GbE x540 Server Adapter Intel 1GbE i350 Server Adapter QLogic QLE8262 Converged Network Adapter
Storage Array	Dell EqualLogic 1 Gigabit and 10 Gigabit PS Series with firmware 6.0.1 or higher.



## 1.2 Terminology

**12G PowerEdge Servers** or **12G**: 12<sup>th</sup> generation of Dell PowerEdge servers.

**Arrays**: Refers to iSCSI EqualLogic PS Series storage arrays.

**iSCSI Qualified Name (IQN)**: A naming format used to assign iSCSI names for targets and/or initiators. The iSCSI Qualified Name is documented in RFC 3720 (<http://tools.ietf.org/html/rfc3720>) and RFC 3721 (<http://tools.ietf.org/html/rfc3721>)

**Storage Area Network (SAN)**: The network that interconnects storage devices, including host interfaces (NICs) and arrays. SAN may also refer to the storage, switches, and host interconnects as a single entity.

**Slipstream**: The process of integrating updates into an original installation media. Some boot from SAN installations require creating a customized bootable DVD to update the drivers contained on the original Windows Server 2012 installation media.



## 2 Process overview

The process to configure iSCSI boot from SAN has been divided into four major steps and is explained in the following sections.

1. Configure EqualLogic storage arrays and prepare the boot volumes ([Section 4](#)).
2. Configure the server and network adapter(s) on the server to support boot from iSCSI targets ([Section 6](#) and [Section 7](#)).
3. Install the OS onto the iSCSI target volume that was prepared for boot in ([Section 8](#)).
4. Configure redundant boot paths and multi-path I/O for the boot volumes and any additional SAN volumes in ([Section 9](#)).

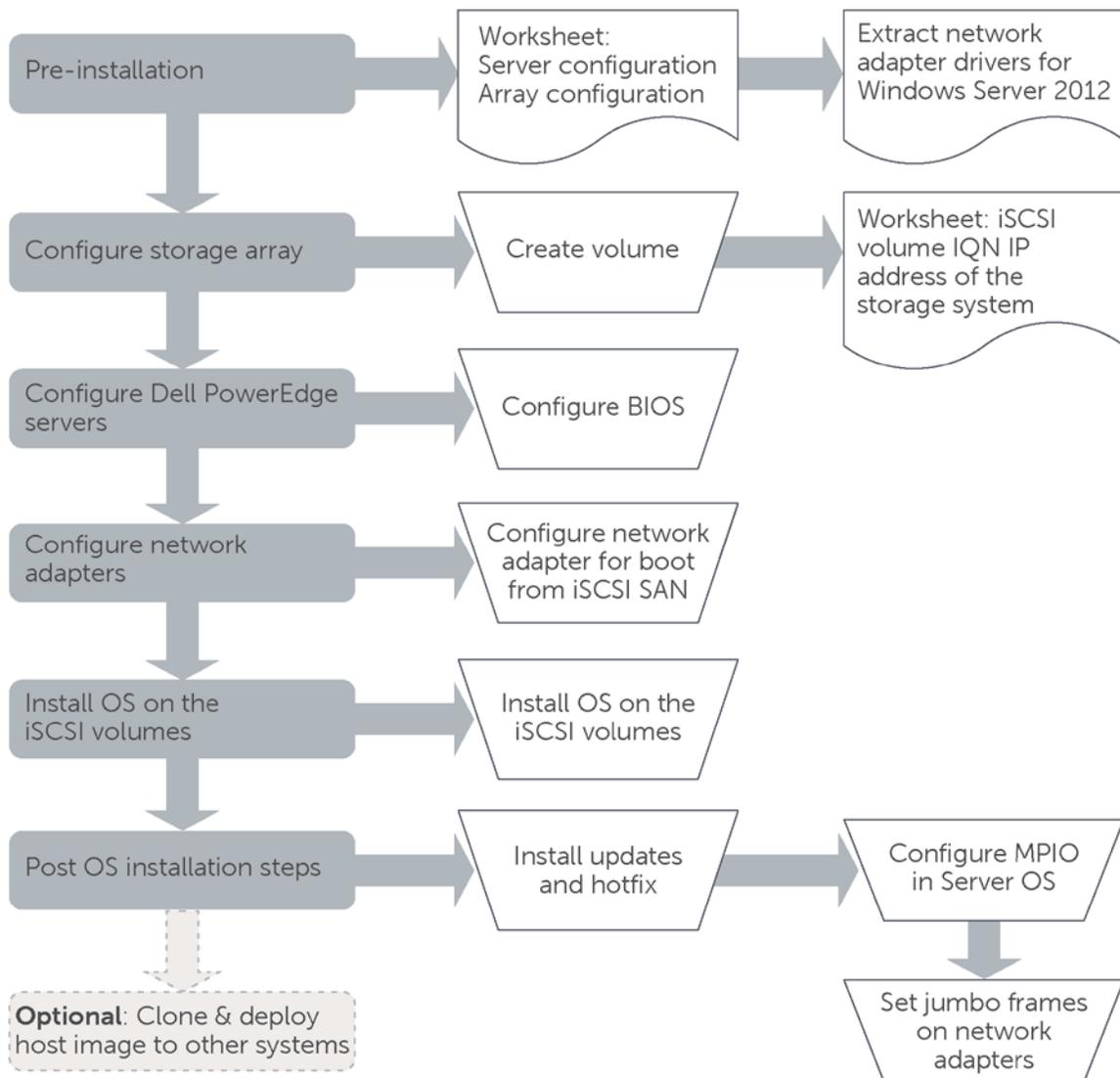


Figure 1 Process for installing Windows 2012 Boot from iSCSI SAN

## 2.1 Prerequisites

Before you start the configuration process, complete the following steps:

1. Use a configuration tracking worksheet similar to the example provided in [Appendix A](#).
  - a. Note the IP address, IQN, subnet mask, and other details about the network adapter.

**Note:** The IQN may also be known as the initiator name in the network adapter configuration. See [Section 6](#) for more information.

- b. Note the EqualLogic group details and volume details as needed.
2. All best practices related to storage, network switches, and servers should be followed. Refer to the following documents for more information:
  - a. General guidelines for configuring an EqualLogic SAN network are provided on the Rapid EqualLogic Configuration Portal at <http://en.community.dell.com/techcenter/storage/w/wiki/3615.rapid-equallogic-configuration-portal-by-sis.aspx>
  - b. Information for configuring network switches is provided in Switch Configuration Guides at <http://en.community.dell.com/techcenter/storage/w/wiki/4250.switch-configuration-guides-by-sis.aspx>
3. Update Dell EqualLogic Storage arrays with the latest drivers and firmware versions. Details are on the Dell EqualLogic website at [https://eqlsupport.dell.com/support\\_](https://eqlsupport.dell.com/support_)

In addition, take the following considerations into account:

- NIC teaming is not supported for iSCSI boot.
- iSCSI boot is not supported with IPv6 networks for the network adapters used in this paper.



## 2.2 Restrictions for Broadcom adapter drivers

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" at <http://support.microsoft.com/kb/974072>.

**Note:** Microsoft KB article 97402 currently refers to Windows Server 2008 R2 only, however the same information applies to Windows Server 2012.

The procedure for an iSCSI boot using Broadcom network adapters is available on the Broadcom support website in the *Broadcom NetXtreme® II Network Adapter User Guide* under the section titled, "Using iSCSI".

[http://www.broadcom.com/docs/support/ethernet\\_nic/Broadcom\\_NetXtremeII\\_Server\\_T7.6.pdf](http://www.broadcom.com/docs/support/ethernet_nic/Broadcom_NetXtremeII_Server_T7.6.pdf)  
(exact link is subject to change as new drivers are released)

Broadcom NICs were not tested as part of this paper.



## 3 Extract drivers for a Windows Server 2012 installation

Before you begin the installation steps, download and extract the latest network adapter drivers from <http://support.dell.com>. Copy the extracted drivers to a USB flash drive so that they can be easily accessed during the Windows Server 2012 installation.

Choose the appropriate Intel or QLogic drivers for the configuration. The following steps provide detail on how to extract the drivers for each specific network adapter.

**Note:** After extracting the drivers, make note of the directory structure where the files are extracted.

### 3.1 Extract Intel NIC drivers (optional)

1. Download Intel NIC drivers from <http://support.dell.com>.
2. Download the latest Network\_Driver\_\*.EXE file and double click it to unpack the driver installation files.
3. On the **Update Package** window click **Extract without installing...** When prompted, choose a location to unpack the driver files.
4. Right click the cmd.exe file and select **Run as administrator** to open the command prompt with administrator rights.
5. Change the directory in the command prompt to the location of the unpacked driver files.
6. Run this command to extract the drivers: `Setup.exe -a`
7. Choose a location for the files. If the files are extracted to a USB drive they can be easily mounted on the system when needed.
8. The installation drivers can be found at `\production\W2012-x64\<NIC-Folder>`.

### 3.2 Extract QLogic NIC drivers (optional)

1. Complete the following steps on a compatible system, such as Windows Server 2012.
2. Download the QLogic NIC drivers from <http://support.dell.com>.
3. Download the latest Network\_Driver\_\*.EXE file, and then double click it to unpack the driver installation files.
4. On the **Update Package** window, click **Extract without installing...** and choose a location to unpack the driver files.
5. Open the command prompt and change the directory to the location of the unpacked driver files.
6. Choose a location for the driver files. Run this command to extract the drivers:  
`Setup.exe /z"/extractdrivers="<location-for-files>"`

**Example:**

```
Setup.exe /z"/extractdrivers="C:\temp\"
```

7. Proceed with the installation, accept the license terms, and choose **Drivers only** when prompted to select the feature you want to install. Do not select **Install VLAN/TeamingDriver**.
8. Unzip the driver package (located at, `\production\W2k12-x64\p3p_nic_win2k12_x64.zip`).
9. The drivers for installation can be found in the unzipped folder.



## 4 Configure the EqualLogic storage system

This section describes the process of configuring the EqualLogic storage arrays to host the iSCSI boot volumes for a Windows host.

Perform the following steps to create a target volume for booting the Windows host:

1. Log on to the Dell EqualLogic PS Series Group Manager by entering the IP address of the group in your web browser.
2. Click **Storage Pools** and select the pool where the volume will be created.
3. In the **Activities** section click **Create Volumes** to create a volume on the EqualLogic storage.
4. Give the volume a name (without spaces) and, if desired, enter a description. Select a storage pool with free pool space and then click **Next**.
5. Assign the size of the volume to be created. A thin volume can be created by selecting the checkbox labeled "Thin provisioned volume". The snapshot reserve defaults to 100% and can be changed if needed.

**Note:** Microsoft recommends a system partition size of 84865 MB (80 GB) for Windows Server 2012 installations depending on system RAM, possible power states, and other considerations. A minimum of 32 GB is required according to Microsoft. For more information, see the Microsoft Windows Server website at <http://technet.microsoft.com/en-us/library/jj134246.aspx>.

**Note:** For more information on the default allocation of a snapshot reserve, see the paper titled, "EqualLogic Snapshots and Clones: Best Practices and Sizing Guidelines" at: <http://en.community.dell.com/dell-groups/dtcmedia/m/mediagallery/20097871/download.aspx>



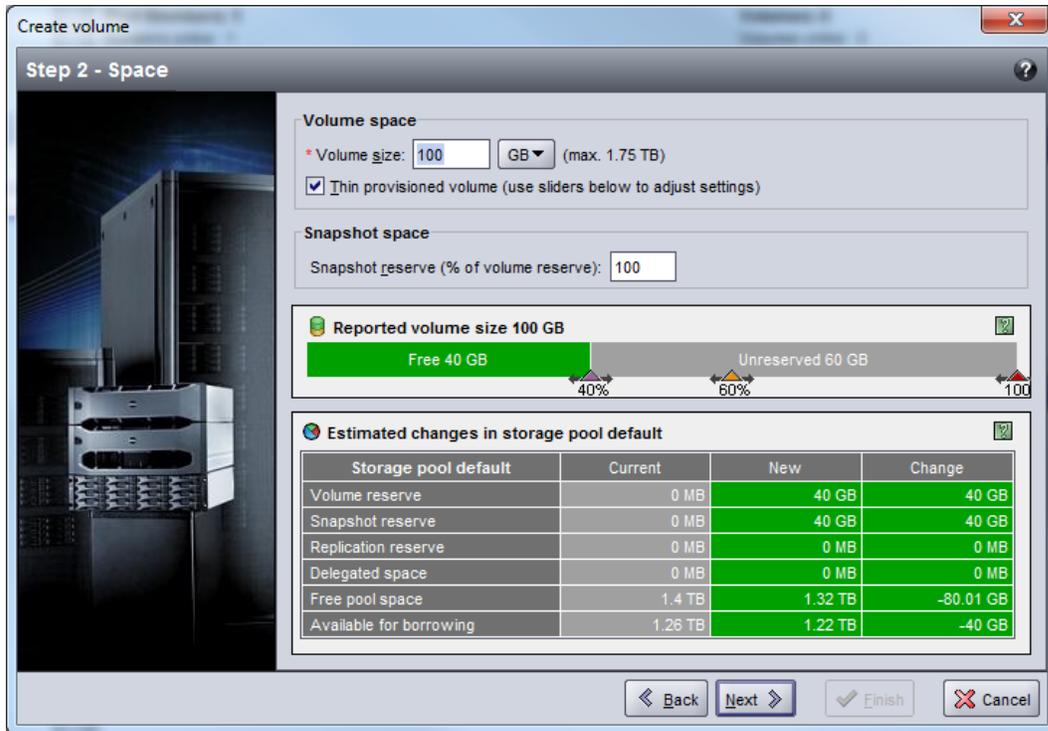


Figure 2 Configuring the volume size via EqualLogic Group Manager

6. Select one or more of the following iSCSI access modes for the volume receiving the array disk.
  - Authenticate using CHAP user name
  - Limit access by IP address
  - Limit access to iSCSI initiator name

**Note:** If access is limited based on the iSCSI initiator name, the IQN name entered here must match the IQN name of the host server adapter booting from this volume. When using two NIC ports for redundancy, both of the ports may have different IQN names. In this case, add both IQN names. When creating a volume only one access type can be added, however once the volume is created additional access configuration can be added.

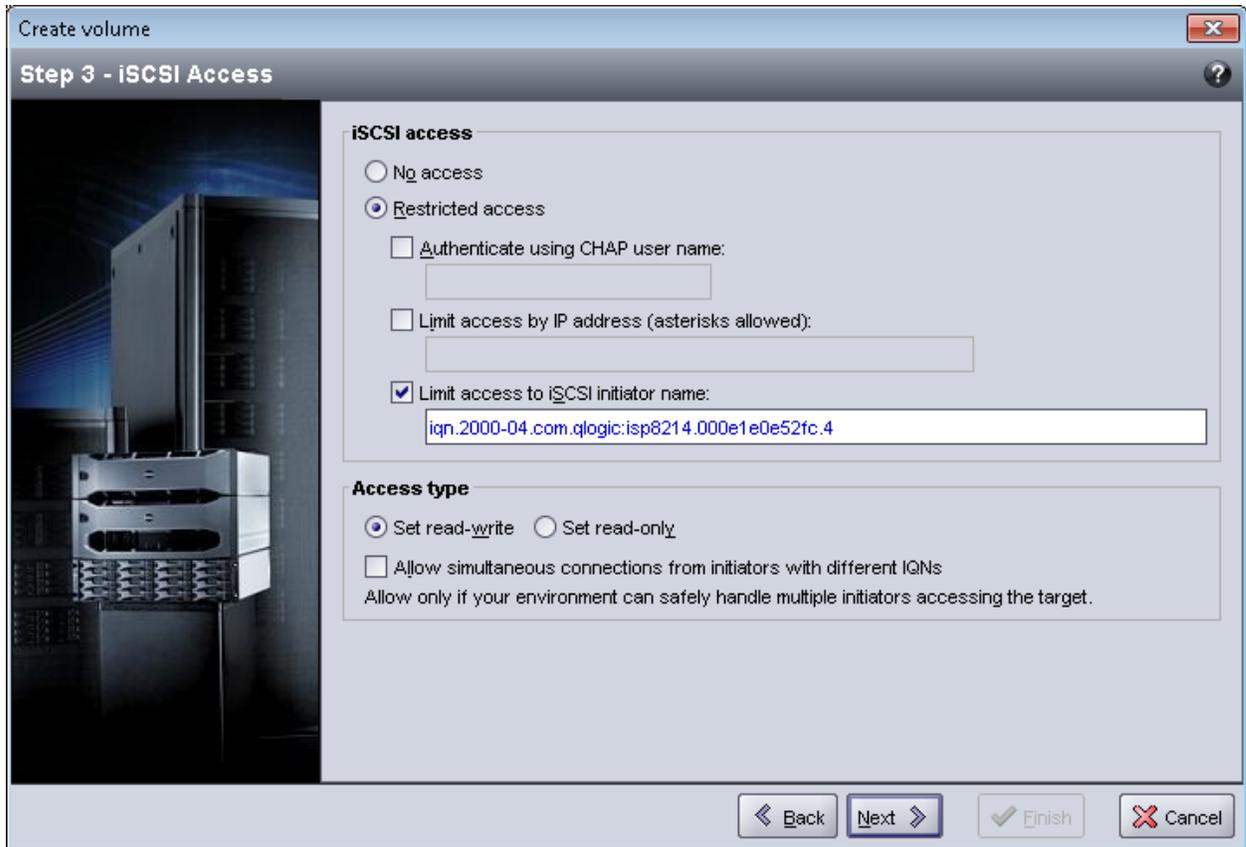


Figure 3 iSCSI access window allows you to choose the access type

7. Keep the default access type set to read-write, and click **Next**.

**Note:** It is usually not necessary to enable shared storage except when the IQN name of two network adapter ports used for iSCSI boot are different.

**Example:** When using a QLogic QLE8262 dual-port network adapter, and configuring redundant boot paths, add the unique IQN name for each individual port. For Broadcom and Intel adapters, the IQN name is the same for all ports on the same card by default.

For QLogic QLE8262 dual port adapters and other adapters with different IQN name for network adapter ports, enable simultaneous access from different IQNs by checking the box for **Allow simultaneous connections from initiators with different IQNs**.

8. When the summary screen is displayed, verify the settings and click **Finish** to create the volume.
9. Open the **Volumes** section of the Group Manager and select the volume recently created. In the **Connections** tab, note the iSCSI target name in [Appendix A, "Configuration worksheet"](#).
10. To add new access parameters, open the **Volumes** list in Group Manager and choose the volume. In the **Access** tab click the **Add** button.

## 5 Prepare Intel Network adapters for iSCSI boot

**Note:** Intel network adapters are not shipped with iSCSI enabled in the Boot ROM. Enable iSCSI so the Intel network adapters are detected as a boot device and are listed in the boot sequence. During the system boot, if the [Ctrl+D] option to configure the Intel NIC is not displayed, follow the following steps in this section to enable iSCSI on the Intel network adapter.

1. Create a DOS bootable USB flash drive.

**Note:** The open source utility UNetbootin can be used to create a DOS bootable USB flash drive using FreeDOS. The utility can be downloaded at <http://unetbootin.sourceforge.net/>.

2. Download the Intel Boot Agent from the Intel support website. The file is named, "Preboot.exe"

**Note:** The support site for Intel is [www.intel.com/support](http://www.intel.com/support).

3. Extract the Preboot.exe zip file to the bootable USB key created in step 1.
4. With the Intel NIC installed, start the server using the DOS bootable USB key.
5. Once the system starts from the DOS bootable USB key, change to the directory containing the Boot Agent (\Preboot\Apps\Bootutil\Dos), To enable the capability to run flash firmware on the selected adapter, run the following command:

```
bootutil.exe -all -fe
```

6. If this command returns an error, then program the flash using this command:

```
bootutil.exe -up=combo -all -File=<path>/bootimg.flb
```

See Figure 4 for more detail.

Repeat step 5 to enable flash on the network adapter. (bootimg.flb is located in Preboot\apps\bootutil.)



```

=====
 1  001B21CC4AC0  Gigabit YES UEFI,PXE,iSCSI Primary      2.3.52
 2  001B21CC4AC1  Gigabit N/A UEFI,PXE,iSCSI
=====

C:\PREBOOT\APPS\BOOTUTIL\DOS>bootutil -up=combo -all -File=bootimg.flb

Intel(R) Ethernet Flash Firmware Utility
BootUtil version 1.3.45.0
Copyright (C) 2003-2012 Intel Corporation

Programming flash on port 1 with flash firmware image
Create restore image of NIC 1 before proceeding? (Y)es or (N)o: Y

Saving flash firmware image on port 1 to file 10C9401B.FLB...saved

Flash update successful

Skipping port 2 (shared flash with previous port)

Port Network Address Series  WOL Flash Firmware      Version
=====
 1  001B21CC4AC0  Gigabit YES UEFI,PXE,iSCSI Primary      2.7.125
 2  001B21CC4AC1  Gigabit N/A UEFI,PXE,iSCSI
=====

C:\PREBOOT\APPS\BOOTUTIL\DOS>bootutil

```

Figure 4 This screen shows the steps to program the flash with “bootimg.flb” file

7. Restart the server using the DOS bootable key to apply the new configuration.
8. Change to the directory containing the Boot Agent (\Preboot\Apps\Bootutil\Dos), and run the following commands:  

```
bootutil.exe -all -bootenable=iscsiprimary
```

```
bootutil.exe -all -bootenable=iscsissecondary
```

These commands enable network adapter ports as iSCSI primary/secondary for legacy BIOS.



```

C:\PREBOOT\APPS\BOOTUTIL>cd dos

C:\PREBOOT\APPS\BOOTUTIL\DOS>bootutil.exe -all -bootenable=iscsiprimary

Intel(R) Ethernet Flash Firmware Utility
BootUtil version 1.3.45.0
Copyright (C) 2003-2012 Intel Corporation

Port Network Address Series WOL Flash Firmware Version
==== =====
1 A0369F01535C 10GbE N/A UEFI,PXE,iSCSI,FCOE -----
2 A0369F01535E 10GbE N/A UEFI,PXE,iSCSI Primary,FCOE 2.7.88

C:\PREBOOT\APPS\BOOTUTIL\DOS>bootutil.exe -all -bootenable=iscsisecondary

Intel(R) Ethernet Flash Firmware Utility
BootUtil version 1.3.45.0
Copyright (C) 2003-2012 Intel Corporation

Port Network Address Series WOL Flash Firmware Version
==== =====
1 A0369F01535C 10GbE N/A UEFI,PXE,iSCSI Secondary,FCOE 2.7.88
2 A0369F01535E 10GbE N/A UEFI,PXE,iSCSI Primary,FCOE 2.7.88

C:\PREBOOT\APPS\BOOTUTIL\DOS>

```

Figure 5 Running commands to configuring Intel network adapter ports as primary and secondary source for iSCSI boot



## 6 Configure network adapters for 12G PowerEdge servers

Configure the network adapter to connect to an iSCSI volume and later boot from the volume. The following steps describe the procedure for Intel and QLogic network adapters. Use the sections below that apply to your configuration:

[6.1 Configure QLogic Network adapters](#)

[6.2 Configure Intel Network adapters](#)

### 6.1 Configure QLogic network adapter for iSCSI boot

**Note:** The steps shown below use the iSCSI Boot Firmware Table (iBFT) method for boot from SAN. For QLogic QLE8262 you can also use FastUTIL to enable the legacy iSCSI HBA mode. Information about this alternate method is available in Section 4 titled, "Boot Configuration", of the QLogic *Converged Network Adapter User's Guide* at <http://i.dell.com/sites/content/shared-content/data-sheets/en/Documents/Qlogic-QME8242-k-User-Guide.pdf>.

Or can be found in the QLogic Manual under **Boot Configuration** > **iSCSI Configuration** Using FastUTIL downloaded from [www.support.dell.com](http://www.support.dell.com).

Use the following steps to configure the QLogic QLE8262 network adapter for iSCSI boot from SAN.

1. During the system boot, press **[Ctrl+Q]** when prompted to enter the QLogic configuration menu.
2. In the **Function Configuration** menu, change the protocol type to IBFT for network adapter ports used for iSCSI boot as shown in Figure 6.



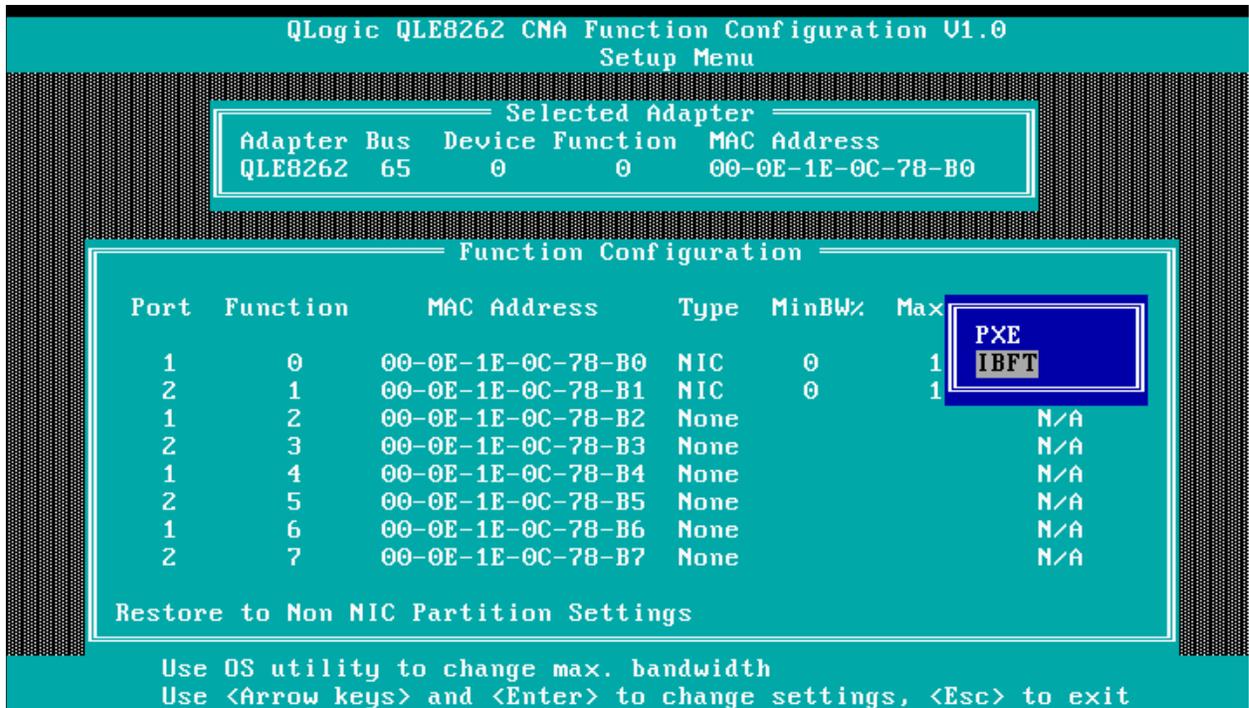


Figure 6 QLogic network adapter configuration menu

3. Highlight the **Function** column for the network adapter and press [Enter] to open the **Adapter Settings** menu for that network adapter port.
4. **Enable ROM** and select the IP format **IPv4**.
5. Enter the **Initiator Settings** menu and disable DHCP, and then enter the initiator details such as: Initiator IP address, subnet mask, and CHAP as needed. See Figure 7.

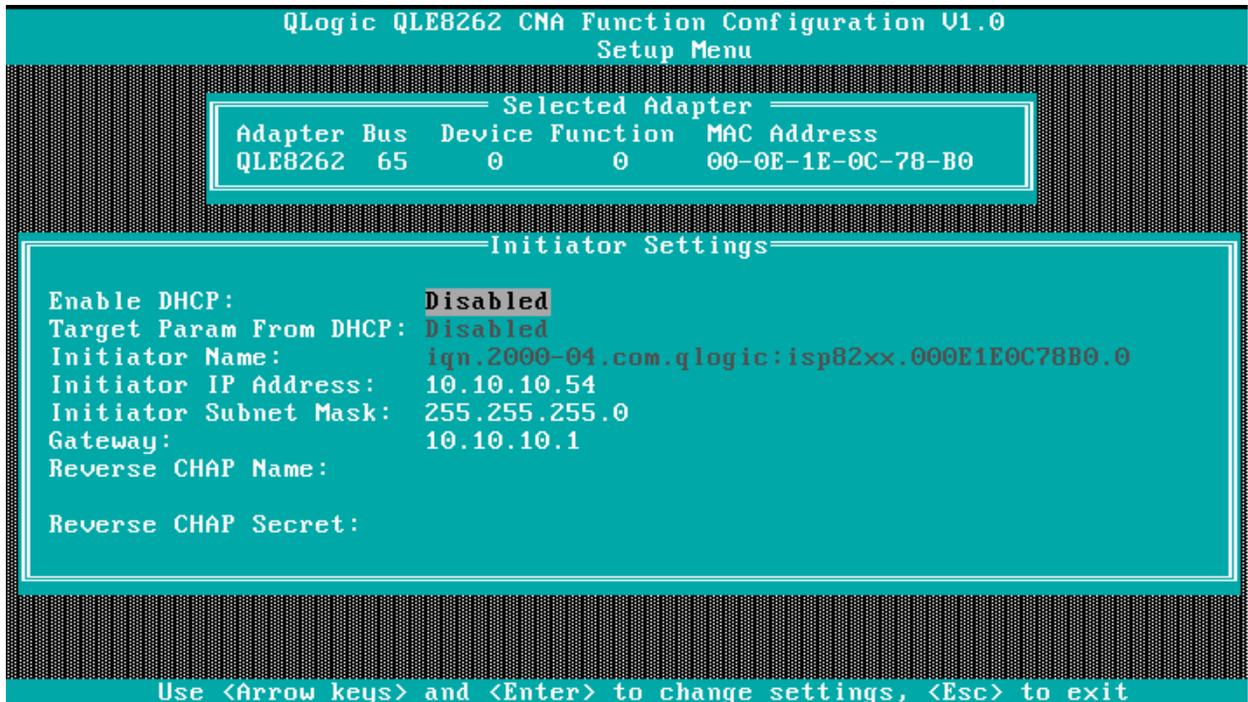


Figure 7 Initiator settings for QLogic network adapters

- Exit the **Initiator Settings** menu and open the **Target Settings** menu. Enter the **Target Name** (or IQN for the volume in [Appendix A](#)), Target IP, and Target Port (3260) as shown in Figure 8.

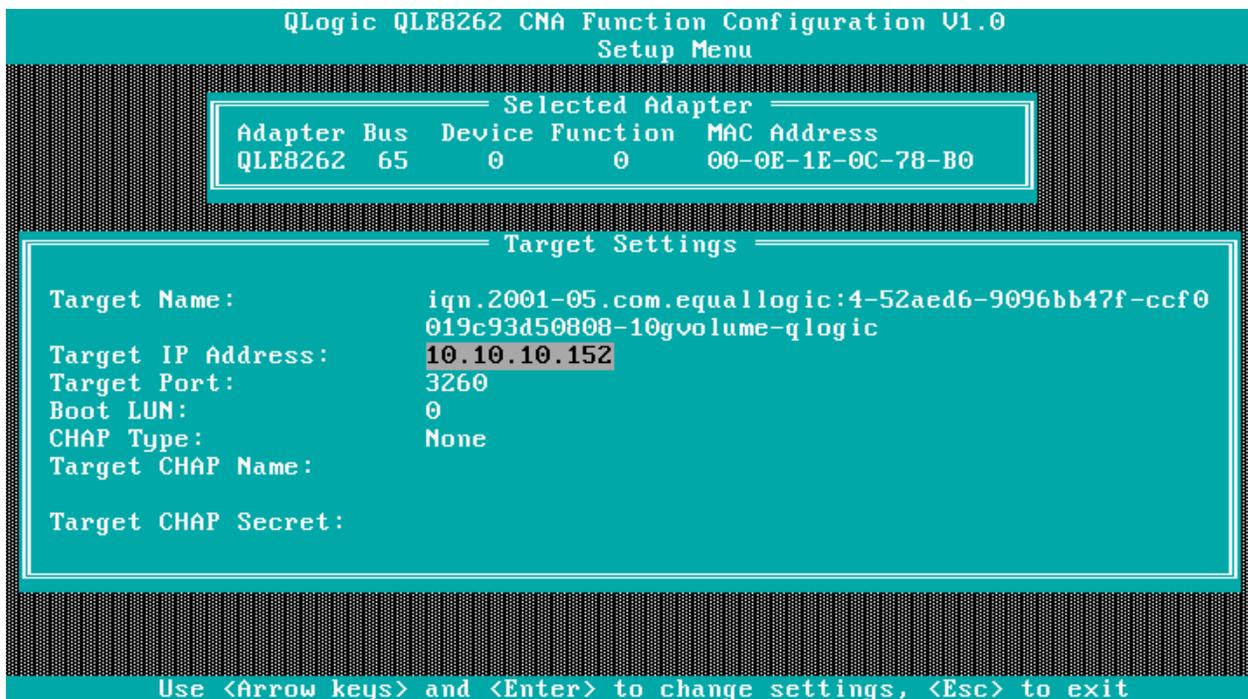


Figure 8 Target Settings for QLogic network adapter

7. Exit to the **Function Configuration** menu and enter information for other network adapter ports as needed.
8. Once complete, press **[ESC]** and select **Save changes**. Reboot the system when prompted.
9. Continue to Section 7 to configure a primary boot device.

## 6.2 Configure Intel Network Adapters for iSCSI boot

Intel network adapters are not shipped with the Boot ROM enabled for iSCSI. During the system boot if the [Ctrl+D] option to configure the Intel NIC is not displayed, see [Section 5](#) to enable iSCSI on an Intel network adapter.

Use the following steps to configure an Intel network adapter for iSCSI boot from SAN.

1. Start or reboot the system. During the system boot press **[F2]** to enter system setup, access the **Device Settings**.
2. Choose an Intel Network adapter port to be used for the iSCSI boot.
3. Enter the **NIC Configuration** and change **Legacy Boot Protocol** to **iSCSI Primary** or **iSCSI Secondary**. Click **Back** to return to the network adapter main configuration page.
4. Enter the **iSCSI Configuration** and **iSCSI General Parameters**. Disable **TCP/IP parameters DHCP** and enable/disable **CHAP authentication** as desired.
5. Return to the **iSCSI Configuration** page.
6. Enter the **iSCSI initiator parameter**, IP address, Subnet Mask and iSCSI IQN if needed. Return to the **iSCSI configuration** page when complete.

**Note:** The server will auto-generate an IQN for this host. If the target is set to control access based on the IQN, then add the IQN to the volume access as shown in step 6 of [Section 4](#).

7. Enter the **iSCSI Target Parameter**, and enter the IP address, TCP port (3260) and iSCSI Name for the target.

**Note:** The target IP will be same as the group IP of the EQL group.

8. Return to the **Device Settings** page, saving the changes as prompted.
9. Configure other Intel network adapter ports for redundancy as shown above in steps 3 through 7 and exit after saving.
10. Click Finish to exit **Device Settings** and System Setup. This will restart the system.
11. Continue to Section 7 to configure a primary boot device.



## 7 Configure Dell PowerEdge servers for iSCSI boot

The following sections describe the process for configuring the server BIOS and NICs to support boot from iSCSI targets.

1. During the boot, press **[F2]** to enter the setup mode and access the **System BIOS**.
2. Select **Integrated Devices**, disable the **Integrated RAID Controller**, and click **Back**.
3. Select **Boot settings > BIOS Boot Settings > Boot Sequence**.
4. Adjust the boot sequence order to display the DVD/CD or other Windows Server 2012 ROM device first in the list followed by the Broadcom/Intel/QLogic NIC used for iSCSI boot.
5. If the network adapter used for iSCSI boot is not listed in the **Boot Sequence**:
  - a. Make **Hard drive C:** the top second choice followed by additional desired boot devices. PCIe add-in network adapter cards are reported in the GUI as **Hard Drive C:**.
  - b. In the **Hard-Disk Drive Sequence**, bring the desired network adapter to the top as seen in Figure 9.

**Note:** The USB drive and Virtual CD are automatically detected if they are loaded.



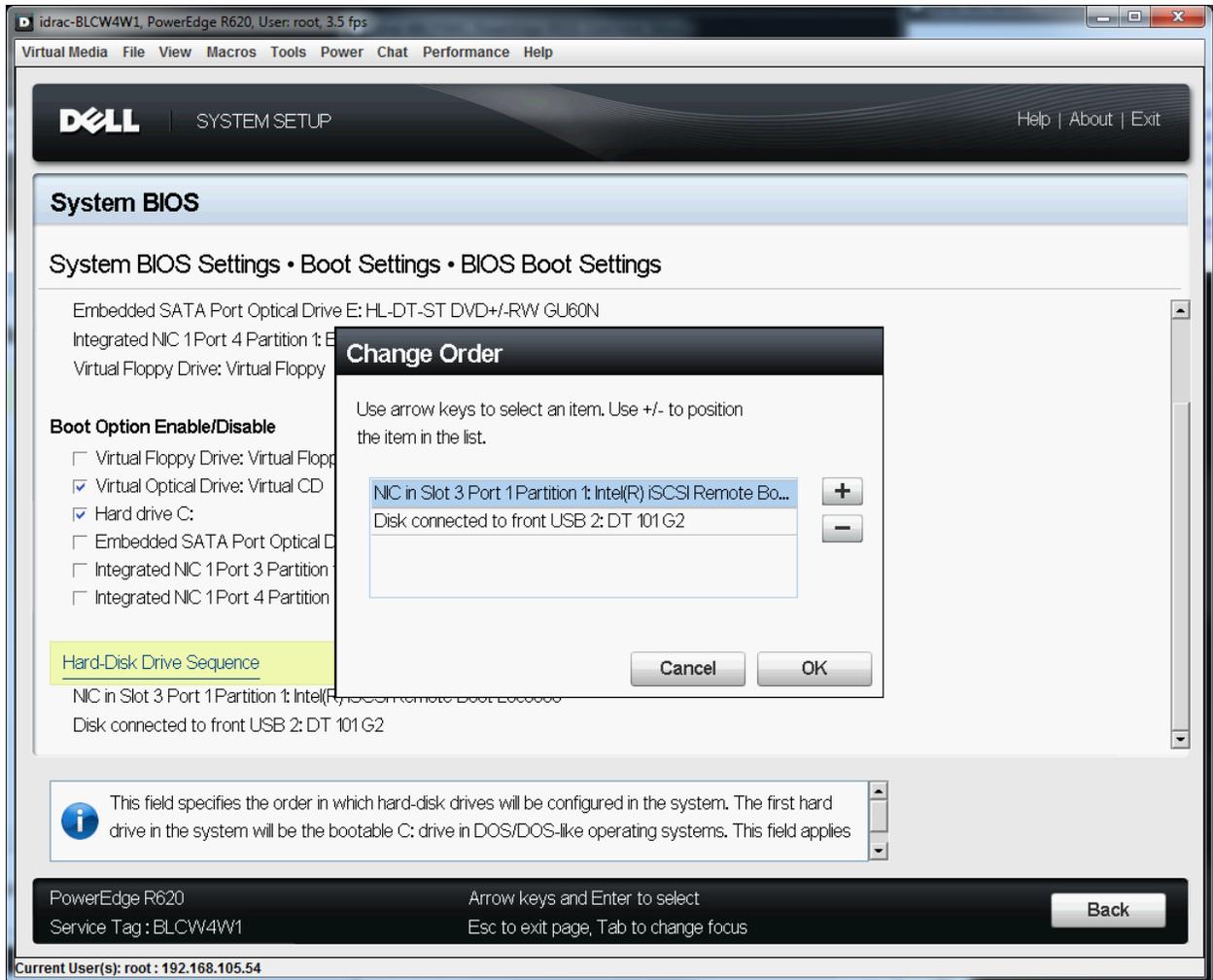


Figure 9 Changing hard disk drive sequence in the system BIOS

6. In the **Boot Option Enable/Disable** section, select the checkbox next to the network adapter used for iSCSI boot from SAN and the Optical or Virtual CD drive (assuming it contains Windows Server 2012 media). When the network adapters are listed in the **Hard-Disk Drive Sequence** section, select the **Hard drive C:** checkbox as well.
7. Return to the **System Setup Main Menu** and click **Finish**. Save the configuration when prompted.
8. Click **Exit** on the top right corner to exit and reboot.
9. After boot-up, the network adapter immediately connects to the specified target. Verify that the login to the target is successful.

## 8 Installing Windows on the iSCSI volume

Perform the following steps to install the Windows Server 2012 OS on the iSCSI volume.

1. Insert the Windows Server 2012 media into the system.
2. Turn on or restart the system.

**Note:** Do not use [F11] with the BIOS Boot Manager. Doing so may prevent Windows Server 2012 from detecting network boot devices that use the inbox drivers.

3. Press any key as prompted, to boot from the CD/DVD.
4. The **Install Windows** dialog box appears. Select the appropriate language, time, and keyboard options. Click **Next** and then **Install Now** to continue the installation.
5. Enter the product key if prompted.
6. When the **Operating System Selection** page appears, select the appropriate Windows Server 2012 installation and click **Next** to continue.
7. Read the license agreement that is displayed and select **I accept the license terms** to continue with the installation. Click **Next**.
8. Select **Custom** from the **Installation Type** page.
9. Determine if the target volume is available in the list of drives. If the target volume is available, proceed to step 14 below. To install the latest drivers please proceed to the next step.
10. Insert the removable media containing the drivers for the network adapter extracted in Section 3.
11. Click **Load Driver** to display the dialog box.
12. Click **Browse** to locate the network device driver and click **OK**.
13. Click **Next** to load the drivers.  
The available drives list containing the targeted volume appears.

**Note:** After loading the drives if the iSCSI volume does not appear, click **Refresh**. It may take a minute before the list is displayed.



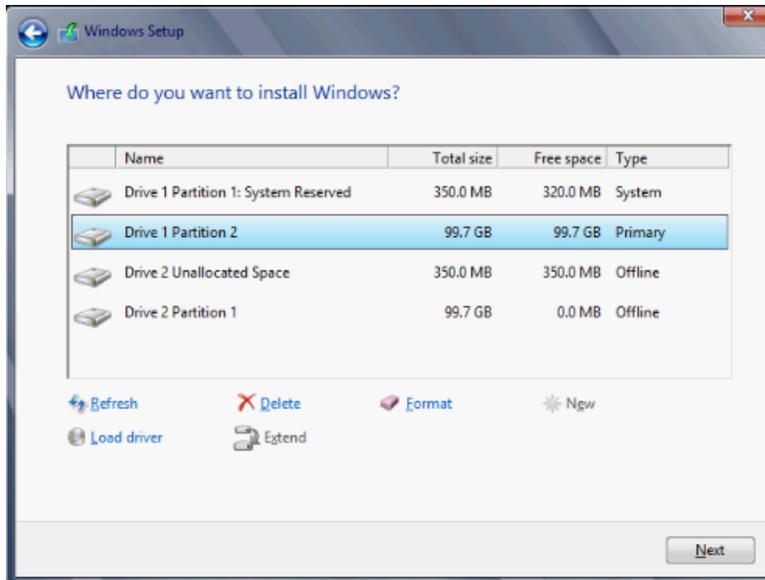


Figure 10 Selecting the location for the Windows Server 2012 installation

14. Select the drive, create a new partition by clicking **New** if needed, and then click **Next** to start the Windows installation.

**Note:** When redundant network adapter ports are configured for iSCSI boot, the EqualLogic iSCSI volume might appear as two disks. Select the volume that is not listed as **Offline**.

**Note:** If Windows Setup in a boot from SAN configuration reports **Setup was unable to create a new system partition or locate an existing system partition**, refer to the following Microsoft KB article: <http://support.microsoft.com/kb/2826787/en-us>

**Note:** If Windows Setup reports the error **We couldn't create a new partition or locate an existing one**, refer to the following Microsoft KB article: <http://support.microsoft.com/kb/938984> and take action accordingly.

15. The Windows installer copies and expands files and installs features and updates. Once the installation is complete, the server restarts and boots from the iSCSI volume to complete the Windows setup.
16. Continue with the configuration steps in [Section 9](#) to setup the system according to the best practices.

## 9 Post Windows Server 2012 OS installation steps

Perform the following steps after Windows Server 2012 is initially installed on the bootable iSCSI volume. These steps complete the configuration of a bootable iSCSI SAN by configuring multi-path I/O and redundancy, as well as optimization. As a best practice, install the HIT kit ([section 9.3](#)) and configure jumbo frames ([section 9.4](#)).

### 9.1 Install hotfixes

Check for other Microsoft Hotfixes and updates that may be needed for the Windows Server 2012 system on the Microsoft website.

### 9.2 Make network adapter the primary boot device.

The following section configures the BIOS to use the network adapter used for iSCSI boot as the primary boot device.

1. Restart the system and press **[F2]** during the boot to enter the setup mode and access the **System BIOS**.
2. Select **Boot settings > BIOS Boot Settings > Boot Sequence**.
3. Adjust the boot sequence order to display Broadcom/Intel/QLogic NIC used for iSCSI boot first in the list.
4. If the network adapter used for iSCSI boot is not listed in the **Boot Sequence**:
  - a. Make **Hard drive C:** the top choice. PCIe add-in network adapter cards are reported in the GUI as **Hard Drive C:**.
  - b. In the **Hard-Disk Drive Sequence**, bring the desired network adapter to the top as seen in Figure 9.

### 9.3 Install the EqualLogic Host Integration Tool (HIT) kit

The Host Integration Tool kit, or HIT kit, is a device specific module (DSM) for Dell EqualLogic arrays that is installed on Windows Server 2012 systems to create redundant connection paths from the host system to EqualLogic arrays. The HIT kit also installs other utilities and configures the host system according to the best practices for Dell EqualLogic arrays.

Complete the following steps to install the HIT kit.

1. Go to <https://eqsupport.dell.com> to download the HIT kit. An account is required to access the files.
2. Go to **Downloads > HIT kit for Microsoft**. Download the latest Host Integration Tools for Microsoft.
3. Double click **Setup64.exe** (for x64 bit system) to install HIT kit on the system.
4. Click **Next** on the Welcome page to proceed.
5. Read and accept the license agreement and click **Next** to proceed.



6. Install Dell EqualLogic Host Integration Tools at the default location. Click **Next** to proceed.
  7. Select **Complete** setup type, and click **Next**.
  8. Click **Install** to proceed with installation.
  9. Select the **Launch Remote Setup Wizard** check box and click **Finish**.
  10. Information about Dell EqualLogic is displayed, as well as the Welcome page for the **Remote Setup Wizard**.
  11. Click **Configure MPIO Settings**.
  12. Include only the subnet used for the SAN (iSCSI network) in the MPIO settings (exclude all other the subnets from MPIO). Click **Save and close the window**.
- If other subnets are added in the future, exclude them from MPIO if they are not a part of the SAN.

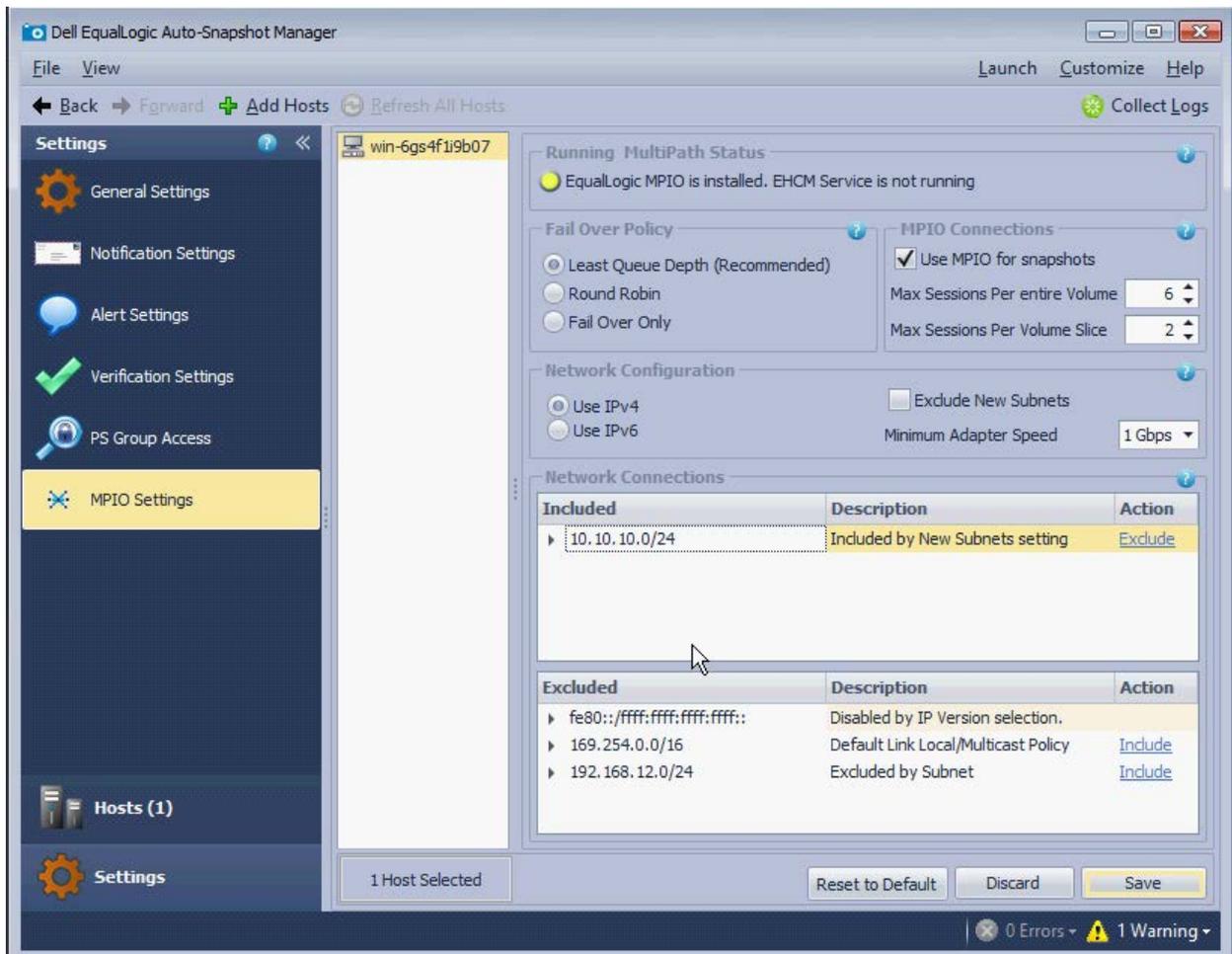


Figure 11 Configuring MPIO in Remote Setup Wizard

13. In the **Dell EqualLogic Auto-Snapshot Manager**, click **PS Group Access** in the **Settings** column on the left to add the array group.
14. Click **Add PS Group** on the right and enter the **PS Group name** and **Group IP** of the array member, and then click **Save**. Close the **Dell EqualLogic Auto-Snapshot Manager**.



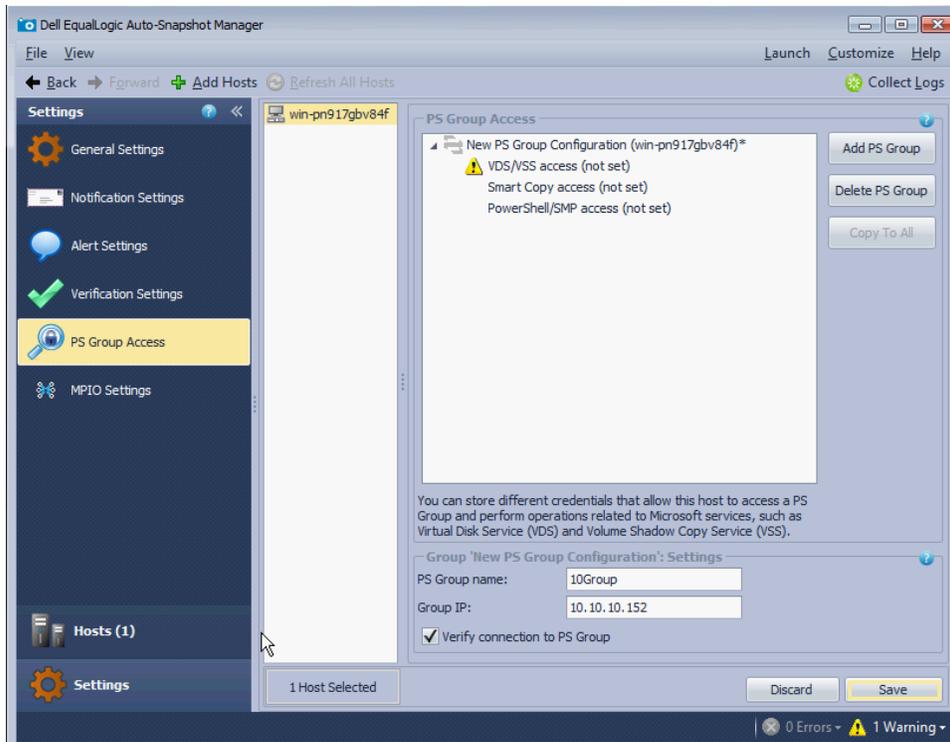


Figure 12 Adding PS group access.

15. Reboot the system after installation.

## 9.4 Set Jumbo frames on Network adapters

Enable Jumbo frames on the network adapter ports. After configuring the jumbo frames, reboot the system for the new settings to take effect if prompted.

The jumbo frame settings may require specific configuration utilities for each adapter. For example, enabling jumbo frames with QLogic CNAs require the use of the QLogic® QConvergeConsole® management utility.

The following steps show the configuration for Intel network adapters. The procedure may vary for other network adapters.

1. Go to **Server Manager > Tools > Computer Management**.
2. Under **System Tools** select **Device Manager** and expand the **Network adapters** list.
3. Locate and double-click the network adapter used for the iSCSI boot.
4. In the **Adapter Properties** window, go to the **Advanced** tab and choose **Jumbo Packets in Property**.
5. Change the value to **9014**.
6. Click **OK** to save and close the **Adapter Properties** window.
7. Complete the same steps for the other adapters used for iSCSI boot from SAN.
8. Reboot the system for these settings to take effect.

## 10 Recovery from a degraded network interface

When the host system is booted with a single active link to the boot volume (degraded boot), reestablishing the failed connection does not create redundant connections to the boot volume. To regain the redundant connection you must either reboot the host system or configure the IP address manually in the OS.

To reestablish the network interface without restarting, use the following steps:

1. Open the **Control Panel** from the **Start** menu.
1. Click **Network and Internet > Network and Sharing Center > Change adapter settings**.
2. Choose the network adapter used for the iSCSI network and double click it.
3. Select **Properties** on the **Network adapter Status** window.
4. Select **Internet Protocol Version 4 (TCP/IPv4)** and click **Properties**.
5. In the **Internet Protocol Version 4 (TCP/IPv4) Properties** select the radio button for **Use the following IP address**.
6. Enter the IP address and Subnet mask details as needed. (These details should be the same as those entered in [Section 6](#) for the particular network adapter.)
7. Click **OK** and close the **Network Adapter Properties** window.
8. Repeat these steps for the remaining network adapters used for iSCSI boot.

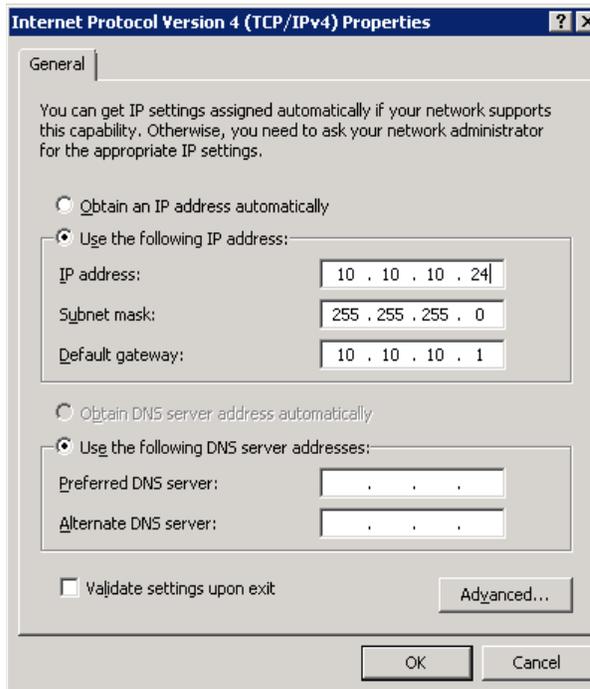


Figure 13 Entering IP address and Subnet mask.

# 11 Conclusion and best practices

Configuring a Windows Server 2012 to boot from an EqualLogic iSCSI SAN has several advantages for management of the server and network. It also provides high reliability for the IT environment. Using boot from SAN is valuable in an IT environment for the following advantages:

- Quick and easy centralized backup
- Faster recovery in event of server failure
- New servers can be replaced, re-purposed, and added quickly and easily
- The operating cost is lowered by eliminating the need for local hard disks on each server
- Simplified management for administrators

Using an external storage device to host server boot images helps with quick and easy centralized backups for the boot images. Data, including boot information, can be easily replicated minimizing the recovery time from a server failure. The boot images are securely stored on a storage platform independent of the servers making it is easy to replace the servers. Simply pointing the new server to a newly replicated or existing boot image makes adding a new server with a replicated boot image quick and easy.

Boot from iSCSI SAN gives higher reliability in terms of hardware failure, data loss, rapid disaster recovery, and easier centralized backup. Using iSCSI storage instead of local hard drives provides efficient use of storage space, because over-provisioning in terms of the internal storage of the server can be eliminated, resulting in lower operating cost. SAN storage systems are generally more robust and reliable compared to hard-drives on individual servers.

Boot from iSCSI SAN enables simplified management for the administrator. Operating system patching and upgrades can be carried out with very little downtime. Upgraded operating system images can be prepared and cloned on the storage device and individual servers can be pointed to new boot images and rebooted with very little downtime. Boot images can be cloned and used to test upgrades, service packs, and other patches without disturbing a production environment.

Boot from iSCSI SAN provides great benefits and offers opportunities to make administrative tasks simpler. By following the configuration settings outlined in this paper, server and storage administrators can improve the operational efficiency and productivity in their IT environment.



# A Configuration worksheet

Use the following worksheet to capture configuration information for the boot from iSCSI SAN environment.

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

<b><u>Dell PowerEdge Server (Host/Initiator)</u></b>	
<b>Primary Boot NIC</b>	<b>Secondary Boot NIC (optional)</b>
IQN:	IQN (Optional: if different from Primary NIC):
IP Address:	IP Address:
Subnet Mask:	Subnet Mask:
Slot Location:	Slot Location:
<b><u>Dell EqualLogic Storage (Target)</u></b>	
IQN:	
iSCSI Port: (default 3260)	
EqualLogic Group IP address:	



## B Network adapter driver and firmware version

Table 2 Driver versions for Network adapters used.

Network adapter	Firmware version	Driver version
Intel 10GbE x520 Server Adapter	13.1.0	3.0.81.1
Intel 10GbE x540 Server Adapter	13.5.2	3.0.81.1
Intel 1GbE i350 Server Adapter	14.0.12	12.0.150.0
QLogic QLE8262 Converged Network Adapter	01.11.29	4.00.17

## C System details

Table 3 System information

	Version
BIOS	1.6.0
Operating System version	6.2.9200
Operating System name	Microsoft Windows Server 2012 Standard



## Additional resources

Support.dell.com is focused on meeting your needs with proven services and support.

Dell TechCenter (<http://delltechcenter.com>) is an IT Community where you can connect with Dell Customers and Dell employees for the purpose of sharing knowledge, best practices, and information about Dell products and your installations.

Microsoft articles:

- Windows 2008 R2 "Microsoft iSCSI Boot Step-by-Step Guide" at [http://technet.microsoft.com/en-us/library/ee619733\(v=ws.10\).aspx](http://technet.microsoft.com/en-us/library/ee619733(v=ws.10).aspx)
- Information on creating a slipstreamed Windows image is in the Microsoft Knowledge Base support article "KB974072" at <http://support.microsoft.com/kb/974072>
- For the Windows Setup in a boot from SAN configuration error message **Setup was unable to create a new system partition or locate an existing system partition**, refer to the following Microsoft KB article: <http://support.microsoft.com/kb/2826787/en-us>
- For the Windows Setup error **We couldn't create a new partition or locate an existing one**, refer to the following Microsoft KB article: <http://support.microsoft.com/kb/938984>

Referenced or recommended Dell publications:

- *PS series Deployment: Boot from SAN using QLogic iSCSI Host Buss Adapters* at <http://en.community.dell.com/dell-groups/dtcmedia/m/mediagallery/19861476/download.aspx>
- *Dell EqualLogic Configuration Guide* at <http://en.community.dell.com/techcenter/storage/w/wiki/equallogic-configuration-guide.aspx>
- *Configuring Windows Server 2008 R2 for iSCSI SAN Boot with EqualLogic Storage* at <http://en.community.dell.com/dell-groups/dtcmedia/m/mediagallery/20310666/download.aspx>

For EqualLogic best practices, reference architectures, and deployment guidelines for enterprise applications and SANs, refer to Storage Infrastructure and Solutions Team Publications at:

- <http://dell.to/sM4hJT>





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