HP StorageWorks

Using the QLogic HBA driver for single-path or multi-path failover mode on Linux systems application notes
About this document

These application notes cover the following major topics:

- Intended audience
- Other documentation
- Supported hardware and software
- Installing the QLogic HBA driver
- Removing the kit components
- Using the source RPM
- Contents of hp qla2x00 and hp qla2x00src
- Fibre Channel utilities
- Downloading Red Hat Package Manager
- Using QLogic failover with different storage system types

Intended audience

This document is intended for customers who are using the QLogic Host Bus Adapter (HBA) driver.

Other documentation

In addition to these application notes, HP provides the HP StorageWorks LUN migration and persistence utilities application notes.

Additional documentation, including white papers and best practices documents, is available on the HP web site: http://www.hp.com.

New features

The following is a list of new features or support since the last release:

- Path Preference
- Auto-restore
- Coexistence with Secure Path on the same host and host bus adapter
- Support for the HP StorageWorks 4000/6000/8000 Enterprise Virtual Array
- SANsurfer GUI 4.0

Supported hardware and software

This driver kit contains all the drivers and utilities needed to set up supported HP adapters on Linux. Table 1 lists supported hardware and software.
NOTE:

Depending upon your storage array, existing Secure Path customers are eligible to transfer their path failover to the QLogic HBA driver. For more information see the HP StorageWorks LUN migration and persistence utilities application notes.

<table>
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<tr>
<th>Table 1 Supported hardware and software</th>
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<td><strong>Component</strong></td>
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<td>Linux distributions 8.xx</td>
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</tbody>
</table>

NOTE:

If an EVA4000/6000/8000 storage system resides in a storage area network (SAN), the minimum driver revisions for 2.4 kernels must be 7.05.00a and 8.00.02a for 2.6 kernels.

Installing the QLogic HBA driver

You can download the new driver from the HP HBA web site:


The QLogic HBA driver kit contains the following components:
• Source code Red Hat Package Manager (RPM) for QLA 7.xx driver \( (\text{hp}_\text{qla2x00src}) \)
• Source code RPM for QLA 8.xx driver \( (\text{hp}_\text{qla2x00src}) \)
• Source RPM for QLA 7.xx driver \( (\text{hp}_\text{qla2x00}) \)
• Source RPM for QLA 8.xx driver \( (\text{hp}_\text{qla2x00}) \)
• Fibre Channel utilities for x86 architectures (fibreutils, i386)
• Fibre Channel utilities for x86_64 architectures (fibreutils, x86_64)
• Fibre Channel utilities for ia64 architectures (fibreutils, ia64)
• Kernel-specific driver parameter configuration scripts are as follows:
  • For 2.4 kernels (set_parm.24)
  • For 2.6 kernels (set_parm.26)
• Master installation script \( (\text{INSTALL}) \)

You can install this driver kit using one of the following methods:

**Setting up driver parameters**

Before you install the driver, set up the driver mode with the `set_parm.xx` for your kernel type script that comes with the driver kit. Refer to Changing Driver Parameters for a list of modes and switches.

**Using the scripted installation**

**NOTE:**
You will need to install the GNU Compiler Collection `gcc` and the kernel sources to use the scripted installation.

The `INSTALL` script installs the `hp_qla2x00src` RPM and the `fibreutils` RPM for the x86, x86_64, or ia64 architecture. The `INSTALL` script handles the following pre-existing system configuration conditions:

• No previous driver or platform kit installed
• Configuration was installed with a previous `hp_qla2x00src` RPM
• Configuration was installed with a previous platform kit that includes the `qla2x00` binary RPM

The default `INSTALL` command with no switches, installs the driver in either failover or non-failover mode depending upon the mode of the currently installed driver. The following command is an example of the `INSTALL` command for single path-mode:

```
# ./INSTALL
```

If you want to install the driver in multipath failover mode, use the `-f` switch with the `INSTALL` command. For example:

```
# ./INSTALL -f
```

The following command line switches for the `INSTALL` script are also available:

• Compile and install the driver for all installed kernels using the `-a` switch
• Skip third party storage detection using the `-F` switch. The driver RPMs search all devices attached to FC HBAs (using `/proc/scsi/scsi`) and if any devices have vendor IDs other than DEC, COMPAQ or HP, the RPM installation fails. The `-F` switch overrides that behavior.
Using the manual installation

You can install the driver manually using the **RPM** command for installing the individual RPM packages.

- **To install the driver package and the fibreutils package,** enter the following commands:
  ```
  # rpm -ivh hp_qla2x00src-version-revision.noarch.rpm
  # rpm -ivh fibreutils-version-revision.architecture.rpm
  ```

- **To install the hp_qla2x00src RPM without running the driver build scripts,** enter the following commands:
  ```
  # rpm -ivh --noscripts hp_qla2x00src-version-revision.noarch.rpm
  ```

- **If you need to manually upgrade the RPMs,** enter the following commands:
  ```
  # rpm -ivh hp_qla2x00src-version-revision.noarch.rpm
  # rpm -ivh fibreutils-version-revision.architecture.rpm
  ```

**NOTE:**

If you have a **qla2x00** RPM from HP installed on your system, use the **INSTALL** script. The **INSTALL** script removes the old **qla2x00** RPM and installs the new **hp_qla2x00src** while retaining the driver settings from the previous installation.

If you have a previous version of the **qla2x00** RPM and Secure Path installed and you plan to migrate to the QLogic failover solution, you must uninstall Secure Path and reboot first. Failure to do so can cause a kernel panic.

Removing the kit components

To remove the driver kit components, use the **INSTALL** script with the **-u** option:

```
# ./INSTALL -u
```

If you want to manually remove all the components, choose all of the three following commands. If you want to remove just one of the components, choose the appropriate command:

```
# rpm -e fibreutils
# rpm -e hp_qla2x00
# rpm -e hp_qla2x00src
```

Using the source RPM

In some cases, you may have to build a binary RPM (**hp_qla2x00**) from the source RPM and use that in place of the scripted RPM (**hp_qla2x00src**). You need to do this if the production servers do not have your kernel sources and **gcc** installed.

If you need to build a binary RPM to install, use a development machine with the same kernel as the production servers that you are targeting. Then, install the binary RPM produced using the usual **rpm** methods on your production servers.

**NOTE:**

The binary RPM that you build works only for the kernel and configuration that you build it on (and possibly some errata kernels).

Use the following steps to create the binary RPM from the source RPM:
1. Select one of the following options:
   a. Enter the following command to automatically build a binary RPM:
      ```
      # ./INSTALL -s
      ```
      **NOTE:**
      If you use `./INSTALL -s`, you do not need to perform Step 2 through Step 4.
   b. Enter the following command to install the source RPM:
      ```
      # rpm -ivh hp_qla2x00-version-revision.src.rpm
      ```

2. Select one of the following options, depending upon your Linux distribution:
   - Use the following command for Red Hat Linux:
     ```
     # cd /usr/src/redhat/SPECS
     ```
   - Use the following command for SuSE Linux:
     ```
     # cd /usr/src/packages/SPECS
     ```

3. Build the RPM by executing the following `rpmbuild` command:
   ```
   # rpmbuild -bb hp_qla2x00.spec
   ```
   **NOTE:**
   In some older distributions, the `rpm` command contains RPM build functionality.

   At the end of the command output, the following sample output line is displayed:
   ```
   Wrote: ...rpm.
   ```
   In between `Wrote` and `rpm`, the location of binary RPM is displayed.

4. Copy the binary RPM to the production servers and install it using the following command:
   ```
   # rpm -ivh hp_qla2x00-version-revision.architecture.rpm
   ```
Contents of hp_qla2x00 and hp_qla2x00src

The hp_qla2x00 and hp_qla2x00src RPMs contain the following scripts in the /opt/hp/hp_qla2x00 or /opt/hp/src/hp_qla2x00src directories.

### Table 2 RPM scripts

<table>
<thead>
<tr>
<th>Script name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>condition_kernel</td>
<td>Sets the kernel source dependencies to reflect the current running kernel or the specified kernel.</td>
</tr>
<tr>
<td>* build_driver</td>
<td>Builds the QLA driver from source code.</td>
</tr>
<tr>
<td>edit_conf</td>
<td>Makes the proper edits to system configuration files to imbed the qla2200 and qla2300 modules in the initrd with the proper driver load time parameters.</td>
</tr>
<tr>
<td>make_initrd</td>
<td>Builds a new initrd using the correct system utilities.</td>
</tr>
<tr>
<td>set_parm</td>
<td>Sets up the /etc/hp_qla2x00.conf file so that it has the correct driver settings based upon the configuration that the user wants to run; it then rebuilds the initrd.</td>
</tr>
<tr>
<td>* master.sh</td>
<td>Runs the condition_kernel, build_driver, edit_conf and make_initrd utilities. Useful for compiling a new driver when a new kernel is loaded.</td>
</tr>
<tr>
<td>*compile_all_kernels</td>
<td>Runs master.sh for all installed kernels.</td>
</tr>
<tr>
<td>scsi_patch_sles9.bin</td>
<td>(For use with SLES 9 only) Corrects the HSV110 entry in the scsi_devinfo.c file. It also recompiles scsi_mod.ko and creates a new initrd.</td>
</tr>
</tbody>
</table>

**NOTE:**
Table 2 Script names containing an asterisk (*) are available only in the hp_qla2x00src RPM.

### Using master.sh

You can compile new modules using master.sh even after the hp_qla2x00src RPM has been installed. This is especially useful when you install a new errata kernel, as that errata kernel may not have the latest supported HP driver. To compile a new driver for the current kernel, enter the following command:

```
# hp_compile_qldriver
```

**NOTE:**
The hp_compile_qldriver file is a symbolic link to master.sh.
If you have just installed a new kernel, perform the following steps:

1. Change the directory to /opt/hp/src/hp_qla2x00src.
2. Execute the following command to display a list of valid module and source directories:
   ```bash```
   ./master.sh -l
   ```bash```
3. Select the set of directories that match your new kernel and enter them with the `-s` and `-m` switches of the `master.sh` script. For example:
   ```bash```
   master.sh -s linux-2.4.21-9.EL -m linux-2.4.21-9.ELsmp
   ```bash```

   The script automatically completes the rest of the compilation.

Getting information on the QLA SDM/HBAAPI libraries

The `hp_qla2x00src` and `hp_qla2x00` RPMs contain the QLA SDM libraries (`libqlsdm`) for x86(i386) and ia64 architectures. This library is located in `/usr/lib` as `libqlsdm.so`. There is also a readme file that comes with the library; the file is located in `/opt/hp/src/hp_qla2x00src` or `/opt/hp/hp_qla2x00` and is named `readme.libqlsdm`.

Changing driver parameters

HP changes the following four parameter values from the default values in the NVRAM of the QLogic adapters.

- Port Down Retry Count (`qlport_down_retry`)
- Login Retry Count (`qlogin_retry_count`)
- Queue Depth (`ql2xmaxqdepth`)
- Failover (`ql2xfailover`)
- Load Balancing Type (`ql2xlbType`)
- Exclude Model (`ql2xexcludemodel`)

The following sections describe the driver parameters and the values set on each parameter.

**Port Down Retry Count**

The Port Down Retry Count (`qlport_down_retry`) parameter sets the number of retries that the driver attempts when a port communicates a port down status. Depending upon your configuration, ensure that the values are set to the following:

- Single Path: 64
- Secure Path: 1
- For QLogic failover mode, the value depends on your kernel. Kernel values are as follows:
  - For 7.x: 3
  - For 8.x: 30

**Login Retry Count**

This Login Retry Count (`qlogin_retry_count`) parameter sets the number of logins the driver attempts before declaring the port down. Ensure that this value is set to one of the following parameters:

- For 7.x: 16
- For 8.x: 30
Queue Depth

This value sets the length of the command queue for each LUN attached to the QLogic adapter. This LUN command queue value can be anything from 1 to 256. However, you must not set this value high enough so that you saturate the storage that you are connected to. HP sets the default value of this parameter to 16.

Failover

The ql2xfailover value turns the failover functionality of the QLogic driver on or off. A value of 0 disables it and a value of 1 enables it.

The following parameters are set automatically by choosing one of the failover modes:

- **Static Load Balancing (ql2xlbType)**
  This parameter will make the driver attempt to distribute LUNs evenly across known active paths. This parameter only works in failover mode with active-active arrays.

- **Exlude Device (ql2xexcludedevice)**
  When the driver is in failover mode, this parameter forces the driver to export particular devices as non-failover devices. Used only when Secure Path is installed.

These values reside in a file called `/etc/hp_qla2x00.conf`. HP recommends that you do not edit this file directly, but use the `set_parm` script. If you want to edit these values manually in the `/etc/hp_qla2x00.conf` file, you will have to run the `edit_conf` and `make_initrd` scripts after you do so or else your new values will not take effect.

You can change the parameters of the driver using the `set_parm` script in either the `/opt/hp/src/hp_qla2x00src` directory or the `/opt/hp/hp_qla2x00` directory depending upon which RPM you have installed. Table 3 describes the predetermined settings.

<table>
<thead>
<tr>
<th>Parameter setting type</th>
<th>Switch</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Path</td>
<td>-s</td>
<td>Connect through one path to the storage without any redundancy.</td>
</tr>
<tr>
<td>Secure Path</td>
<td>-m</td>
<td>Using the Secure Path software for multipathing and failover.</td>
</tr>
<tr>
<td>QLogic Failover</td>
<td>-x</td>
<td>Using multipathing and failover functionality built into the qla2x00 adapter driver.</td>
</tr>
<tr>
<td>QLogic Failover</td>
<td></td>
<td>Using multipathing and failover functionality built into the qla2x00 adapter driver.</td>
</tr>
</tbody>
</table>

You can also manually set the driver parameters if you invoke `set_parm` with no arguments and select the **manual** option from the menu.

**NOTE:**

If you changed the driver parameters, a new `initrd` has to be build. This is done by the `set_parm` script calling the `edit_conf` and `make_initrd` scripts.
Fibre Channel utilities

The fibreutils RPM contains assorted utilities that complement the hp_qla2x00src driver package.

Installing and removing the fibreutils RPM

The fibreutils RPM is installed during the normal installation procedure. The fibreutils RPM can also be installed by copying the .rpm file to your system by entering the following command:

```
# rpm -ivh fibreutils-version-revision.arch.rpm
```

To remove the fibreutils package, enter the following command:

```
# rpm -e fibreutils
```

Table 4 describes the default utilities that are installed with fibreutils RPM.

<table>
<thead>
<tr>
<th>Utility</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lssd</td>
<td>Lists /dev/sd disks on your system.</td>
</tr>
<tr>
<td>adapter_info</td>
<td>Lists information for HP-supported adapters on the system. Use the -h command to display a list of options.</td>
</tr>
<tr>
<td>hp_rescan</td>
<td>Dynamically rescans for new devices on the SAN.</td>
</tr>
<tr>
<td>probe-luns</td>
<td>Forces the SCSI mid-layer to rescan for LUNs. The probe-luns utility is used in conjunction with the hp_rescan utility.</td>
</tr>
<tr>
<td>scsi_unfo</td>
<td>Lists inquiry information for a /dev/sd device.</td>
</tr>
<tr>
<td>hp_system_info</td>
<td>Gathers system and installation information about the server that it is executed upon. Once the information is gathered, it is put together into a compressed tar file called system_info.tar.gz.</td>
</tr>
<tr>
<td>lssg</td>
<td>Lists all sg* devices with instance, channel, bus, and LUN information as well as SCSI product ID, firmware level, and FC port WWID information.</td>
</tr>
</tbody>
</table>

EFI driver and utilities

The latest supported version of the Extensible Firmware Interface (EFI) driver, HBA firmware, and EFI configuration utility for the A6826A adapter are included with the ia64 fibreutils RPM. Refer to the qlefireadme.txt in the /boot/efi.../qla2x00 directory for more information. The user’s guide for efiutil can be found in PDF format in /opt/hp/hp_fibreutils.

Downloading and Installing Red Hat Package Manager

The following bullets list RPMs that you can download depending upon your Linux architecture:

- For x86 and EM64T Proliant servers, use the i386 version
- For AMD64 Proliant servers, use the x86_64 version
- For Itanium Integrity servers, use the ia64 version

Once you have downloaded the appropriate RPM, install it using the following command:
Persistence binding notes

You will need to rebuild the initrd when you make a persistent binding change. This is because a new qla2300_conf.o (for 2.4 kernels) or qla2xxx_conf.ko (for 2.6 kernels) is built. These rebuilt modules need to be in the initrd for the QLogic driver to access them during boot. Rebuilding the initrd solves this issue. If you are using the hp_qla2x00src RPM, you can use the /opt/hp/src/hp_qla2x00src/make_initrd script to do this.

With Linux, you can only select targets to persistently bind to HP XP and VA storage arrays through a drop-down menu. Enterprise Virtual Arrays and MSAXxx storage systems are automatically bound to a particular target number and do not allow you to select the target ID through a drop-down menu. You must use the automatically assigned target numbers for persistence through reboots.

Using QLogic failover with different storage system types

The following sections indicate specific storage system procedures you may need to follow when using QLogic failover depending upon your storage system type.

Using QLogic Failover with Enterprise Virtual Array storage system

If you are using the built-in failover functionality of the QLogic driver (version 7.00.03 or later) set the failover preference to Path A Failover or Path B Failover in the Management Appliance host settings. Failure to do so can cause I/O errors when a failover occurs.

NOTE:
The host mode must be set to Sun Solaris. Failure to do so can result in discovery errors.

Using QLogic Failover with MSA1000

If you are using the built-in failover functionality of the QLogic driver (version 7.00.03 or later), set the host mode to Linux. Failure to do so can cause I/O errors when a failover occurs.

HSG80 storage systems

The failover mode of the QLogic driver is not supported on HSG80 controller-based storage.

Avoiding problem situations

The following sections address problem situations and how to avoid them.

Coexistence with other multipathing products

This section addresses adding new EVA4000/6000/8000 LUNs to a host which also presents LUNs to a legacy storage system managed by Secure Path.

Use the following procedure to update to the new QLogic driver and Utilities that support EVA4000/6000/8000: run /opt/hp/src/hp_qla2x00src/set_parm to setup driver parameters, Select option 4, change Failover to 1, Export models to 6, Answer Yes to Create a new initrd.

1. Enter /opt/hp/src/hp_qla2x00src/set_parm to setup the driver parameters.
2. Select option 2 Secure Path. Enter No to create a new initrd.
3. Enter 1 in option 4 Failover.
4. Export models to 6, Answer Yes to create a new initrd.
5. Select option 5 quit
6. Enter /opt/hp/hp_fibreutils/pbl/pbl_inst.sh -i for the 2.4 kernels SCSI blacklist that does not include the HSV 2x0 arrays. This step is needed for EVA XL LUN discovery to occur on system boot.
7. Reboot the system, and verify that Secure Path operations are working.
8. Add your EVA4000/6000/8000 storage system selection to the SAN.

**NOTE:**
In order for all LUNs to be listed in sequential order, your EVA4000/6000/8000 storage system selection must be placed in front of the lower switch port numbers of the legacy storage system managed by Secure Path.

9. Reboot the system, and verify that the QLogic and Secure Path LUNs are present and accessible.

**NOTE:**
Running hp_rescan and probe-luns is not supported when Secure Path is loaded. For discovering newly added devices, reboot the system.

**Troubleshooting HSV210 devices on Linux operating system distributions**

As of the release of this document, the blacklist or HSV210 device list entries needed by the SCSI midlayer of the Linux kernel do not exist. Blacklist or device list entries can cause Linux not to be able to see these devices during system boot. If you are having trouble seeing these devices, run the /opt/hp/hp_fibreutils/probe-luns script during system boot to see these devices. The following distributions may need to have probe-luns run during system boot:

- Red Hat Enterprise Linux 2.1
- Red Hat Enterprise Linux 3
- Red Hat Enterprise Linux 4

If you need to start probe-luns at system boot, the appropriate code can be installed with the pbl_inst.sh script in the /opt/hp/hp_fibreutils/pbl directory. Use the following procedure to start probe-luns.

1. Enter the following commands to install prob-luns startup code:
   ```
   # cd /opt/hp/hp_fibreutils/pbl
   # ./pbl_inst.sh -i
   ```

2. Enter the following commands to remove prob-luns startup code:
   ```
   # cd /opt/hp/hp_fibreutils/pbl
   # ./pbl_inst.sh -u
   ```

**NOTE:**
If you are not having issues seeing your devices, do not run probe-luns at system boot!