Red Hat Enterprise Linux 6 or 7 Host Configuration and Backup with Auto-Snapshot Manager

Rapid EqualLogic Configuration Series
Implementation Guide

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Revisions

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1 **Scope**

This document explains the key configuration steps performed on a Red Hat Linux host that is being deployed in a Dell Storage PS Series iSCSI SAN. This document is one part of a complete installation guide series from the Rapid EqualLogic Configuration Portal. Please make sure that you have the complete set of documents for your configuration before proceeding.

Full link to document site:

http://en.community.dell.com/techcenter/storage/w/wiki/3615.rapid-equallogic-configuration-portal

2 **NIC device driver update and installation**

Use the following procedures to update drivers on Red Hat® Enterprise Linux® (RHEL) 6 or 7 hosts.

- Follow the steps in section 2.1 to connect to an Intel® 1G or 10G NIC.
- Follow the steps in section 2.2 to connect to Broadcom® NICs.

2.1 **Intel NICs**

1. Go to [http://support.dell.com](http://support.dell.com).
2. Enter the server service tag and click ‘Submit’. If service tag is unavailable, browse the product category to find the server model.
3. Next, click the **Drivers & downloads** tab.
4. Click the **Change OS** option to select either **Red Hat Ent Linux 6** or **Red Hat Ent Linux 7** to view downloads specific to that OS version.
5. In the **Refine Your Results** window, select **Network** as the **Category**.
6. Expand the available files by clicking the Network link.
7. Click the view details link next to the most recent version of the Intel NIC Family Version 17.5.0 Linux Base Drivers – RPM Install package title to open the Driver Details page.
8. To install the driver, follow the Installation Instructions listed in the Driver Details page for the selected download on the Dell support site.

Note: This package includes several Intel drivers, such as igb and ixgbe. The Version mentioned in these instructions corresponds to the package version. Do not confuse it with a specific driver version. To check a specific driver version, check the Driver Details page or extract the files from the package using the following command:

tar -xzvf <package name>

Example:
tar -xzvf Intel_LAN_17.5.0_Linux_Binary_RPMs_A00.tar.gz

2.2 Broadcom NICs

2. Enter the server service tag. If unavailable, browse the product category to find the server model.
3. Next, click on the Drivers & downloads tab.
4. Click the Change OS option to select either Red Hat Ent Linux 6 or Red Hat Ent Linux 7 to view downloads specific to that OS version.
5. In the Refine Your Results window, select Network as the Category.
6. Expand the available files by clicking the **Network (68 files)** link.
7. Click the most recent version of the **QLogic Linux Binary Drivers for QLogic Fibre Channel, QLogic 82xx, QLogic BCM 57xx/57xxx and QLogic 45xxx series of adapters** title to open the **Driver Details** page.
8. To install the driver, follow the **Installation Instructions** listed in the **Driver Details** page for the selected download on the Dell support site.

On February 18, 2014, Broadcom and QLogic entered into an ASIC partnership agreement around certain Ethernet Controller-related assets. On the Dell support website, related drivers, firmware, and documentation after this partnership can be recognized by the presence of “QLogic BCM57xx and BCM57xxx” in the download title. For more information, see the **Dell Support Knowledge Base article** concerning this partnership agreement.

**Note:** This package includes several Broadcom drivers for multiple adapters separated by folder names; such as for **E3** for QLogic BCM 57xx and 578xx adapters, **E4** for QLogic FastLinQ 45xxx 25G adapters and **QC** for Fibre Channel and 82xx adapters. The **Version** mentioned in these instructions corresponds to the package version. Do not confuse it with a specific driver version. To check a specific driver version, check the **Driver Details** or extract the files from the package using the following command:

```
tar -xzvf <package name>
```

### 3 Dell EqualLogic Host Integration Tools for Linux

The Dell EqualLogic Host Integration Tools for Linux (HIT/Linux) provide a collection of applications and utilities to simplify the configuration and administration of Dell Storage PS Series arrays.

HIT/Linux is packaged as an ISO image with the file name **equallogic-host-tools-version.iso**. This image contains all necessary user- and kernel-mode RPM files and an installation script for specific Linux distributions.

The instructions included in this document cover both RHEL 6 or RHEL 7 environments. When necessary, specific CLI (Command Line Interface) differences between RHEL versions will be addressed.

#### 3.1 Downloading EqualLogic Host Integration Tools for Linux

A Dell EqualLogic Customer Support account is required to obtain the installation kit from the EqualLogic customer support web site. Set up an account at [https://support.dell.com/equallogic](https://support.dell.com/equallogic).

Use the support account to obtain the installation kit as follows:

1. Log into your account at [https://eqlsupport.dell.com](https://eqlsupport.dell.com).
2. Click **Downloads** in the navigation bar and select **Host Integration Tools for Linux**.
3. Click the latest revision of the toolkit to display the Web page for that revision.
4. Click the download link for the current software and accept the terms and conditions of the Dell End User License Agreement (EULA).
5. Save the ISO installation image and public GPG key to a temporary, local location. The installation requires a public key to authorize the RPM signature and run the installation.

6. Import the downloaded GPG key using the following command:
   \[
   \text{# rpm --import file-name}
   \]
   **Example:**
   \[
   \text{# rpm --import RPM-GPG-KEY-DELLQL}
   \]

**Note:** The *Dell EqualLogic Host Integration Tools for Linux Installation and User's Guide* is also included in this package. It includes a complete reference about HIT/Linux.
3.2 Before installing the HIT/Linux kit

1. Be sure the iscsi-initiator-utils.version.rpm package is installed.
   a. Use the following command to check if the iscsi-initiator-utils package is installed:
      ```
      # rpm -qa | grep -i iscsi-initiator-utils
      ```
   b. If no results are returned the iscsi-initiator-utils package is not installed. Use the following command to install the iscsi-initiator-utils package:
      ```
      # yum install iscsi-initiator-utils -y
      ```

2. Configure the NICS to be used for SAN connectivity with IP addresses, netmask, and gateway.

3. Frame size (MTU) needs to be set to Jumbo frames (9000) for each NIC on the host that will be connected to the SAN with the following instructions.
   a. Edit the /etc/sysconfig/network-scripts/ifcfg-nic file
      Example using p1p1 NIC and Vim text editor (any text editor of your choice can be used):
      ```
      # vi /etc/sysconfig/network-scripts/ifcfg-p1p1
      ```
   b. Add the MTU settings.
      ```
      MTU=9000
      ```
   c. Save and close the file.

   Note: The MTU (Jumbo Frame) size must be configured with the same value on each port in the Ethernet switch configuration, any additional NIC on the host that will be connected to the SAN as well as the Dell Storage PS Series array. If the MTU size in all three components (storage, switch and host) do not match, anomalous behavior can occur within the SAN.
   d. Restart the network.
      ```
      # service network restart
      ```

4. Flow Control must be set to RX=On and TX=On for every NIC that will be connected to the SAN.
   a. Check the Flow Control setting using the command `ethtool -a nic`
      Example using p1p1 NIC:
      ```
      # ethtool -a p1p1
      ```
   b. If the displayed value is set to something other than On, use the command `ethtool -A nic rx on tx on`
      Example using p1p1 NIC:
      ```
      # ethtool -A p1p1 rx on tx on
      ```
   c. Finally, to make the new settings persistent across host reboots, add the previous command to the /etc/rc.local file for each NIC on the host that will be connected to the SAN.
3.3 Installing and configuring the HIT/Linux kit

1. Mount the HIT/Linux kit ISO image. It can be done using these different methods:
   - Use the Dell PowerEdge iDRAC Virtual Media feature to map the image to the server
   - Burn the image to a CD and insert it in the server optical drive
   - Copy the image to a USB drive and insert it into one of the available server USB ports
   - Mount the ISO image file (shown in this example)

   a. The following commands, executed from within the directory containing the ISO image file, mount the ISO image file:
      
      ```
      # mkdir -p /media/iso
      # mount -o loop equallogic-host-tools-version.iso /media/iso
      ```

      After mounting the image, the following files and directories are available.

      ```
      # ls /media/iso
      ```

      EULA hit-release-notes.pdf hit-user-guide.pdf install LICENSES packages README support welcome-to-HIT.pdf

      **Note:** To simplify this guide, it is assumed that the HIT/Linux ISO image content is in the /media/iso/ directory. Replace this directory in the following commands if another directory is used (such as /media/CDROM/).

2. Run the installation script by entering the following command.

   ```
   # /media/iso/install
   ```

3. The Dell End User License Agreement is displayed; type **Accept** to continue.
4. Type **y** to install the **equallogic-host-tools** package.
5. Right after the **Install succeeded** message appears, the installation procedure invokes the script **eqlconfig** to perform the initial configuration.
6. When prompted, “Would you like ehcmd to actively manage MPIO and iSCSI sessions (Yes/No) [Yes]?” press **[Enter]**.
7. When prompted, “Choose address protocol (IPv4/IPv6) [IPv4]:” press **[Enter]** to choose IPv4, or type **IPv6** and press **[Enter]**.

   **Note:** While Dell Storage PS Series arrays support IPv6, the following example shows IPv4 configuration.

8. When prompted for a subnet list or individual NICs to use for MPIO, type the number corresponding to **Choose individual NICs** and press **[Enter]**.
9. Type the numbers of the NICs, separated by commas, to connect to the EqualLogic SAN. See the following example:
10. When prompted for the document directory where ASM (Auto-Snapshot Manager) stores Smart Copy backup documents, press [Enter] to confirm the default directory or type a custom location.

**Note:** The ASM feature of HIT/Linux is installed by default during HIT/Linux installation.

11. Next, the installation procedure invokes the script eqltune to verify that the configurable parameters conform to the Dell recommended values. After eqltune identifies critical system issues in a summary table, it repairs each category of critical issue. Press [Enter] to fix the detected errors.

12. After all of the settings have been optimized, the message, “Installation complete” is displayed.

13. Run the following to take advantage of BASH completion for most Dell EqualLogic tools.

```
# . /etc/bash_completion.d/equallogic
```

14. Once installation configuration has completed, use the ehcmcli utility to confirm adapter configuration:

```
# ehcmcli status
```

```
[root@RHEL6-BCM-CoExist ~]# ehcmcli status
Generating diagnostic data, please wait...

Adapter List

Name: pip1
IP Address: 10.10.10.108
HW addr: 00:10:18:ED:54:00

Name: pip2
IP Address: 10.10.10.109
HW addr: 00:10:18:ED:54:02

Volume list

Summary

Adapters: 2
Managed Volumes: 0
iSCSI Sessions: 0
Errors: 0
Warnings: 0
Suggestions: 0
```
The `ehcmcli` command (with status flag) shows the current status of the Dell EqualLogic Host Connection Manager daemon (ehcmd) as well as useful information such as the adapter list, volume list, number of iSCSI sessions, errors and warnings.

4 **Configure SAN switch fabric**
If you have already configured your SAN switches, continue to the next section. If not, refer to the specific instructions for configuring each switch model at the Rapid EqualLogic Configuration Portal on Dell TechCenter.

5 **Configure storage**
If you have already configured the storage array, continue to next section. If you have not completed the array configuration, follow the array configuration instructions at the Rapid EqualLogic Configuration Portal on Dell TechCenter.

6 **Accessing a PS Series group**
Once the HiT/Linux installation is complete, the `rswcli` (Dell EqualLogic Remote Setup Wizard CLI) and `ehcmcli` (Dell EqualLogic Host Connection Manager CLI) utilities will be used to configure host access to the PS Series arrays.

6.1 **Connecting to the Group:**
To configure host access to a PS Series group, use the `rswcli` utility as such:

```
# rswcli -a -gn=group name -gip=group IP address
```
Example:
```
# rswcli -a -gn=Coexistence-10GbE -gip=10.10.10.10
```
To verify the group is accessible from the host, use the `rswcli` utility as such:
```
# rswcli -l
```
Example:
6.2 Edit volume access permissions for Linux host

Three different types of access can be established to a Dell Storage PS Series SAN volume: using CHAP account information, using iSCSI initiator name, or using the initiator IP address. Each access type can be used or a combination of these methods (e.g., CHAP + iSCSI initiator name) for host access.

On the Linux host that will access a volume on the storage array, perform the following steps.

1. Review the iSCSI initiator name stored in the `/etc/iscsi/initiatorname.iscsi` file as shown in the following example.

   ```
   [root@RHEL6-BCM-CoExist ~]# rswcli -l
   Processing list-group command...
   Groups accessible from this computer:
   Group Name: Coexistence-10GbE
   Group IP Address: 10.10.10.10
   
   The list-group command succeeded.
   ```

2. If CHAP authentication is used to access the volume, edit the CHAP Setting section of the `/etc/iscsi/iscsid.conf` file.

   ```
   # vi /etc/iscsi/iscsid.conf
   ```

3. If the initiator IP address is used, use the ehcmcli utility to get the Adapter List information.

   ```
   # ehcmcli status
   ```
Perform the following steps from the Group Manager Web application.

4. If creating a **new volume**, the wizard requests access type information. Enter the CHAP authentication info, iSCSI initiator name, or initiator IP addresses to limit iSCSI access to the new volume. This example uses the iSCSI Initiator name.

![Create volume screen shot](image)

5. Select whether or not to allow simultaneous connections from initiators with different IQN names (see the previous screen shot).

6. If the volume was already created, click the volume **Access** tab and add a new **basic access point**.

**Tip**: Access Points are used to add or change initiator names, CHAP, and IP address access for existing volumes.
6.3 Accessing volumes using Multipath I/O

To access volumes using Multipath I/O (MPIO), you must discover targets (volumes) and then log into at least one iSCSI session for each volume. By default, the EqualLogic Host Connection Manager (ehcmd) service uses the software iSCSI initiator to connect to volumes.

To log into an MPIO volume, use the ehcmcli utility as such:

```
# ehcmcli login --target target_name --portal portal
```

- **target_name** indicates the full iSCSI-qualified name (IQN) or a volume name for the PS Series group target node
- **portal** indicates the iSCSI portal (group IP address).

If the entire target name is unknown, check the volume **Connections** tab in the EqualLogic Group Manager. The following EqualLogic Group Manager screen shot displays the iSCSI target used for this example.
Using the verified target name, the following example shows the **Login succeeded** message and the **Device to mount** information.

```
[root@RHEL6-BCM-CoExist ~]# ehcmcli login --target ign.2001-05.com.equallogic:0-af1ff6-07112d3db-e1c050a7ae55616c-rhel6-bcm-eql-vol01 --portal 10.10.10.10
Login succeeded. Device to mount: /dev/eql/rhel6-bcm-eql-vol01
```

After a single session is created, the EqualLogic Host Connection Manager (**ehcmd**) will analyze the configuration and create additional iSCSI sessions as appropriate. When complete, an iSCSI session is initialized for the appropriate PS Series volume, `/dev/eql/volume-name`, and the volume is available for use. All further iSCSI management by **ehcmd** is transparent to any application using `/dev/eql/volume-name`.

### 6.4 Mounting an MPIO volume

1. Confirm the name of the device to mount by running:
   ```
   # ehcmcli status
   ```

2. Look for the device to mount line.
   ```
   Device to mount: /dev/eql/volume_name
   ```

3. Build a Linux file system.
   ```
   # mkfs.ext4 /dev/eql/volume_name
   ```

4. Specify a directory and create a mount point for the new volume.
   ```
   # mkdir /mount
   # mkdir /mount/Vol01
   # mount /dev/eql/volume_name /mount/Vol01
   Example:
   # mount /dev/eql/rhel6-bcm-eql-vol01 /mount/Vol01
   ```

On completing the steps, files can be written to `/mount/Vol01`.

**Note**: PS Series storage supports partitions (for example, using **fdisk**), but Dell recommends using Linux file systems on the full volume instead of individual partitions on that volume. If you want to auto-mount a mount point on system reboot, add it to your `/etc/fstab` file. For example, to auto-mount the above:

```
/dev/eql/rhel6-bcm-eql-vol01/mount/Vol01 ext4 _netdev,defaults 0 0
```
The ASM/LE package that's bundled with the HIT/Linux installation provides the ability to create file system consistent copies of data stored within one or more PS Series storage arrays. These file system consistent copies are referred to as a Smart Copy within EqualLogic Group Manager. When creating the Smart Copy of a volume ASM/LE uses the snapshot, clone and replication features within the PS Series storage arrays. The Smart Copy process through ASM/LE can be automated at the host level to provide a higher level of data integrity and availability within the SAN through consistent, automated backups.

The following steps demonstrate a Smart Copy process using the ASMCLI utility.

1. Create Group access credentials. This is a required first step to establish group access and create cached credentials on the Linux host.

   [root@RHEL6 ~]# asmcli create group-access --name Coexistence-10GbE --ip-address 10.10.10.10 --user-name pooladmin
   Dell EqualLogic Auto-Snapshot Manager CLI Version 1.5.0
   Copyright (c) 2010-2016 Inc.
   Using Management IP 10.211.15.202 to contact Coexistence-10GbE.
   Password for user pooladmin on Coexistence-10GbE: *******
   Successfully created credentials record in file /etc/equallogic/asm-group-access.

2. Create a Smart Copy as needed. In this example, a Smart Copy of the mounted PS Series volume "/eql_vols/Vol01" is created.

   [root@RHEL6 ~]# asmcli create smart-copy --source /eql_vols/Vol01
   Dell EqualLogic Auto-Snapshot Manager CLI Version 1.5.0
   Copyright (c) 2010-2016 Inc.
   The mount point has been frozen.
   Created snapshot RHEL6-Intel-CoExist-01-2016-06-20-09:19:39.12931.1 on Coexistence-10GbE
   The mount point has been thawed.
   Successfully created a Smart Copy from 1 target.

3. Confirm the newly created Smarty Copy by using the asmcli utility to list available copies.

   [root@RHEL6 ~]# asmcli list smart-copy
   Dell EqualLogic Auto-Snapshot Manager CLI Version 1.5.0
   Copyright (c) 2010-2016 Inc.

   ==============================================================
   Smart Copies
   ==============================================================
   Source:       RHEL6-Intel-CoExist : /eql_vols/Vol01
   Snapshot:     20-Jun-2016 09:33:53.15345
   ObjectId:     7-cd5aea-794f4e0b-fbe26106d7aaac93
       RHEL6-Intel-CoExist-01 --> RHEL6-Intel-CoExist-01-2016-06-20-09:19:39.12931.1 on Coexistence-10GbE
   1 Smart Copy found.
4. Use the asmcli utility to mount the newly created Smart Copy snapshot and unmount the snapshot (“/SNAPSHOTS/” in this example).

   [root@RHEL6 ~]# mkdir /SNAPSHOTS
   [root@RHEL6 ~]# asmcli mount smart-copy --latest --destination /SNAPSHOTS/

   Dell EqualLogic Auto-Snapshot Manager CLI Version 1.5.0
   Copyright (c) 2010-2016 Inc.

   Logging in 1 Smart Copy target.
   Logged in RHEL6-Intel-CoExist-01-2016-06-20-09:19:39.12931.1 on Coexistence-10GbE
   Mounted /SNAPSHOTS/eql_vols/Vol01
   Successfully mounted 1 file system from 1 Smart Copy target.

   [root@RHEL6 ~]# asmcli unmount smart-copy --latest

   Dell EqualLogic Auto-Snapshot Manager CLI Version 1.5.0
   Copyright (c) 2010-2016 Inc.

  Unmounted /SNAPSHOTS/eql_vols/Vol01
   Removing sessions to RHEL6-Intel-CoExist-01-2016-06-20-09:19:39.12931.1 on Coexistence-10GbE
   Successfully unmounted 1 file system and logged out 1 target.

5. Use the ASMCLI command to delete the smart copy.

   [root@RHEL6 ~]# asmcli delete smart-copy --latest

   Dell EqualLogic Auto-Snapshot Manager CLI Version 1.5.0
   Copyright (c) 2010-2016 Inc.

   Deleted Smart Copy: 7-cd5ae-794f48e0b-fb26106d7aaac93
   Successfully removed the Smart Copy.

The above examples demonstrate using the asmcli utility in an interactive shell. These asmcli utility examples can be used within shell scripts for task automation as well as using the asmcli utility with host task scheduling features makes unattended creation of Smart Copies possible.

For more detailed ASM/LE CLI instructions reference the Using HIT/Linux and ASM/LE with Dell PS Series Storage document on available at Dell.com/StorageResources.