Dell EqualLogic – Red Hat Enterprise Linux 6.2 Boot from SAN

A Dell EqualLogic best practices technical white paper

Storage Infrastructure and Solutions Engineering
Dell Product Group
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1 Introduction

This document provides instructions for configuring Dell™ PowerEdge™ 12th Generation (12G) family of servers to boot Red Hat® Enterprise Linux® 6.2 from iSCSI SAN-based boot images residing on Dell™ EqualLogic™ PS Series arrays.

The evolution of server and storage virtualization as well as the adoption of Storage Area Networks (SANs) by SMB, Departmental, and Enterprise markets has created the demand to boot servers directly from SAN-based volumes (Logical Unit Numbers or LUNs). Beyond the obvious flexibility and power efficiency benefits of not needing Direct-Attached Storage (DAS) Boot Disks in servers, Boot from SAN allows for quick reconfiguration and deployment of multiple operating system- and application-specific images.

1.1 Scope

The process for configuring a boot from iSCSI SAN can vary considerably. Factors that determine the exact process include the type of network adapter used to boot from SAN, the specific operating system and multi-path I/O software being installed, and the type of iSCSI SAN arrays used to store the boot volumes.

In this document, we limit our focus to the steps required to configure the iSCSI SAN boot scenarios as shown in the following table.

Component:	**Details:**
Operating System	Red Hat Enterprise Linux 6.2
Server	Dell PowerEdge 12G Family • Process validated on PowerEdge R620, system BIOS v1.2.6
Network Interface Controllers	Broadcom® BCM5720 • Firmware v7.2.20 Intel® i350-t • Firmware v13.1.10
Storage	Dell EqualLogic PS Series • Process validated on PS6100XV, firmware v6.0.1
Multi-path software	Host integration Tools for Linux v1.1.0

2 Procedure

The following section provides detailed instructions for each key configuration process.

2.1 Configuring the iSCSI target

In order to boot from an iSCSI SAN there must be a target volume created on the storage array dedicated to the boot partition of the server operating system. This target volume must be accessible by the storage host initiator.

On Dell EqualLogic PS Series storage array groups the boot from SAN volume can be created from within the Group Manager application interface.

1. Create an iSCSI volume.
2. Grant access to the volume from the RHEL 6.2 storage initiator using IP address range, IQN name, or CHAP authentication.
3. Record the iSCSI volume IQN name and CHAP authentication details if applicable.

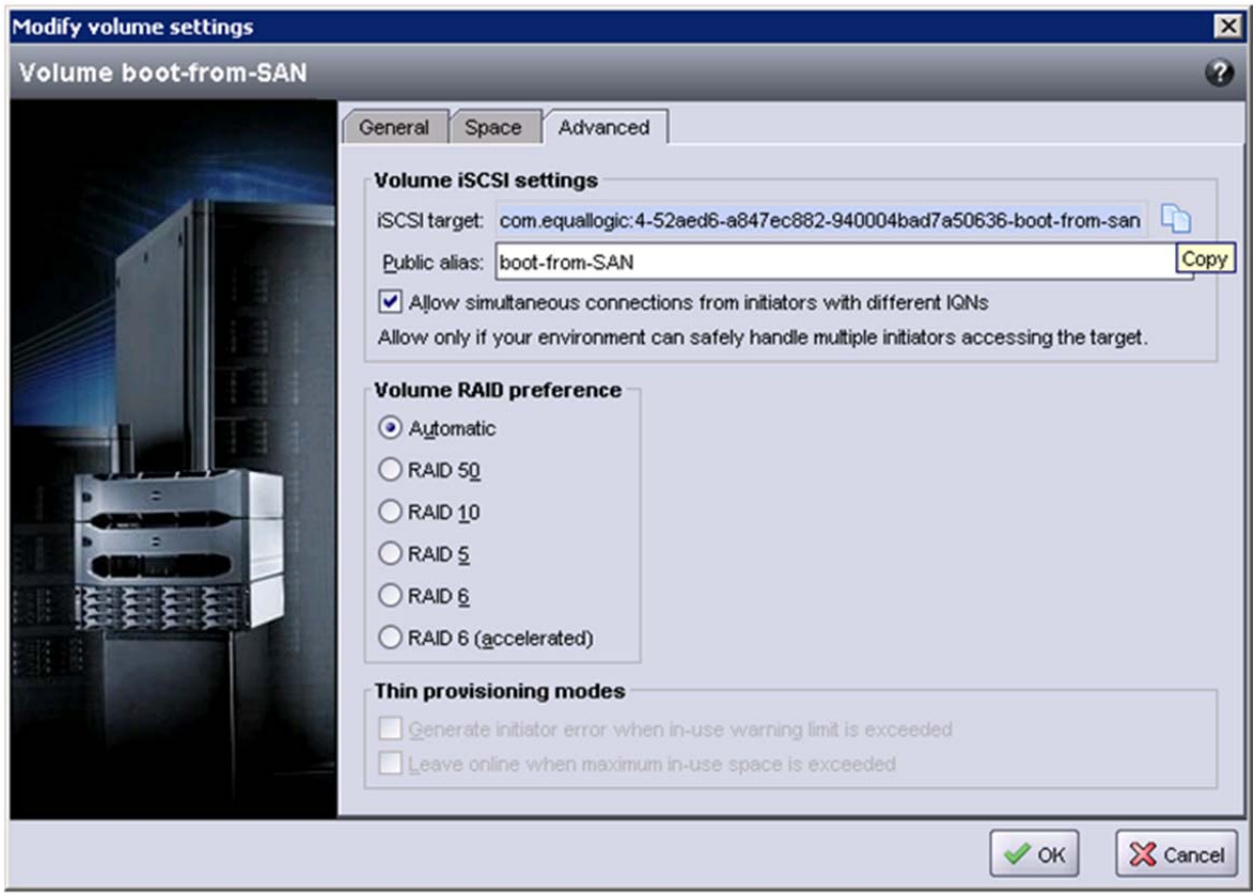

Figure 1 Dell EqualLogic PS Series Group Manager iSCSI volume properties

2.2 Configuring the iSCSI initiator

The next step is to configure the onboard Broadcom BMC5720 or an add-in Intel i350-t network adapter to act as an iSCSI initiator and connect to the newly created EqualLogic PS Series volume. Once connected, the storage host can install RHEL 6.2 to and then boot from the iSCSI target volume.

1. Boot the storage host.
2. Press [**F10**] to enter the Dell Lifecycle Controller **Unified Server Configurator (USC)**.

Figure 2 Dell Lifecycle Controller Unified Server Configurator (USC)

3. Select **System Setup**, **Advanced Hardware Configuration**, and then **Device Settings**.

2.2.1 Configuring the Broadcom NIC

Note: For configuration instructions of an Intel NIC, skip to section 2.2.2.

The following section provides instructions for configuring the onboard Broadcom BCM5720 network adapter as the iSCSI initiator.

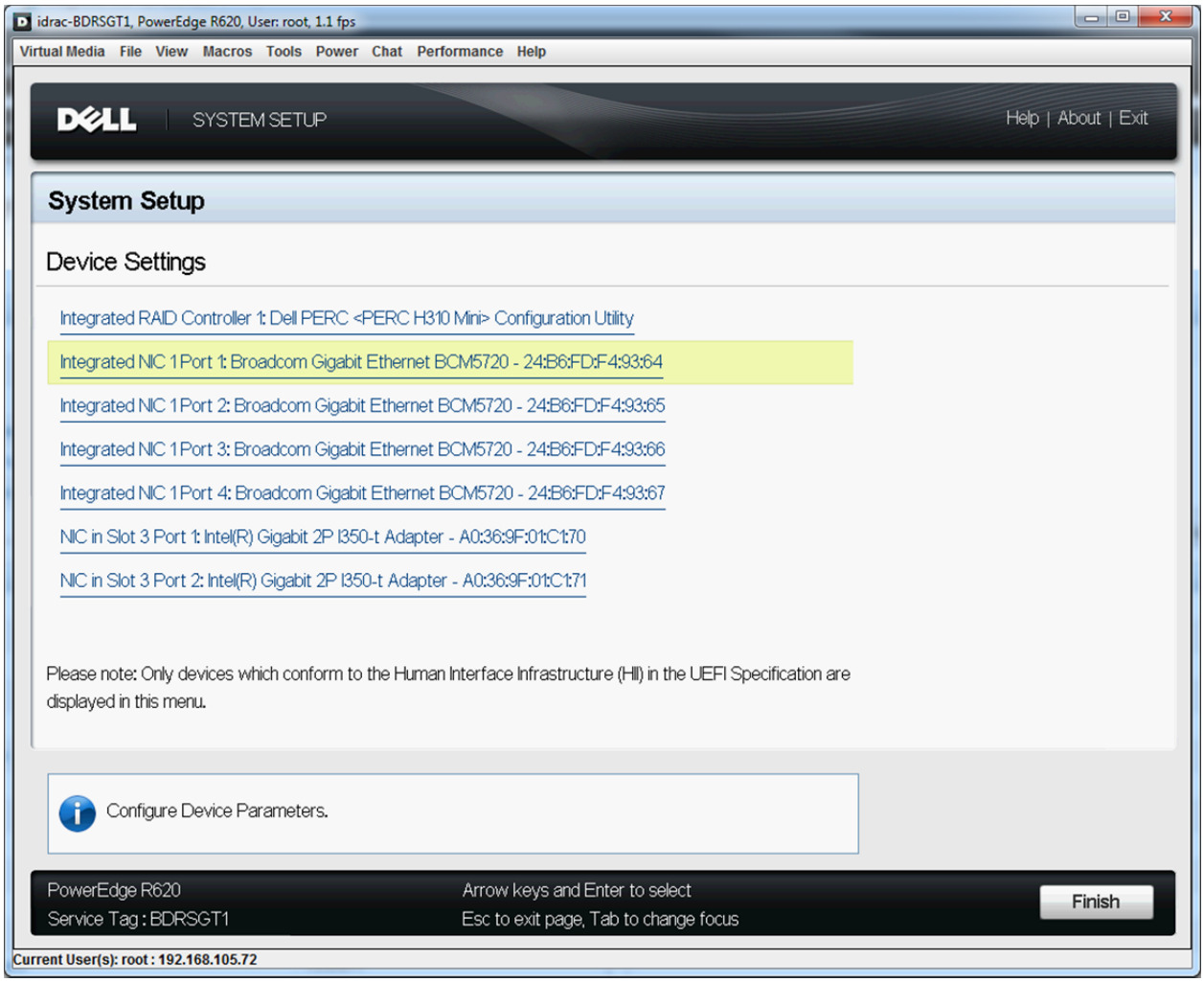

Figure 3 Device Settings menu

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

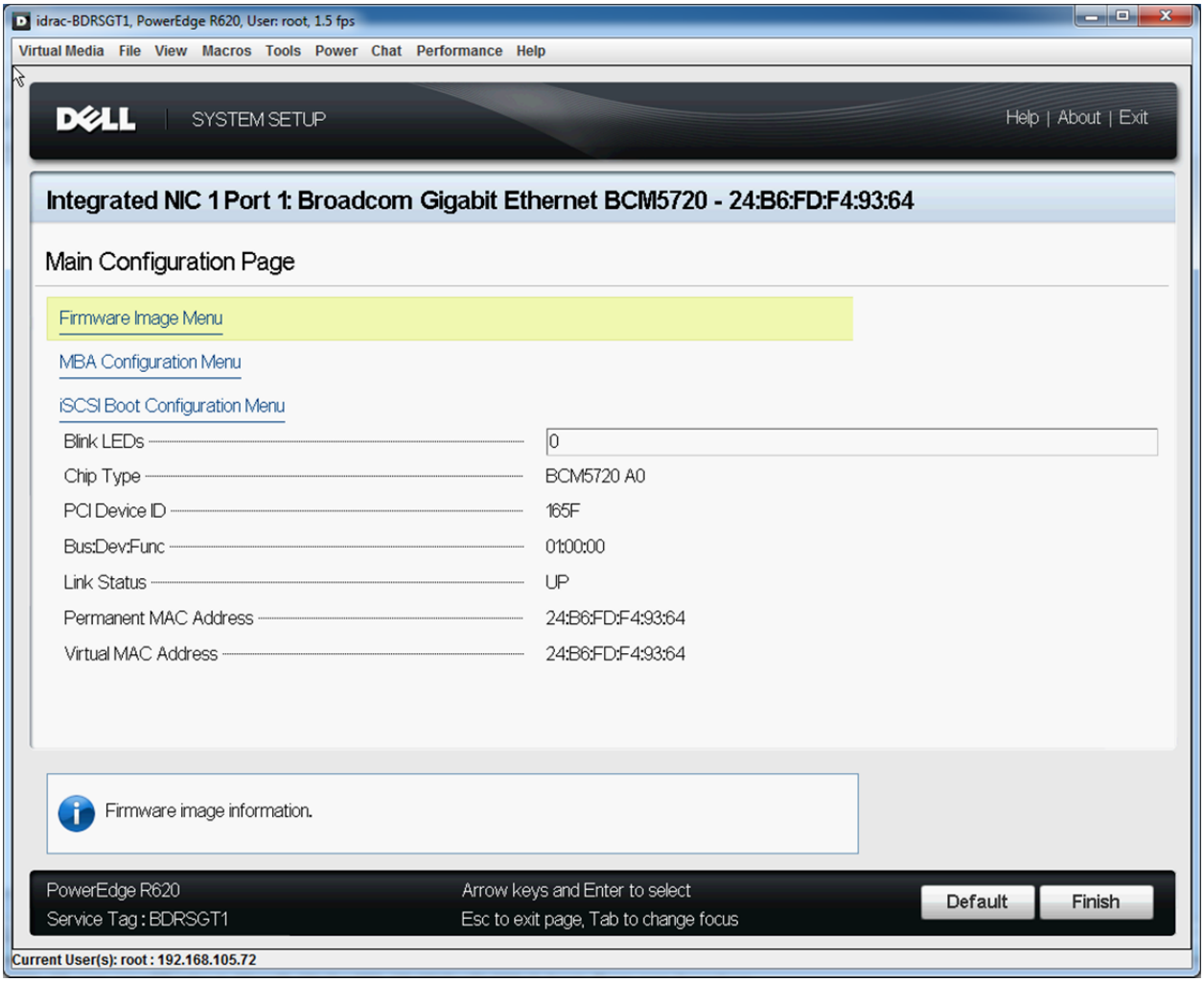

Figure 4 Broadcom BCM5720 Main Configuration Page

5. The adapter firmware is viewable in the **Firmware Image Menu**. After the firmware version is noted, return to the **Main Configuration Page**.

6. Select **MBA Configuration Menu.**

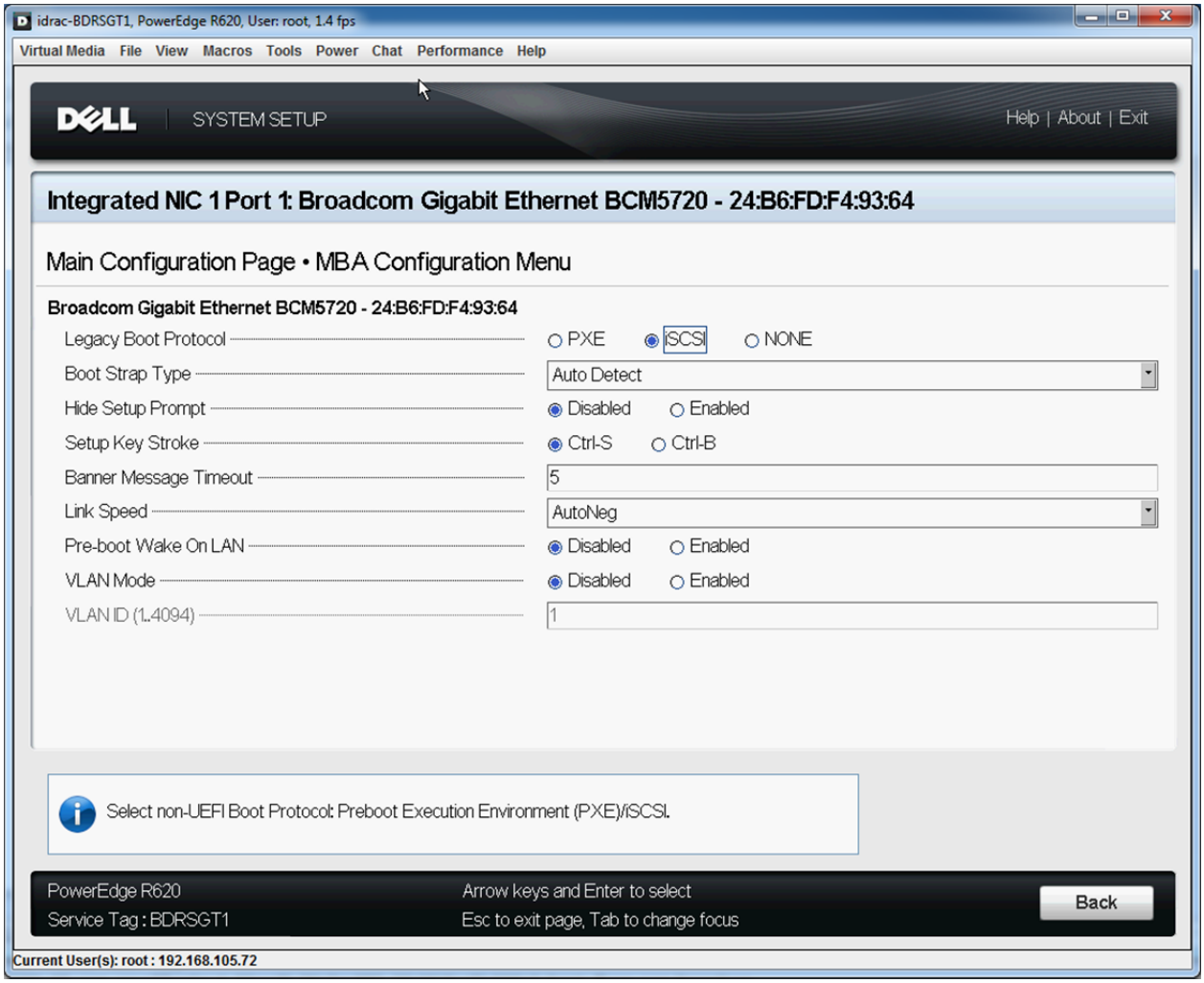

Figure 5 Broadcom BCM5720 MBA Configuration Menu

7. Set the **Legacy Boot Protocol** to **iSCSI**.
8. Return to the **Main Configuration Page**.

9. Select **iSCSI Boot Configuration Menu** and then **iSCSI General Parameters**.

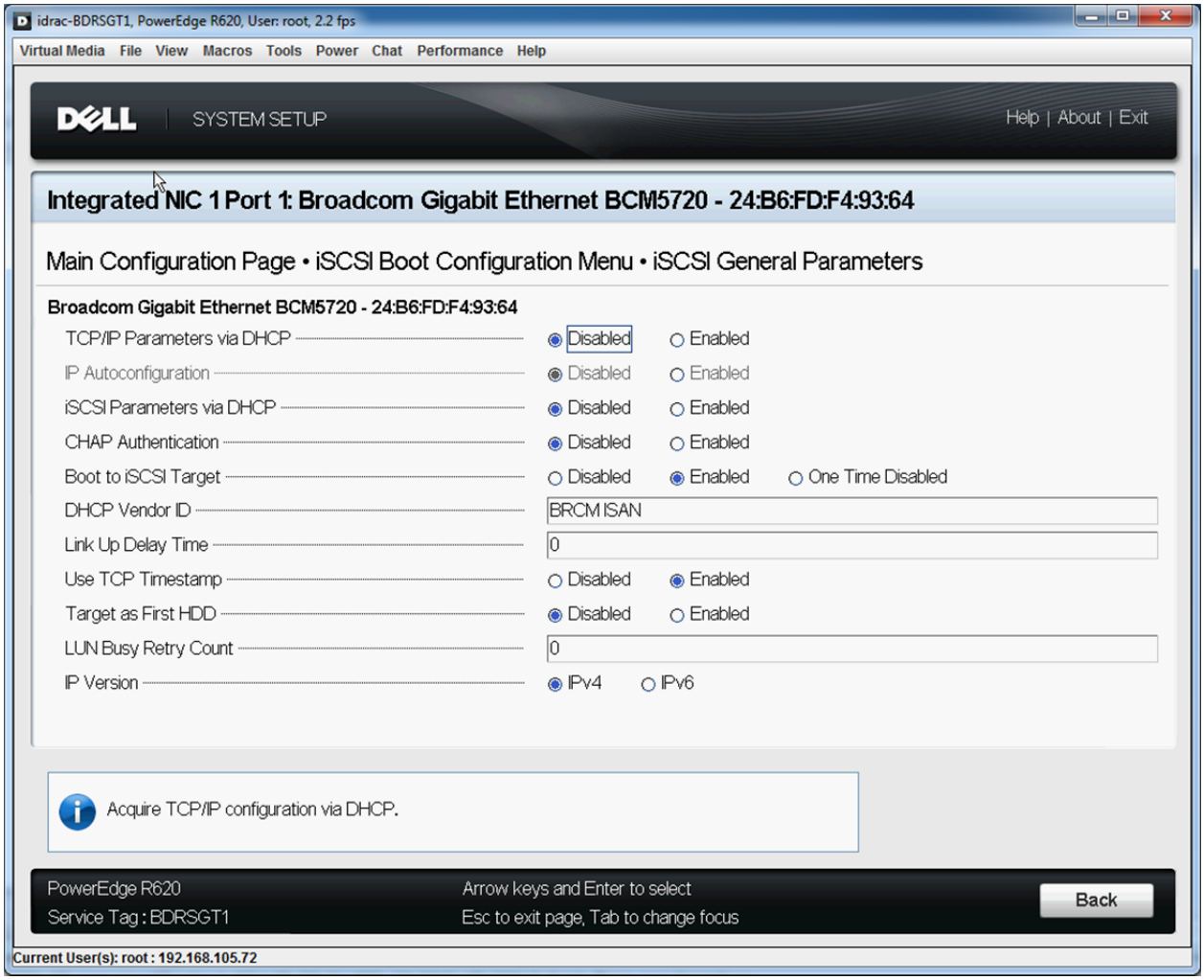

Figure 6 Broadcom BCM5720 iSCSI General Parameters

10. To use a static IP address, set the **TCP/IP parameters via DHCP** and **iSCSI Parameters via DHCP** to **Disabled**. To use CHAP authentication, set **CHAP Authentication**, set to **Enabled**.
11. Return to the **iSCSI Boot Configuration Menu**.

12. Select **iSCSI Initiator Parameters**.

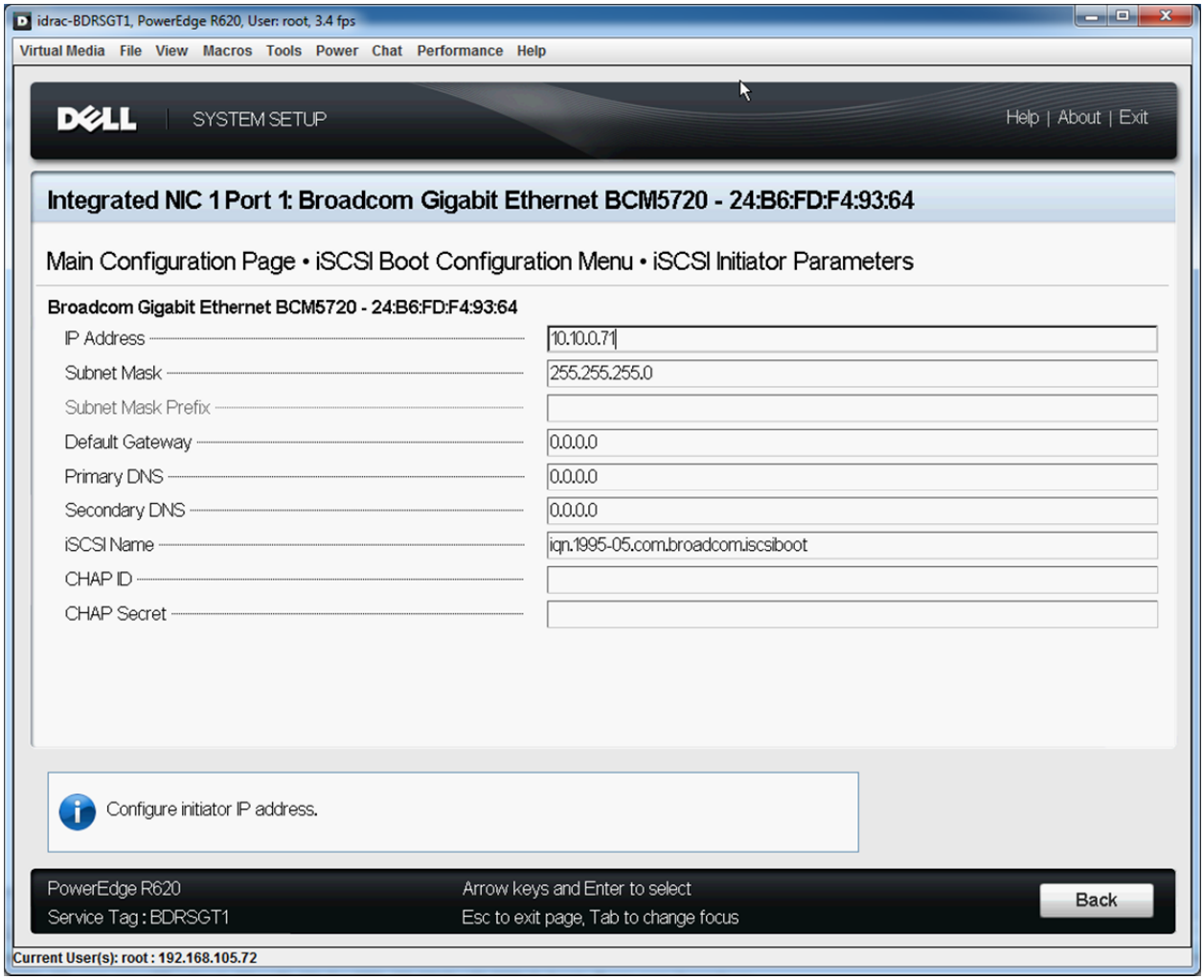

Figure 7 Broadcom BCM5720 iSCSI Initiator Parameters

13. Set the initiator **IP Address**, **Subnet Mask**, and if required, the **Default Gateway**, **DNS**, **iSCSI IQN**, **CHAP ID**, and **CHAP Secret**.
14. Exit to the **iSCSI Boot Configuration Menu**.

15. Select **iSCSI First Target Parameters.**

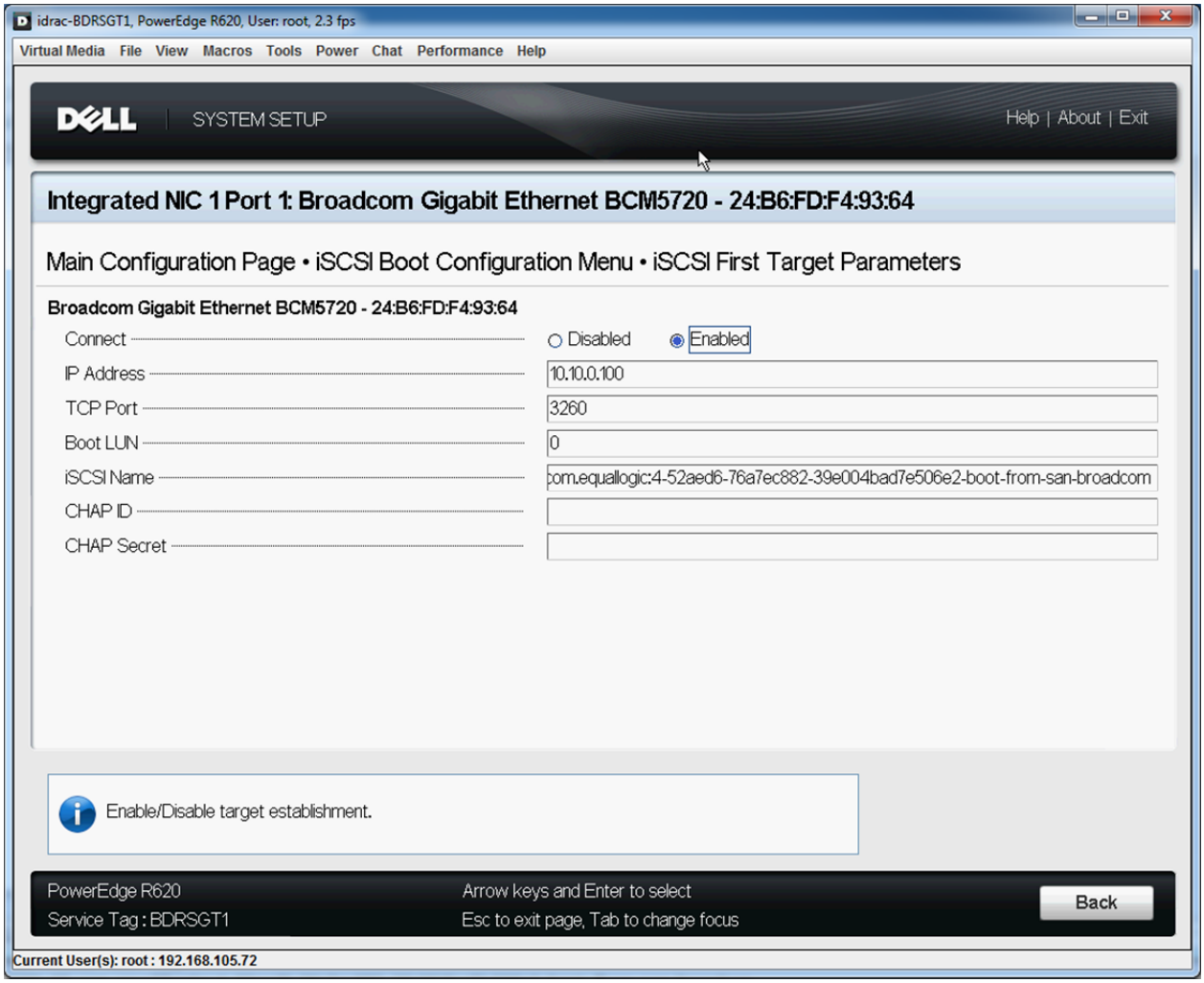

Figure 8 Broadcom BCM5720 iSCSI First Target Parameters

16. Set **Connect** to **Enabled**.
17. Set **IP Address** as the IP address of the EqualLogic Group hosting the iSCSI volume to be used for booting from SAN.
18. Set **iSCSI Name** to the iSCSI IQN of the volume.
19. Set **CHAP ID** and **CHAP Secret** if using CHAP authentication.
20. Press [**Esc]** until prompted to save, and then save adapter settings.
21. Press [**Esc**] until the **USC** is displayed.
22. Press [**Esc]** and choose to reboot host so that newly configured iSCSI boot device will appear in BIOS boot list.

2.2.2 Configuring the Intel NIC

The following section provides instructions for configuring an add-in Intel i350-t network adapter as the iSCSI initiator.

1. From the **Device Settings** menu, select **NIC in Slot X Port 1: Intel(R) Gigabit 2P I350-t Adapter**.

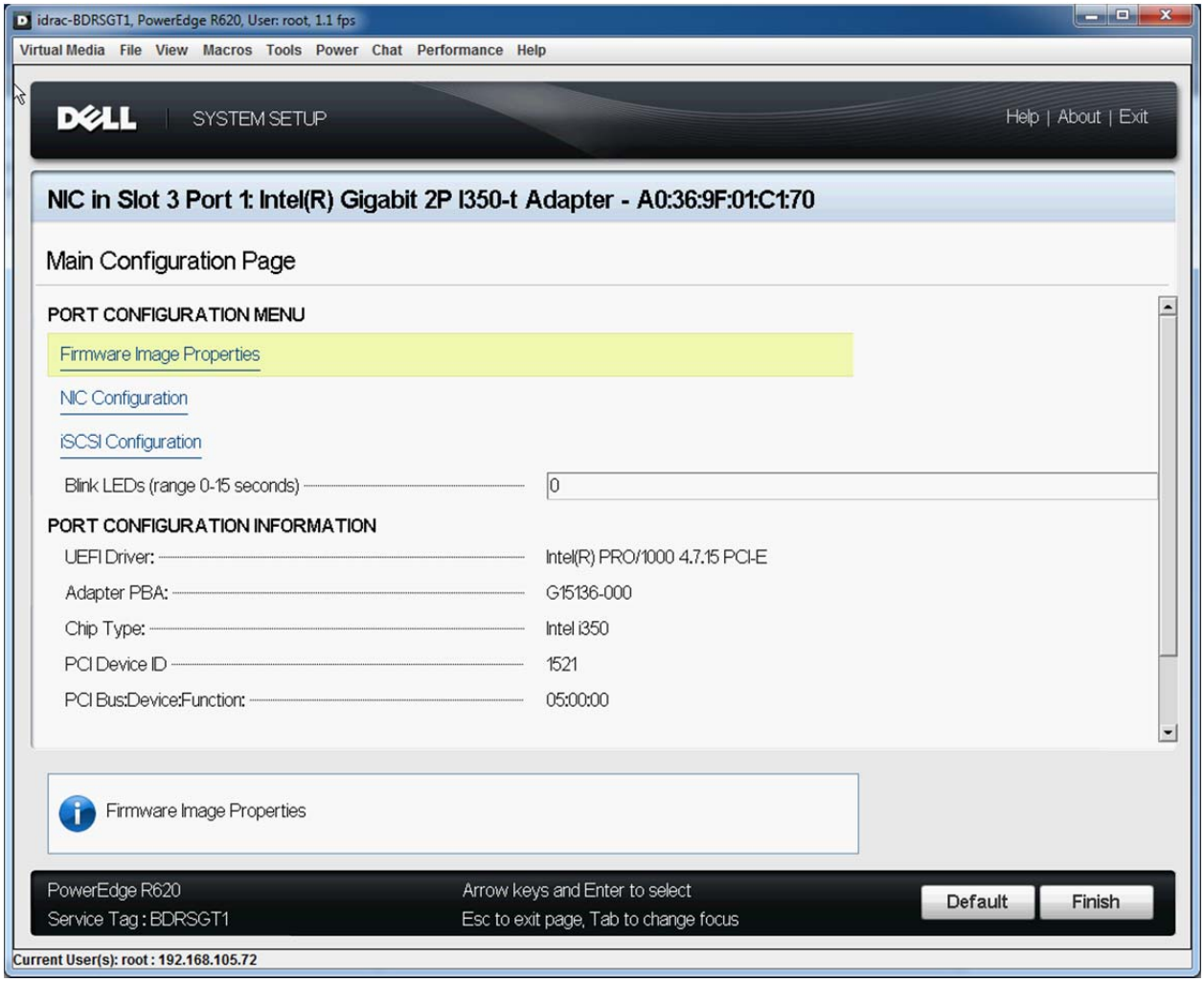

Figure 9 Intel i350-t Main Configuration Page

2. To view the adapter firmware, select **Firmware Image Properties**.
3. Return to the **Main Configuration Page**.

4. Select **NIC Configuration**.

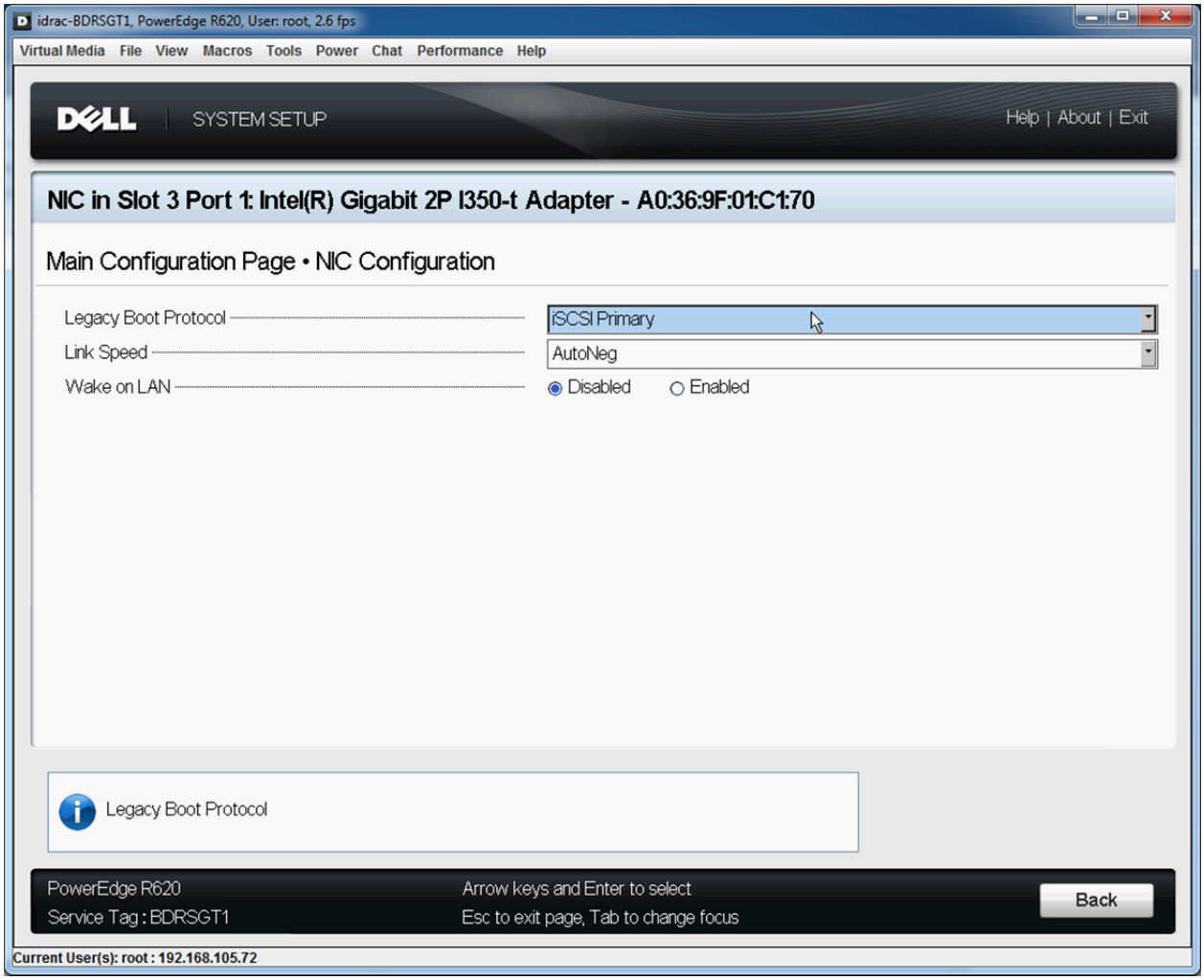

Figure 10 Intel i350-t NIC Configuration

5. Set **Legacy Boot Protocol** to **iSCSI Primary**, and return to the **Main Configuration Page**.

6. Select **iSCSI Configuration** and then **iSCSI General Parameters**.

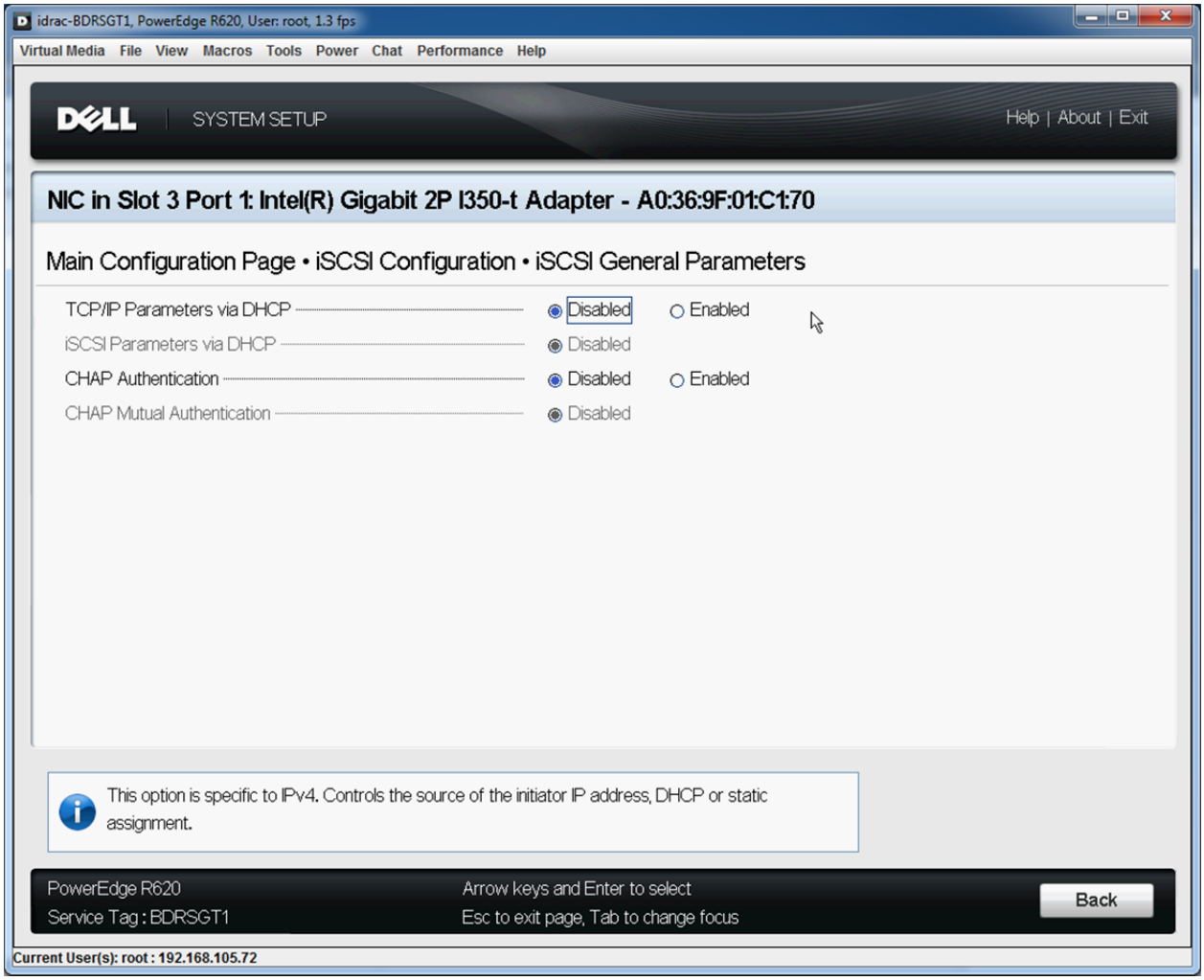

Figure 11 Intel i350-t iSCSI General Parameters

7. If a static IP address is being used, set **TCP/IP Parameters via DHCP** to **Disabled**.
8. If using CHAP authentication, set **CHAP Authentication** to **Enabled**.
9. Return to **iSCSI Configuration**.

10. Select **iSCSI Initiator Parameters**.

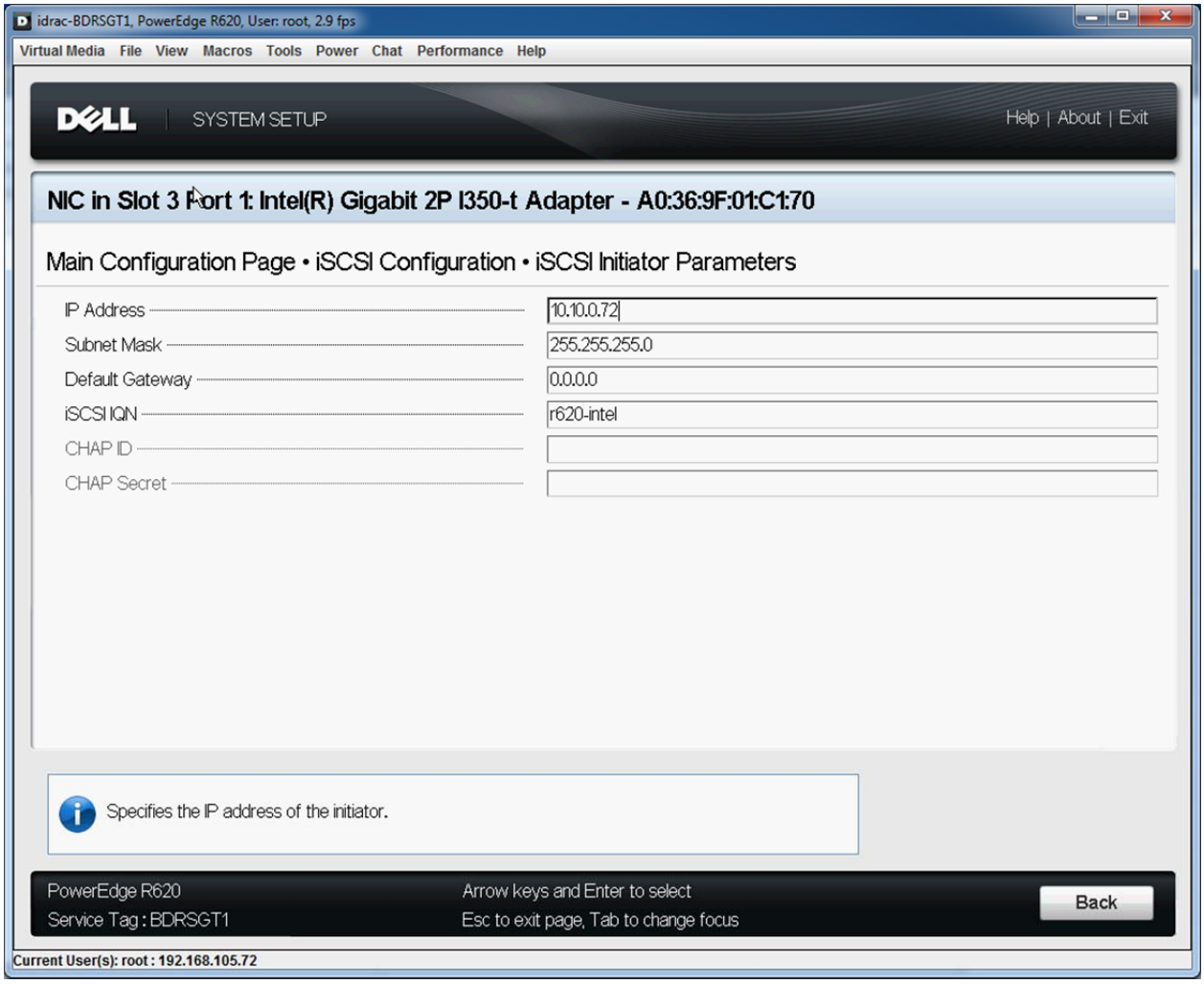

Figure 12 Intel i350-t iSCSI Initiator Parameters

11. Set the initiator **IP Address**, **Subnet Mask** and if required, **Default Gateway**, **iSCSI IQN**, **CHAP ID**, and **CHAP Secret**.
12. Return to **iSCSI Configuration**.

13. Select **iSCSI Target Parameters**.

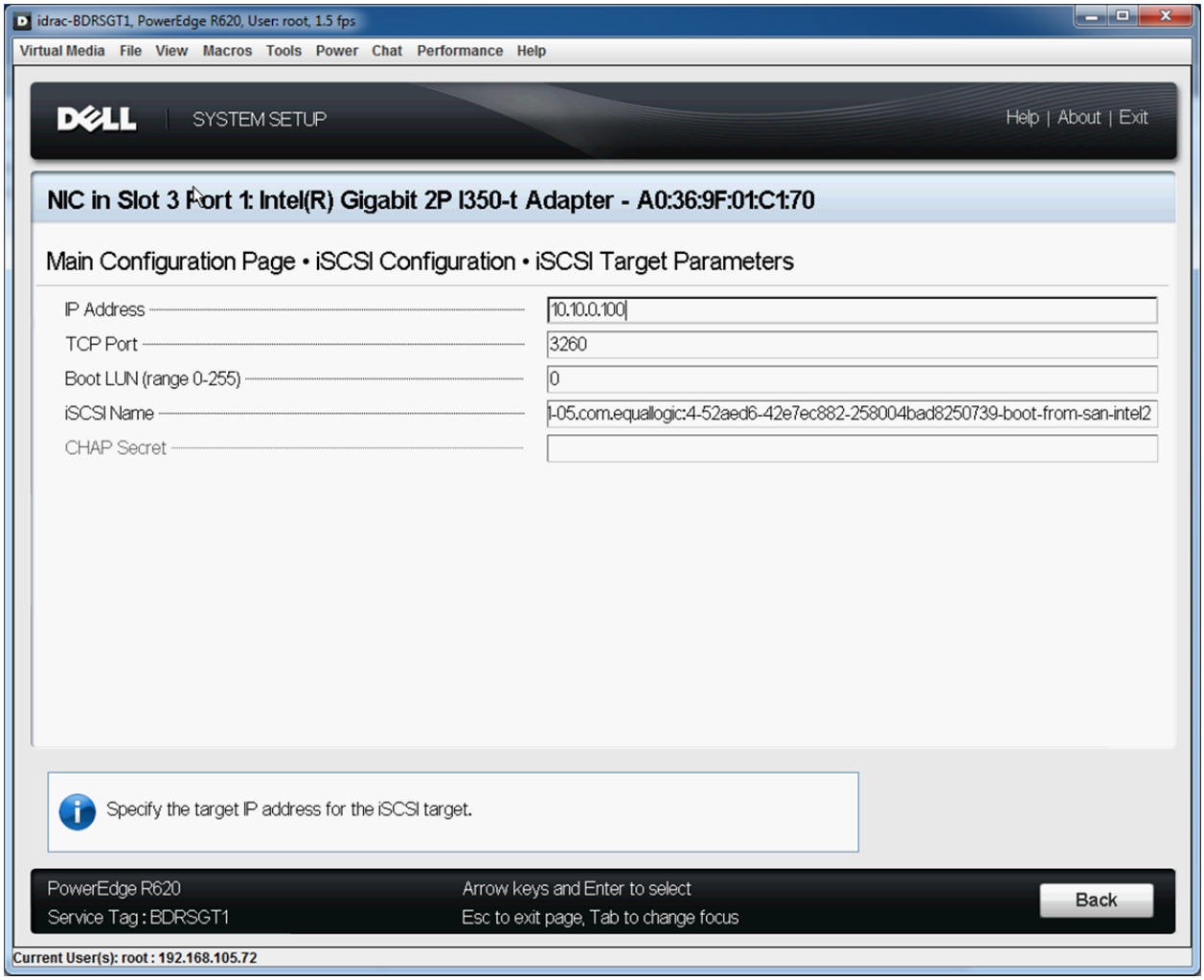

Figure 13 Intel i350-t iSCSI Target Parameters

14. Set IP Address as the IP address of the EqualLogic Group hosting the iSCSI volume to be used for booting from SAN.
15. Set **iSCSI Name** to the iSCSI IQN of the volume.
16. Set **CHAP ID** and **CHAP Secret** if using CHAP authentication.
17. Press [**Esc**] until prompted to save, and then save adapter settings.
18. Press [**Esc**] until the **USC** is displayed.
19. Press [**Esc**] and choose to reboot host so that newly configured iSCSI boot device will appear BIOS boot list.

2.3 Configuring the BIOS boot order

Facilitate the installation of RHEL 6.2 by changing the BIOS boot order to the iSCSI volume used when booting from SAN.

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

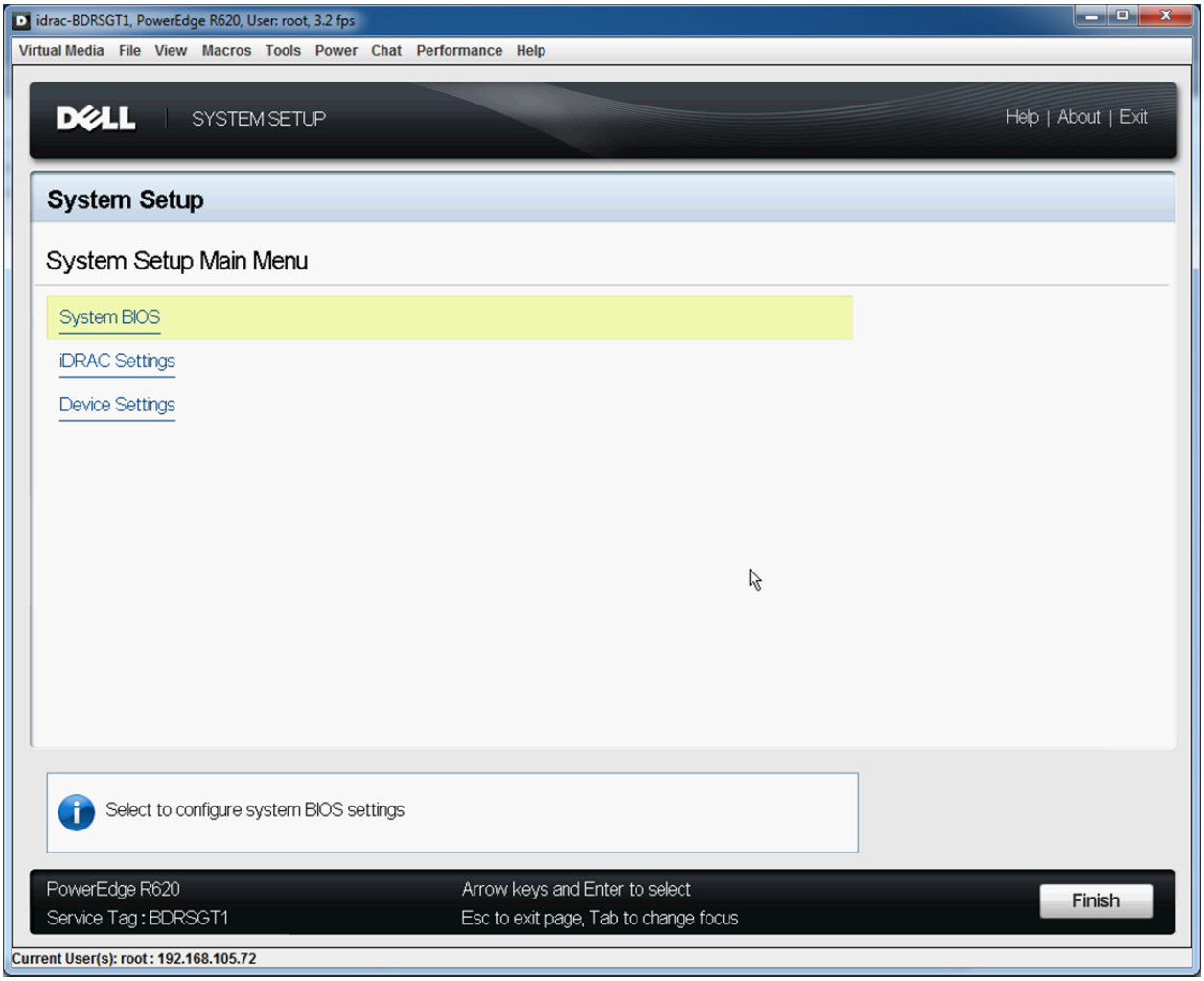

Figure 14 System Setup Main Menu

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

2.3.1 Configuring BIOS boot settings for Broadcom NIC

Note: For instructions on configuring BIOS boot settings for an Intel NIC, skip to section 2.3.2.

The following section provides the steps for configuring the BIOS to iSCSI boot using the onboard Broadcom BCM5720.

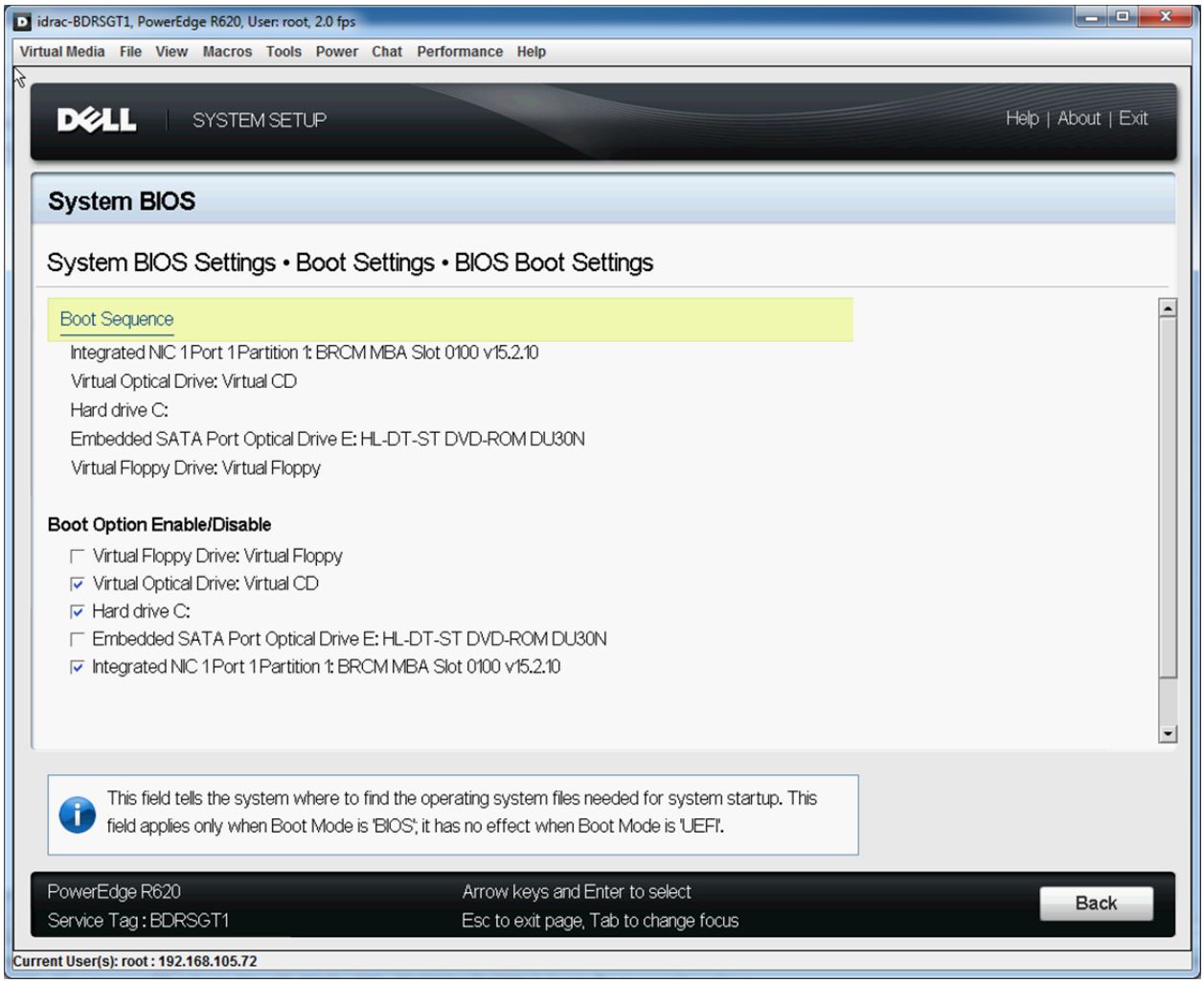

Figure 15 BIOS Boot Settings for Broadcom BCM5720

1. Select **Boot Sequence** and set **Integrated NIC 1 Port 1 Partition 1: BRCM MBA Slot 0100 v15.2.10** as the first boot device.
2. Set the second boot device as the device providing the installation media. For example, DVD, iDRAC virtual optical drive, or PXE-enabled NIC.
3. Press **[Esc]** until the **System Setup Main Menu** is reached. If prompted to save, choose to do so.

When using the onboard Broadcom BMC5720 as the iSCSI initiator, it is necessary to disable the iSCSI boot for a single boot only. Otherwise, the BIOS will attempt to boot to the empty iSCSI target (which at this point has no operating system boot partition) and fail to boot to the RHEL 6.2 installation media.

4. Select **Device Settings**.
5. Select **Integrated NIC 1Port 1: Broadcom Gigabit Ethernet BCM5720**.
6. Select **iSCSI Boot Configuration Menu**.
7. Select **iSCSI General Parameters**.
8. To prevent a failed boot to the empty iSCSI target volume, set **Boot to iSCSI Target** to **One Time Disabled**
9. Return to the **iSCSI Boot Configuration Menu**.
10. Return to the **Main Configuration Page**.
11. Press [**Esc**] until the **Device Settings**, choosing to save the settings when prompted.
12. Press [**Esc**] until the **USC** is reached.
13. Make sure the RHEL 6.2 installation media is available in the device configured as the second BIOS boot device.
14. Press [**Esc**] and choose to reboot the host. The iSCSI initiator should connect to the iSCSI target prior to booting from the device providing the RHEL 6.2 installation media.

2.3.2 Configuring BIOS boot settings for Intel NIC

The following section provides the steps for configuring the BIOS to iSCSI boot using the add-in Intel i350-t network adapter.

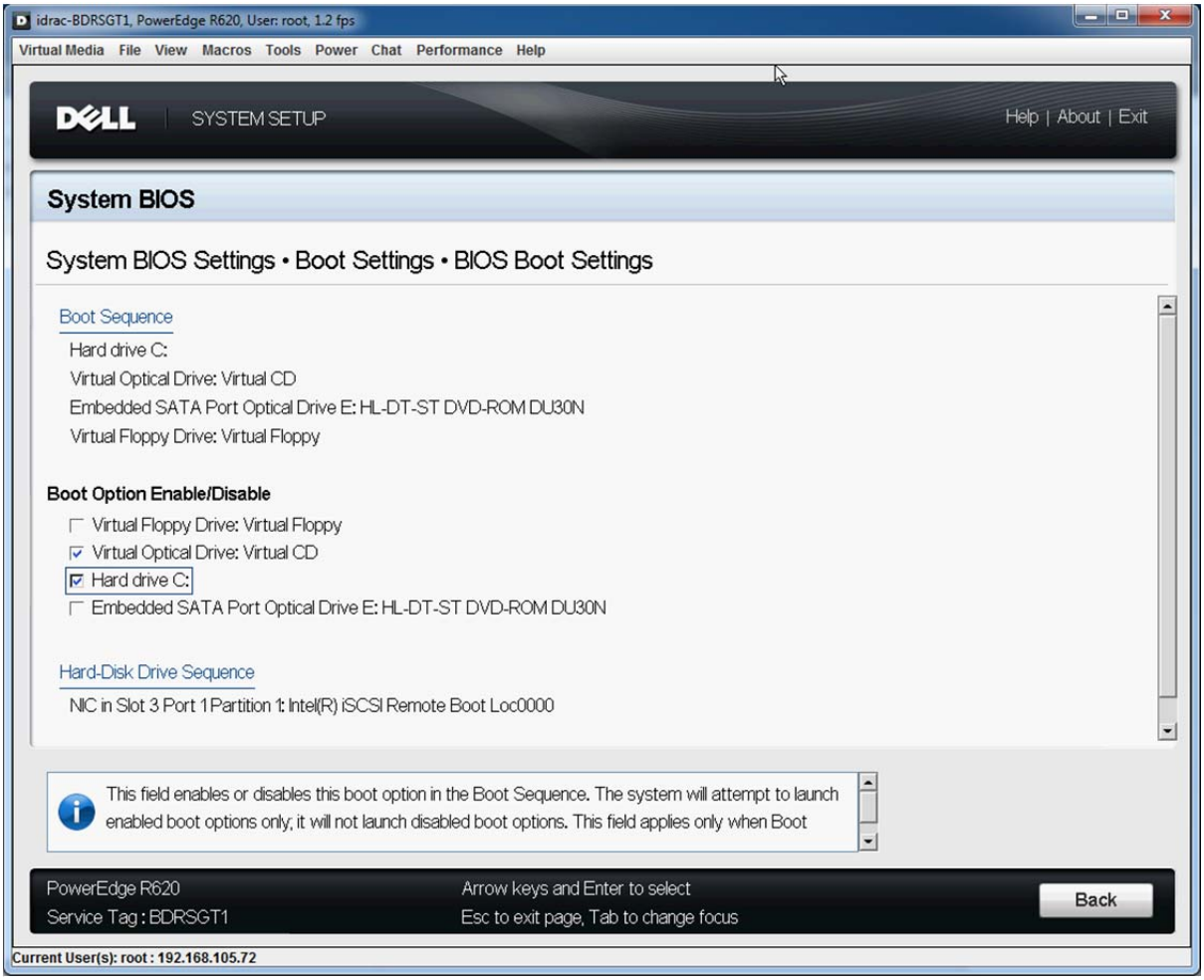

Figure 16 BIOS Boot Settings for Intel i350-t

1. Select **Hard-Disk Drive Sequence**.
2. Set **NIC in Slot X Port 1 Partition 1: Intel(R) iSCSI Remote Boot** ahead of the integrated storage controller.
3. Select **Boot Sequence**.
4. Set **Hard drive C:** as the first boot device.
5. Set the second boot device as the device providing the installation media. For example, DVD, iDRAC virtual optical drive, or PXE-enabled NIC.
6. Press [**Esc**] until the **USC** is displayed.
7. Make sure the RHEL 6.2 installation media is available in the device configured as the second BIOS boot device.
8. Press [**Esc**] and choose to reboot the host. The iSCSI initiator should connect to the iSCSI target prior to booting from the device providing the RHEL 6.2 installation media.

2.4 Install RHEL 6.2 to EqualLogic iSCSI volume

The following steps explain the process for installing RHEL 6.2 to the iSCSI target volume.

1. During the BIOS POST, confirm that the network adapter configured as the iSCSI initiator is connecting to the iSCSI target volume.

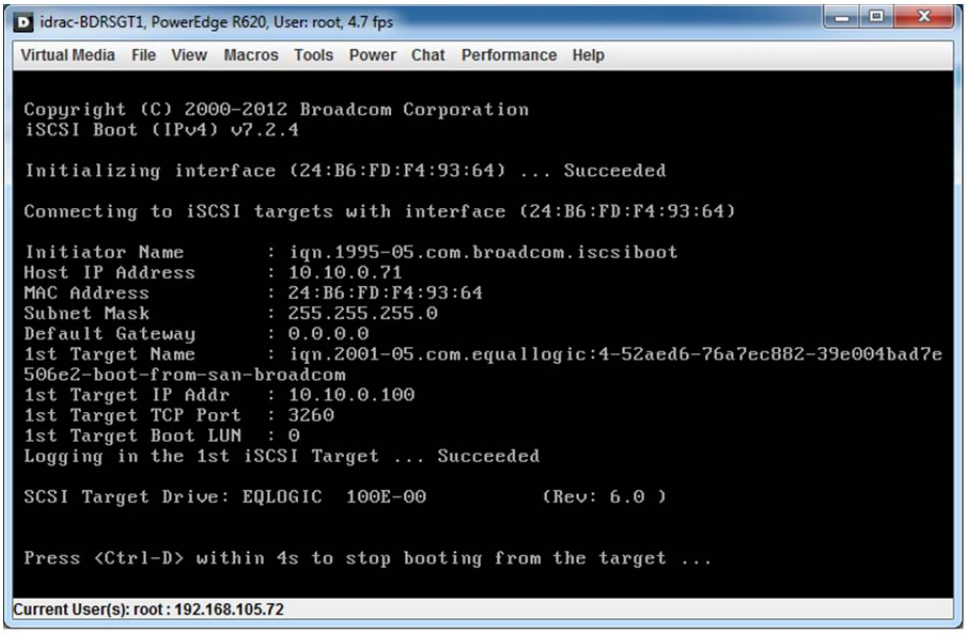

Figure 17 The Broadcom 5720 option ROM connecting to the iSCSI target volume during BIOS POST

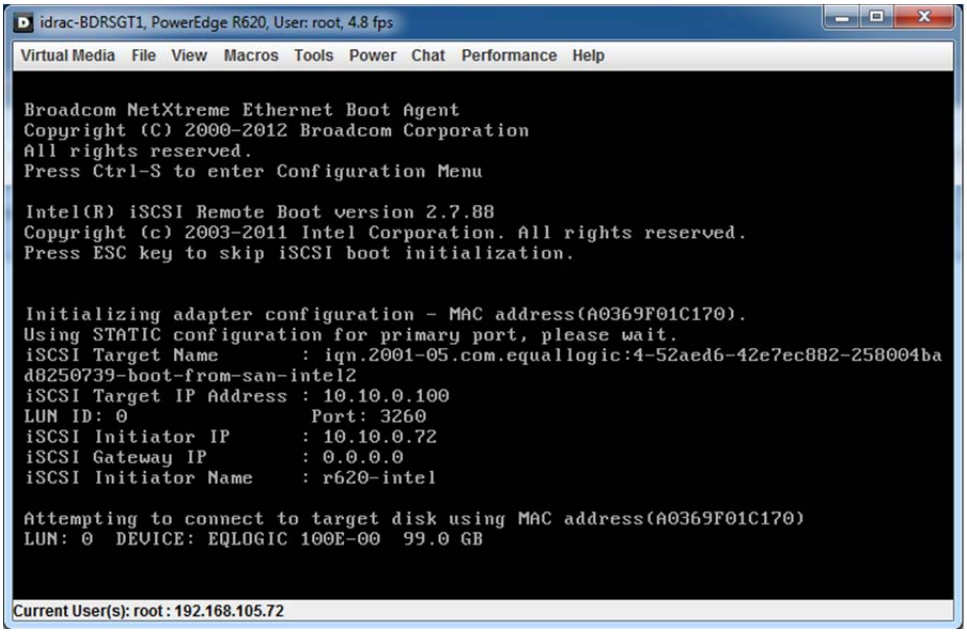

Figure 18 The Intel i350-t option ROM connecting to the iSCSI target volume during BIOS POST

1. Once the host boots to the second boot device and loads the RHEL 6.2 installation media, follow the default RHEL 6.2 installer options; including the selection of **Basic Storage Devices**.

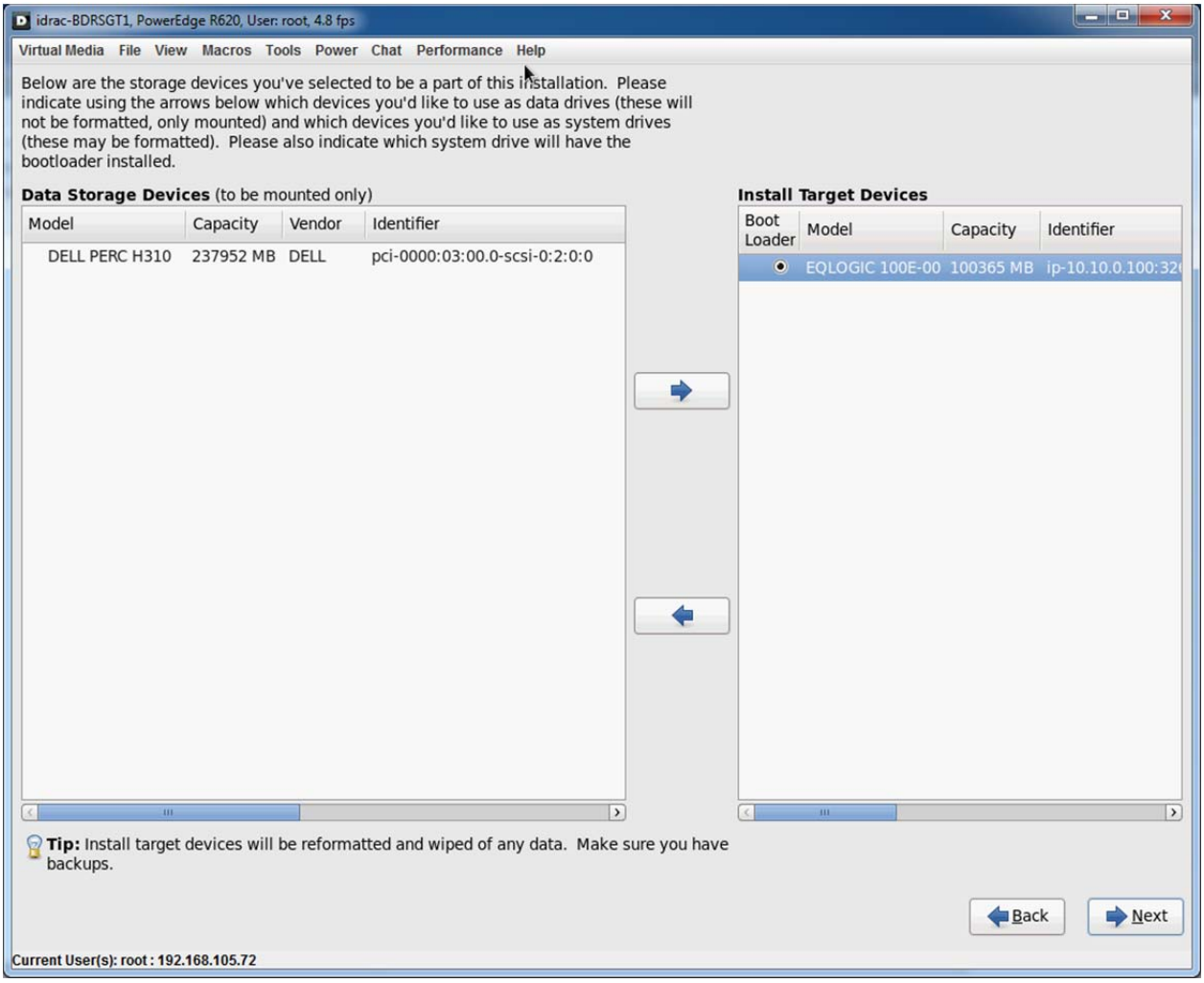

Figure 19 RHEL 6.2 installer Storage Devices menu

2. Since the host already has a connection to the boot from SAN volume using the Broadcom or Intel network adapter boot firmware, the RHEL 6.2 installer will find the target in the iSCSI BIOS Firmware Table (iBFT) residing in the system memory and make it available as an installation target device. Choose the EqualLogic volume as the installation target device and select the local storage for mounting only.
3. Complete installation as desired. Note that the RHEL 6.2 installer will obtain the IP address of the network adapter used to connect to the iSCSI target volume from the iBFT and assign it to the same network interface within the OS.
4. Restart the server.
5. Assign additional network adapters to the SAN subnet as desired.

2.5 Install Host Integration Tools for Linux

The following steps provide instructions for installing Host Integration Tools (HIT) for Linux to manage multiple paths to subsequently connected iSCSI volumes. HIT for Linux actively manages iSCSI volume sessions and load balances across host SAN ports.

1. Download **equallogic-host-tools-1.1.0-1.iso** from https://support.dell.com/equallogic/.
2. Burn the ISO file to a CD or use the iDRAC virtual optical drive to mount the ISO file within Linux.
3. From the root of the file system provided by the ISO image, run **./install** from a Linux shell as a root-level user.
4. Follow the instructions.
   When running **ehcmcli status** from another Linux shell as prompted, an error is reported stating that for the iSCSI SAN target volume used to boot from the SAN, the top-tier device is already in use. This is expected because the volume is acting as the root file system for Linux. For this reason, Host Integration Tools does not support MPIO on a boot from SAN volume and MPIO should be explicitly disabled for that volume only.

5. To disable MPIO for the boot from SAN volume, add the following two lines to the end of **/etc/equallogic/eql.conf** where <volume-name> is the volume name of the bootable volume as reported by **ehcmcli status**.
   ```
   [MPIO Volume Params <volume-name>]

   EnableMPIO = false
   ```

6. Complete HIT install, MPIO will be managed by HIT for any other iSCSI target volumes.

Additional resources

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

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.

Referenced or recommended Dell publications:

- Dell EqualLogic PS Series Network Performance Guidelines: http://www.equallogic.com/resourcecenter/assetview.aspx?id=5229

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

- http://dell.to/sM4hJT

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