

HP 3PAR HP-UX 11i v2 and v3 Implementation Guide

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1 Introduction

This implementation guide provides the information you need to configure an HP 3PAR Storage System with HP-UX 11i v2 or v3. General information is also provided on the basic steps required to allocate storage on the HP 3PAR Storage System that can then be accessed by the HP-UX host.

The information contained in this implementation guide is the outcome of careful testing of the HP 3PAR Storage System with as many representative hardware and software configurations as possible.

REQUIRED

For predictable performance and results with your HP 3PAR Storage System, the information in this guide must be used in concert with the documentation set provided by HP for the HP 3PAR Storage System and the documentation provided by the vendor for their respective products.

Supported Configurations

Fibre Channel connections are supported between the HP 3PAR Storage System and HP-UX host server.

For complete details on supported host configurations, consult the *HP 3PAR InForm OS Configuration Matrix*, which is available on HP's Business Support Center (BSC).

To obtain a copy of this documentation, go to <http://www.hp.com/go/3par/>, navigate to your product page, click **HP Support & Drivers**, and then click **Manuals**.

InForm OS Upgrade Considerations

Refer to the *InForm OS Upgrade Pre-Planning Guide* for information and planning of an online HP 3PAR InForm Operating System upgrade.

Audience

This implementation guide is intended for system and storage administrators who monitor and direct system configurations and resource allocation for HP 3PAR Storage Systems. The tasks described in this manual assume that the administrator is familiar with HP-UX 11i v2 or v3 and the HP 3PAR InForm OS. Although this guide attempts to provide the basic information that is required to establish communications between the HP 3PAR Storage System and the HP-UX host, and to allocate the required storage for a given configuration, the appropriate HP 3PAR documentation must be consulted in conjunction with the HP-UX host and HBA vendor documentation for specific details and procedures.

NOTE: This implementation guide does NOT intend to reproduce any third-party product documentation. For details about devices such as host servers, HBAs, fabric and Ethernet switches, and non-HP 3PAR software management tools, consult the appropriate third-party documentation.

Related Documentation

The following documents also provide information related to HP 3PAR Storage Systems and the InForm Operating System:

For information about...	Read the...
Specific platforms supported	<i>HP 3PAR InForm Configuration Matrix</i>
CLI commands and their usage	<i>InForm OS Command Line Interface Reference</i>
Using the InForm Management Console to configure and administer HP 3PAR Storage Systems	<i>HP 3PAR InForm OS Management Console Online Help</i>

For information about...	Read the...
HP 3PAR Storage System concepts and terminology	<i>HP 3PAR InForm OS Concepts Guide</i>
Determining HP 3PAR Storage System hardware specifications, installation considerations, power requirements, networking options, and cabling	<i>HP 3PAR InServ S-Class/T-Class Storage Server Physical Planning Manual or the HP 3PAR InServ E-Class/F-Class Storage Server and Third-Party Rack Physical Planning Manual</i>
Identifying storage server components and detailed alert information	<i>HP 3PAR InForm OS Messages and Operator's Guide</i>
Using HP 3PAR Remote Copy	<i>HP 3PAR Remote Copy User's Guide</i>
Using HP 3PAR CIM	<i>HP 3PAR CIM API Programming Reference</i>

Typographical Conventions

This guide uses the following typographical conventions:

Table 1 Typographical Conventions

Typeface	Meaning	Example
ABCDabcd	Used for dialog elements such as titles, button labels, and other screen elements.	When prompted, click Finish to complete the installation.
ABCDabcd	Used for paths, filenames, and screen output.	Open the file <code>\os\windows\setup.exe</code>
ABCDabcd	Used to differentiate user input from screen output.	<code># cd \opt\3par\console</code>
<ABCDabcd>	Used for variables in filenames, paths, and screen output.	Modify the content string by adding the <code>-P <x></code> after <code>-jar inform.jar</code>
< ABCDabcd >	Used for variables in user input.	<code>#.\java -jar inform.jar -P<x></code>

Advisories

To avoid injury to people or damage to data and equipment, be sure to observe the cautions and warnings in this guide. **Always be careful when handling any electrical equipment.**



WARNING! Warnings alert you to actions that can cause injury to people or irreversible damage to data or the operating system.



CAUTION: Cautions alert you to actions that can cause damage to equipment, software, or data.

NOTE: Notes are reminders, tips, or suggestions that supplement the procedures included in this guide.

2 Configuring the HP 3PAR Storage System for Fibre Channel

This chapter describes how to establish a connection between an HP 3PAR Storage System and HP-UX host using Fibre Channel and how to set up the fabric when running InForm OS 3.1.x, OS 2.3.x, or OS 2.2.x. For information on setting up the physical connection for a particular HP 3PAR Storage System, see the appropriate HP 3PAR installation manual.

REQUIRED

If you are setting up a fabric along with your installation of the HP 3PAR Storage System, consult [“Setting Up and Zoning the Fabric” \(page 9\)](#) before configuring or connecting your HP 3PAR Storage System.

Configuring the HP 3PAR Storage System Running InForm OS 3.1.x and OS 2.3.x

This section describes how to configure the HP 3PAR Storage System running InForm OS 3.1.x and OS 2.3.x.

REQUIRED

The following setup must be completed before connecting the HP 3PAR Storage System port to a device.

Configuring Ports for a Direct Connection

To configure HP 3PAR Storage System ports for a direct connection to the HP-UX host, complete the following steps:

1. To set up the HP 3PAR Storage System ports for a direct connection, issue the following set of commands with the appropriate parameters for each direct connect port:
 - a. `controlport offline [node:slot:port]`
 - b. `controlport config host -ct loop [node:slot:port]`
where `-ct loop` specifies a direct connection.
 - c. `controlport rst [node:slot:port]`

Example:

```
# controlport offline 1:5:1
# controlport config host -ct loop 1:5:1
# controlport rst 1:5:1
```

2. After all ports have been configured, verify that the ports are configured for a host in a direct connection by issuing the `showport -par` command on the HP 3PAR Storage System.

```
# showport -par
N:S:P Connmode ConnType CfgRate MaxRate Class2 UniqNodeWwn VCN IntCoal
...
1:5:1 host loop auto 4Gbps disabled disabled disabled enabled
...
```

Configuring Ports for a Fabric Connection

To configure HP 3PAR Storage System ports for a fabric connection, complete the following steps for each port connecting to a fabric.

- △ CAUTION:** Before taking a port offline in preparation for a fabric connection, you should verify that the port has not been previously defined and that it is not already connected to a host as this would interrupt the existing host connection. If an HP 3PAR Storage System port is already configured for a fabric connection, you can ignore [Step 2](#) as you do not have to take the port offline.

1. To determine if a port has already been configured for a host port in fabric mode, issue `showport -par` on the HP 3PAR Storage System.

```
# showport -par
N:S:P Connmode ConnType CfgRate MaxRate Class2          UniqNodeWwn VCN
IntCoal
...
1:5:1 host      point    auto    4Gbps disabled disabled          disabled
enabled
...
```

2. If the port has NOT been configured, take the port offline before configuring it for connection to a host server. To take the port offline, issue the InForm CLI command `controlport offline [node:slot:port]`.

```
# controlport offline 1:5:1
```

3. To configure the port to the host server, issue `controlport config host -ct point [node:slot:port]`, where `-ct point` indicates that the connection type specified is a fabric connection.

```
# controlport config host -ct point 1:5:1
```

4. Reset the port by issuing the `controlport rst [node:slot:port]` command.

```
# controlport rst 1:5:1
```

Creating the Host Definition

Before connecting the HP-UX host to the HP 3PAR Storage System, create a host definition that specifies a valid host persona for each HP 3PAR Storage System that is to be connected to a host HBA port through a fabric or a direct connection.

1. To create host definitions, issue the `createhost [options] <hostname> [<WWN>...]` command. For example:

```
# createhost -persona 7 hpux-host 1122334455667788 1122334455667799
```

2. To verify that the host has been created, issue the `showhost` command.

```
# showhost
Id Name                Persona      -WWN/iSCSI_Name- Port
...
 2 hpux-host          HPUX-legacy 1122334455667788 ---
                               1122334455667799 ---
```

Configuring the HP 3PAR Storage System Running InForm OS 2.2.x

This section describes how to configure the HP 3PAR Storage System running InForm OS 2.2.x.

REQUIRED

The following setup must be completed before connecting the HP 3PAR Storage System port to a device.

Configuring Ports for a Direct Connection

To configure the HP 3PAR Storage System ports for a direct connection, complete the following steps.

1. Set each HP 3PAR Storage System port to port personality 5 by issuing `controlport persona 5 <X:X:X>`, where `<X:X:X>` is the port location, expressed as `node:slot:port`.

```
# controlport persona 5 1:2:1
```

2. Verify that each port has the appropriate personality defined:

```
# showport -par
N:S:P ConnType CfgRate MaxRate Class2      VCN -----Persona-----
IntCoal
...
1:2:1      loop      auto      2Gbps disable disabled (5) aglt, g_hba, hp, 0, DC
enabled
...
```

NOTE: When deploying your storage server in a direct connection, the HP Tachyon HBA WWN does not show up.

Configuring Ports for a Fabric Connection

To configure the HP 3PAR Storage System ports for a fabric connection, complete the following steps.

1. Set each storage server port that will connect to a fabric to port persona 8 by issuing `controlport persona 8 <X:X:X>`, where `<X:X:X>` is the port location, expressed as `node:slot:port`.

2. Issue `controlport vcn disable -f <X:X:X>` for each port.
Verify that each port has the appropriate persona defined:

```
# controlport persona 8 1:2:1

# showport -par
N:S:P ConnType CfgRate MaxRate Class2 VCN -----Persona-----
IntCoal
...
1:2:1 point auto 2Gbps disable enabled (8) aglt, g_hba, hp, 0, FA
enabled
...
```

Creating the Host Definition

Before connecting the HP-UX host to the HP 3PAR Storage System, create a host definition that is to be connected to a host HBA port through a fabric or a direct connection.

To create host definitions on the HP 3PAR Storage System, issue `createhost [options] <hostname> [<WWN>]`.

```
# createhost hpux-host 1122334455667788 1122334455667799
```

- To verify the host definition, issue `showhost`:

```
# showhost
Id Name -WWN/iSCSI_Name- Port
...
2 hpux-host 1122334455667788 ---
1122334455667799 ---
```

Connecting the HP 3PAR Storage System to the Host

During this stage connect the HP 3PAR Storage System to the host server directly or to the fabric. This set of tasks includes physically cabling the HP 3PAR Storage System to the host server or fabric.

Setting Up and Zoning the Fabric

Fabric zoning controls which devices have access to each other on the fabric. The required use of single initiator to single target zoning isolates the host server and HP 3PAR Storage System ports from Registered State Change Notifications (RSCNs) that are irrelevant to these ports.

You can set up fabric zoning by associating the device World Wide Names (WWNs) or ports with specified zones in the fabric. Although you can use either the WWN or the port zoning methods with the HP 3PAR Storage System, the WWN zoning method is recommended because the zone survives the changes of ports when cables are reconnected on a fabric.

Use the methods provided by the switch vendor to create relationships between host server HBA ports and storage server ports before you connect the host server HBA ports or HP 3PAR Storage System ports to the fabric.

REQUIRED

When you establish zoning with the HP 3PAR Storage System, there must only be a single initiator zoned with a single target. If an issue occurs using another zoning approach, HP may require that you implement this zoning approach as part of troubleshooting and/or corrective action.

After connecting each host server HBA port and HP 3PAR Storage System port to the fabric(s), verify the switch and zone configurations using the InForm CLI `showhost` command, to ensure that each initiator is zoned with the correct target.

In the following explanations an initiator port (initiator for short) refers to a host server HBA port and a target port (target for short) refers to an HP 3PAR Storage System HBA port.

Configuration Guidelines for Fabric Vendors

Use the following fabric vendor guidelines before configuring ports on fabric(s) to which the HP 3PAR Storage System connects.

- Brocade switch ports that connect to a host server HBA port or to an HP 3PAR Storage System port should be set to their default mode. On Brocade 3xxx switches running Brocade firmware 3.0.2 or later, verify that each switch port is in the correct mode using the Brocade telnet interface and the `portcfgshow` command as follows:

```

brocade2_1:admin> portcfgshow
Ports          0  1  2  3    4  5  6  7
-----+-----+-----+-----+-----+-----+-----+-----+
Speed          AN AN AN AN  AN AN AN AN
Trunk Port     ON ON ON ON  ON ON ON ON
Locked L_Port  .. .. .. ..  .. .. .. ..
Locked G_Port  .. .. .. ..  .. .. .. ..
Disabled E_Port .. .. .. ..  .. .. .. ..
                                where AN:AutoNegotiate, ..:OFF, ??:INVALID.

```

- McData switch or director ports should be in their default modes as type **GX-Port** with a speed setting of **Negotiate**.
- Cisco switch ports that connect to HP 3PAR Storage System ports or host HBA ports should be set to **AdminMode = FX** and **AdminSpeed = auto port**, with the speed set to auto negotiate.
- QLogic switch ports should be set to port type **GL-port** and port speed **auto-detect**.
- QLogic switch ports that connect to the HP 3PAR Storage System should be set to I/O Stream Guard **disable** or **auto**, but never **enable**.

Target Port Limits and Specifications

To avoid overwhelming a target port and ensure continuous I/O operations, refer to the following limitations on a target port:

- Maximum of 64 host server ports per HP 3PAR Storage System port, with a maximum total of 1,024 host server ports per HP 3PAR Storage System.
- I/O queue depth on each InServ Storage Server HBA model as follows:
 - QLogic 2G: 497
 - LSI 2G: 510
 - Emulex 4G: 959
 - HP 3PAR HBA 4G: 1638
 - HP 3PAR HBA 8G: 3276
- The I/O queues are shared among the connected host server HBA ports on a first-come, first-served basis
- When all queues are in use and a host HBA port tries to initiate I/O, it receives a target queue full response from the HP 3PAR Storage System port. This condition can result in erratic I/O performance on each host server. If this condition occurs, each host server should be throttled

so that it cannot overrun the HP 3PAR Storage System port's queues when all host servers are delivering their maximum number of I/O requests.

NOTE: When host server ports can access multiple targets on fabric zones, the assigned target number assigned by the host driver for each discovered target can change when the host server is booted and some targets are not present in the zone. This situation may change the device node access point for devices during a host server reboot. This issue can occur with any fabric-connected storage, and is not specific to the HP 3PAR Storage System.

Configuration Diagrams for Zoning

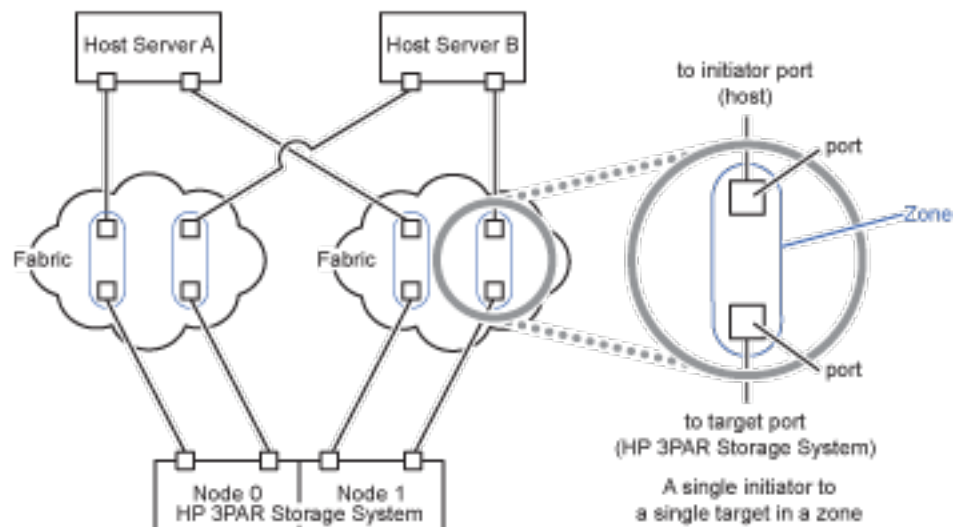
This section describes various zoning configurations.

NOTE: In the examples in the following sections, a fabric can be one or more Fibre Channel switches or directors.

Single Initiator to Single Target Zoning No Fan-In No Fan-Out

With a single initiator to single target zoning, in a no fan-in, no fan-out configuration, each HBA port is connected to only one HP 3PAR Storage System port, as shown in [Figure 1 \(page 11\)](#).

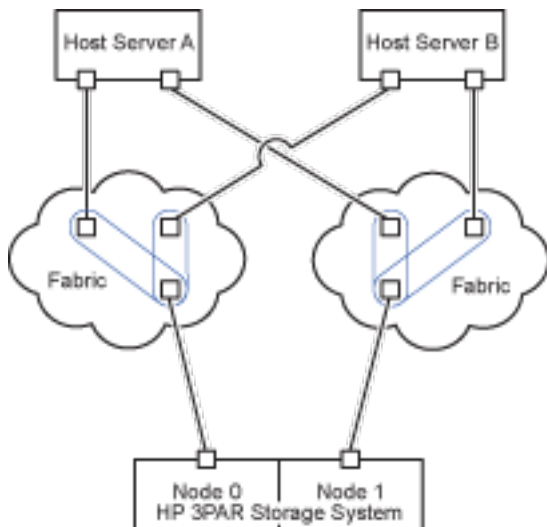
Figure 1 Single Initiator to Single Target Zoning No Fan-In/No Fan-Out



Single Initiator to Single Target Zoning with Fan-Out from One HP 3PAR Storage System Port to Multiple Host Server Ports

With single initiator to single target zoning, in a fan-out configuration, the HP 3PAR Storage System port is connected to more than one host port, as shown in [Figure 2 \(page 12\)](#).

Figure 2 Single Initiator to Single Target Zoning with Fan-Out

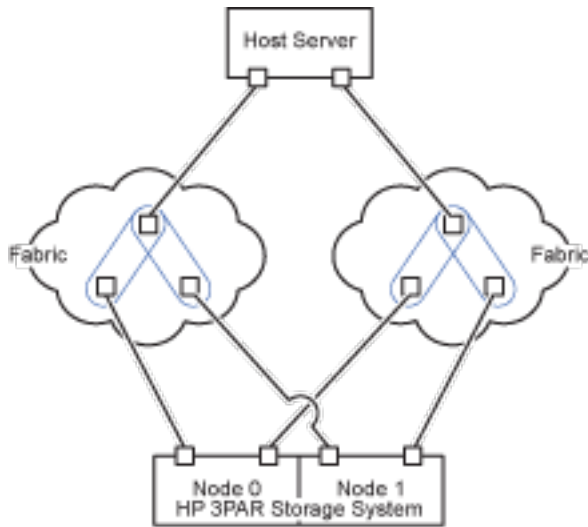


NOTE: A maximum of 64 host server ports can fan-out from a single HP 3PAR Storage System port.

Single Initiator to Single Target Zoning with Fan-In from Multiple HP 3PAR Storage System Ports to One Host Server Port

With single initiator to single target zoning, in a fan-in configuration a host server port connects to many HP 3PAR Storage System ports, as shown in [Figure 3 \(page 12\)](#).

Figure 3 Single Initiator to Single Host Target Zoning with Fan-In

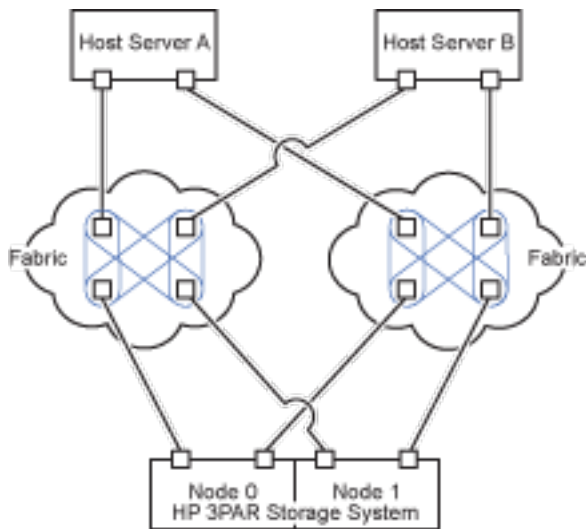


NOTE: A maximum of four HP 3PAR Storage System ports can fan-in to a single host server port.

Single Initiator to Single Target Zoning with Mixed Fan-In and Fan-Out Configurations

With single initiator to single target zoning, in a fan-in and fan-out configuration, one HP 3PAR Storage System connects to multiple host servers.

Figure 4 Single Initiator to Single Target Zoning with Fan-In and Fan-Out

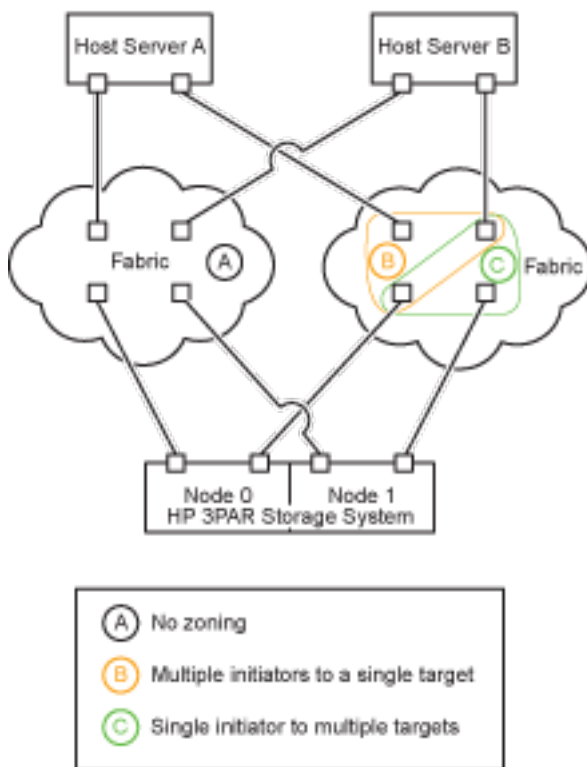


Non-Compliant Zoning Examples

In the following example, the zoning rule of one initiator zoned to one target is not respected, as shown in Figure 5 (page 13).

Figure 5 Non-Compliant Zoning

Non-Compliant Zoning



3 Connecting a Host Server with Fibre Channel

This chapter describes the tasks necessary for connecting the host to Fibre Channel.

Installing the HBA

1. Install the HP-UX operating system from the HP-UX 11i v2 Mission Critical OE June 2008 Release or from the HP-UX 11i v3 Data Center OE March 2011 Release on Integrity/PA-RISC Servers.
2. Install the HP Fibre Channel Mass Storage adapter(s), such as the AB379A/B, AH402A and AD193A, in the server using the documentation supplied with the HBA from the server vendor. A complete list of supported HBAs can be found on SPOCK. The HBA installation manuals are also available at the following web site:

<http://www.hp.com>

Installing the Host OS

The following information is for HP-UX 11i v2 or 11i v3 Itanium/PA-RISC server installations with the AB379A/B, AH402A, and AD193A HBAs.

1. Check the installed patches using the System Administration Manager (SAM) for 11i v2 or SMH for 11i v3 using the `swlist` command.
 - GUI:
SAM→Software Management→View Installed Software
 - CLI:

```
# swlist | grep -i FibrChanl
```

The list should include the following software; the support versions are listed in the HP 3PAR InForm Configuration Matrix:
 - For 11i v3:

```
# swlist FibrChanl*
#
# FibrChanl-00                B.11.31.1003  FibreChannel;HW=A6795A,A5158A
    FibrChanl-00.FC-TACHYON-TL  B.11.31.1003  FibreChannel (TD) Driver
# FibrChanl-01                B.11.31.1103
FibrChnl;HW=A6826A,A9782A,A9784A,AB378A/B,AB379A/B,AB465A,AD193A,AD194A,AD300A
    FibrChanl-01.FC-FCD        B.11.31.1103  FibreChannel (FCD) Driver
# FibrChanl-02                B.11.31.1103
FCLP;HW=AD299A,AD355A,AD221A,AD222A,AD393A,AH402A,AH403A,403621-B21,456972-B21
    FibrChanl-02.FC-FCLP      B.11.31.1103  PCIe FibreChannel
# FibrChanl-03                B.11.31.1103  FCOC;HW=581199-001
    FibrChanl-03.FC-FCOC     B.11.31.1103  PCIe FibreChannel
# FibrChanl-04                B.11.31.1103  FCQ;HW=P3P
    FibrChanl-04.FC-FCQ      B.11.31.1103  FibreChannel (FCQ) Driver
```

- For 11i v2:

```
# swlist FibrChanl*
#
```

```
# FibrChanl-00                               B.11.23.0712  PCI FibreChannel;Supptd
HW=A6795A,A5158A
  FibrChanl-00.FC-TACHYON-TL                 B.11.23.0712  PCI FibreChannel;Supptd
HW=A6795A,A5158A
# FibrChanl-01                               B.11.23.08.02
FibrChnl;SupptdHW=A6826A,A9782A,A9784A,AB378A,AB379A,AB465A,AD193A,AD194A,AD300A

  FibrChanl-01.FC-FCD                         B.11.23.08.02  HP PCI-X/PCIe FibreChannel
Driver(FCD)
# FibrChanl-02                               B.11.23.0712  PCIe FibreChannel;Supptd
HW=AD299A,AD355A
  FibrChanl-02.FC-FCLP                       B.11.23.0712  PCIe FibreChannel
```

The drivers are installed as part of the operating system install. FibreChanl-00 must be also installed for FibreChanl-01 to function.

2. Verify that the OnlineDiag or Support Tools Bundle software is installed and install the software if it is not present. The OnlineDiag bundle is present in the OS media.

```
# swlist Online*
# OnlineDiag                               B.11.31.04.05 HPUX 11.31 Support
Tools Bundle, September 2008
```

3. HP recommends that the Server is at a certain firmware version to detect the Fibre Channel Cards. Verify the firmware version using the MP interface on the Integrity or HP 9000 Server.

```
MP:CM> SYSREV
FIRMWARE:
Core IO
  Master      : A.006.012
  Event Dict. :          1.009
  Slave       : A.006.012
  Event Dict. :          1.009
Cell 0
  PDHC        : A.003.023
  Pri SFW     : 22.002 (PA)
  Sec SFW     : 1.025 (IA)
Cell 1
  PDHC        : A.003.023
  Pri SFW     : 22.002 (PA)
  Sec SFW     : 1.025 (IA)
```

Alternately, if the Online Diagnostics have been installed, run the `cstm` tool to determine the firmware version.

- a. Run the Support Tools Manager (STM) utility `cstm`.

```
# /usr/sbin/cstm
```

- b. Use the `selall` and `il` commands to find all the required system information.

```
cstm>selall
cstm>il
...
Product ID           : ia64 hp server rx7620
Product Number       : not set
System Firmware Revision : 001.025
BMC Revision         : v06.12
System Serial Number: : not set
System Software ID   : 3801066248
```

NOTE: Contact HP for information on upgrading the system firmware.

- c. For Itanium systems, install the supported EFI firmware for the AB379A/B, A6826A, A6795A card. The firmware is downloadable from www.hp.com by searching the HBA model. Those firmware versions are essential to enable the boot over SAN feature.

4 Allocating Storage for Access by the HP-UX Host

Creating Storage on the HP 3PAR Storage System

This section describes the general steps and commands that are required to create the Virtual Volumes that can then be exported for discovery by the HP-UX host. For additional information, see the *HP 3PAR InForm OS CLI Administrator's Manual*. For complete details on creating Virtual Volumes, see the appropriate HP 3PAR documentation.

Creating Virtual Volumes

Virtual Volumes are the only data layer visible to hosts. After devising a plan for allocating space for host servers on the HP 3PAR Storage System, create the Virtual Volumes.

After devising a plan for allocating space for the HP-UX host, you need to create the required Virtual Volumes on the HP 3PAR Storage System. You can create volumes that are provisioned from one or more Common Provisioning Groups (CPGs). Volumes can be fully provisioned from a CPG or can be thinly provisioned. You can optionally specify a CPG for snapshot space for fully provisioned volumes.

Using the InForm Management Console:

1. From the Menu bar, select:
Actions→**Provisioning**→**VV**→**Create Virtual Volume**
2. Use the **Create Virtual Volume** wizard to create a base volume.
3. Select one of the following options from the **Provisioning** list:
 - **Fully Provisioned from PDs**
 - **Fully Provisioned from CPG**
 - **Thinly Provisioned**

Using the InForm CLI:

To create a fully provisioned or thinly provisioned virtual volume, issue the following InForm CLI command:

```
createvv [options] <usr_cpg> <vvname> [.<index>] <size>[g|G|t|T]
```

Here is an example:

```
# createcpg CPG_test
# createvv -cnt 5 CPG_test TestLUNs 5g
# showvv

----Rsvd(MB) ---- - (MB) -
  Id Name          Prov Type  CopyOf          BsId Rd -Detailed_State- Adm  Snp
  Usr  VSize
...
6525 TestLUNs.0    full base  ---            6525 RW normal          0   0
   5120  5120
6526 TestLUNs.1    full base  ---            6526 RW normal          0   0
   5120  5120
6527 TestLUNs.2    full base  ---            6527 RW normal          0   0
   5120  5120
6528 TestLUNs.3    full base  ---            6528 RW normal          0   0
   5120  5120
6529 TestLUNs.4    full base  ---            6529 RW normal          0   0
   5120  5120
```

NOTE: To create thinly provisioned virtual volumes, an HP 3PAR Thin Provisioning license is required.

Consult the InForm Management Console help and the HP 3PAR Command Line Reference for complete details on creating volumes for the InForm OS version that is being used on the HP 3PAR Storage System. Note that the commands and options available for creating a virtual volume may vary for earlier versions of the InForm OS.

Creating Thin Provisioned Volumes

To create Thin Provisioned volumes, see the following documents:

- *HP 3PAR InForm OS Concepts Guide*
- *HP 3PAR InForm OS CLI Administrator's Manual*
- *InForm OS Command Line Interface Reference*

Exporting LUNs to the Host

This section explains how to export LUNs to the host server as VVs, referred to as Virtual LUNs (VLUNs).

To export VVs as Virtual LUNs, issue the following command:

```
createvlun -cnt <number> <VV_name> <LUN> <host_name>
```

where:

- `-cnt <number>` specifies that a sequence of VLUNs, as specified by the `number` argument, are exported to the same system port and host that is created. The `number` argument can be specified as any integer. For each VLUN created, the `.int` suffix of the `VV_name` specifier and `LUN` are incremented by one.
- `<VV_name>` specifies name of the virtual volume being exported as a virtual LUN.
- `<LUN>` indicates that this is the starting LUN number.
- `<hostname/hostdefinition>` indicates that `hostname` is the name of the host created in sections 2.1.1, 2.1.2, or 2.1.3.

Example:

```
# createvlun -cnt 5 TestLUNs.0 1 hpux-host
```

To verify that VLUNs have been created, issue `showvlun`:

```
# showvlun
Active VLUNs
Lun VVName HostName      -Host_WWN/iSCSI_Name-  Port Type
...
VLUN Templates
Lun VVName      HostName  -Host_WWN/iSCSI_Name-  Port Type
  1 TestLUNs.0  hpux-host  -----  --- host
  2 TestLUNs.1  hpux-host  -----  --- host
  3 TestLUNs.2  hpux-host  -----  --- host
  4 TestLUNs.3  hpux-host  -----  --- host
  5 TestLUNs.4  hpux-host  -----  --- host
...
```

Restrictions on Volume Size and Number

Follow the guidelines for creating virtual volumes (VVs) and Virtual LUNs (VLUNs) in the *HP 3PAR InForm OS CLI Administrator's Manual* while adhering to these cautions and guidelines:

- This configuration supports sparse LUNs (meaning that LUNs may be skipped). LUNs may also be exported in non-ascending order (e.g. 0, 5, 7, 3).
- The HP 3PAR Storage System supports the exportation of VLUNs with LUNs in the range from 0 to 16838. Testing was limited to 256 LUNs per storage server port (target) using LUN numbers 1 to 256.
- The maximum LUN size that can be exported to a HP-UX host is 16TB when the installed InForm OS version is 2.3.x. or later. The upper limits on a HP-UX host is dependant on the LVM version. See LVM Version 2.0 Volume Groups in HP-UX 11i v3 and LVM Version 1.0 Volume Groups in HP-UX 11iv2 on <http://www.hp.com>.

Restrictions on Dynamic LUN Expansion

Dynamic LUN Expansion (DLE) is currently not supported on HP-UX 11iv3 and HP 3PAR Storage systems.

- Beginning with HP-UX 11iv3 March 2009 Update, administrators can use the online `vgmodify` command to invoke Dynamic LUN Expansion (DLE) on LVM versions 2.x and 1.0. While HP 3PAR Storage Systems allow a LUN to be dynamically resized, the HP-UX Logical Volume Manager DLE feature is currently not supported with HP 3PAR Storage Systems.
- As a temporary workaround, administrators can leverage the HP-UX `diskinfo` command to trigger detection of the LUN expansion by the operating system.

```
# diskinfo /dev/rdisk/disk100
```

Setting Up Multipathing Software on 11i v3

HP 3PAR supports the HP-UX native multipathing solution.

1. In Agile Addressing Mode, the persistent DSF maps `/dev/disk/diskXX` to the Device WorldWide Identifier (WWID) or serial number which correlates to an HP 3PAR Storage System VV (VV WWN). This WWN is unique and is not affected by LUN path changes; the DSF is called Agile addressing.

NOTE: Additional information on Agile Addressing Mode is provided in the *Next Generation Mass Storage Stack*, *HP-UX 11i v3 Native Multipathing for Mass Storage*, and other documents about Storage Area Management for HP-UX 11i v3 available at <http://docs.hp.com>.

2. By default, the Agile Addressing Mode is enabled. After exporting, new VLUNs that are exported while the host server is running will not be registered on the host until you issue the `ioscan` command. This command scans the hardware for all the new and usable devices. You can consult `/var/adm/syslog/syslog.log` during the discovery process to verify that the new devices are being discovered. Special device files for the new devices (raw and block device paths) that are required to access the devices are created as part of the `ioscan` command by internally executing the `insf -e` command.

```
# ioscan

# tail -f /var/adm/syslog/syslog.log
vmunix: 0/0/4/1/0.0x20420002ac000036.0x400a000000000000 eslpt
vmunix: 0/0/4/1/1.0x21520002ac000036.0x400a000000000000 eslpt
vmunix: 64000/0xfa00/0x243 esdisk
```

```
sfd[2330]: started 'insf' to create device special files for newly found devices.
sfd[2330]: execution of 'insf' completed.
```

Always use the `-N` option for the `ioscan` command to see the persistent devices or agile devices. Without the `-N` option, legacy devices will be seen.

NOTE: Broken or stale device paths are displayed with S/W state of `NO_HW` in the output of the `ioscan -kfnNC disk` command. The `CLAIMED` state indicates a valid disk device path existence.

Example: Without the `-N` option, legacy devices are shown.

```
# ioscan -kfnC disk
Class      I  H/W Path          Driver S/W State  H/W Type  Description
=====
disk      19  0/0/0/3/0.6.0    sdisk  CLAIMED    DEVICE    HP 36.4GST336753LC
          /dev/rdisk/c8t6d0 /dev/rdisk/
          c8t6d0s2
          /dev/dsk/c8t6d0 /dev/dsk/c8t6d0s1 /dev/dsk/c8t6d0s3
          /dev/rdisk/c8t6d0s1 /dev/rdisk/
          c8t6d0s3
disk      7   0/0/4/1/0.18.1.0.0.0.1 sdisk  CLAIMED    DEVICE    3PARdataVV
          /dev/dsk/c11t0d1 /dev/rdisk/c11t0d1
disk      8   0/0/4/1/0.18.1.0.0.0.2 sdisk  CLAIMED    DEVICE    3PARdataVV
          /dev/dsk/c11t0d2 /dev/rdisk/c11t0d2
disk      9   0/0/4/1/0.18.1.0.0.0.3 sdisk  CLAIMED    DEVICE    3PARdataVV
```

Example: Using the `-N` option displays the persistent devices.

```
# ioscan -kfNnC disk
Class      I  H/W Path          Driver S/W State  H/W Type  Description
=====
disk      0  64000/0xfa00/0x23e esdisk  CLAIMED    DEVICE    3PARdataVV
          /dev/disk/disk0 /dev/rdisk/disk0
disk      1  64000/0xfa00/0x23f esdisk  CLAIMED    DEVICE    3PARdataVV
          /dev/disk/disk1 /dev/rdisk/disk1
disk      3  64000/0xfa00/0x240 esdisk  CLAIMED    DEVICE    3PARdataVV
          /dev/disk/disk3 /dev/rdisk/disk3
```

Example: The output of `ioscan` shows the relationship between the legacy and persistent devices.

```
# ioscan -m dsf
Persistent DSF          Legacy DSF(s)
=====
/dev/rdisk/disk0       /dev/rdisk/c11t0d1
                       /dev/rdisk/c15t0d1
/dev/rdisk/disk1       /dev/rdisk/c11t0d2
                       /dev/rdisk/c15t0d2
/dev/rdisk/disk2       /dev/rdisk/c8t6d0
```

3. HP recommends that you do not use the legacy device paths; instead, migrate any application from legacy to persistent device paths by disabling the legacy device paths. All LVM commands

works with persistent device paths (DSF). Use the `rmsf -v -L` command to disable the legacy device paths.

```
# rmsf -vL
WARNING: This command may be disruptive to the system.
Before running this command, make sure you have first run
iofind(1M) and migrated all applications using legacy device
special files. Please refer to the man page of rmsf(1M) to
verify the possible side effects of the option '-L'.
Do you want to continue ?
(You must respond with 'y' or 'n'.): y
rmsf: Removing special file /dev/dsk/c0t6d0
rmsf: Removing special file /dev/dsk/c0t6d0s1
rmsf: Removing special file /dev/dsk/c0t6d0s2
```

NOTE: You can enable the legacy device paths any time by executing the `insf -L` command. Even if you perform I/O on legacy paths, it will be internally routed through the persistent device files.

```
# insf -L
This command will re-install all legacy I/O nodes and legacy DSFs.
Do you want to continue ?
(You must respond with 'y' or 'n'.): y
insf: Legacy mode has been successfully enabled
```

Use `insf -Lv` to display the status as to whether Legacy Mode is enabled or disabled.

```
# insf -Lv
insf: Legacy mode is disabled
```

NOTE: The rest of this document assumes that legacy path has been disabled.

4. You can use various options for the `ioscan` command to obtain more details.

Example:

- a. To show discovered devices, issue `ioscan -kfnNC disk`. The description field will have HP 3PAR VV for all HP 3PAR Storage System volumes.

```
# ioscan -kfnNC disk
Class      I H/W Path  Driver S/W State  H/W Type  Description
=====
disk       2 64000/0xfa00/0x0  esdisk CLAIMED  DEVICE  HP 36.4GST336753LC
/dev/disk/disk2  /dev/disk/disk2_p2  /dev/rdisk/disk2 /dev/rdisk/disk2_p2
disk       0 64000/0xfa00/0x23e  esdisk CLAIMED  DEVICE  3PARdataVV
/dev/disk/disk0  /dev/rdisk/disk0
disk       1 64000/0xfa00/0x23f  esdisk CLAIMED  DEVICE  3PARdataVV
/dev/disk/disk1 /dev/rdisk/disk1
```

CAUTION: All I/O to the devices should use `/dev/rdisk/disk` for raw disk or `/dev/disk/disk` for block I/O. Any partition on the device will be represented as `/dev/disk/diskX_pN` number.

- b. To determine the connected target ports (0:4:2 and 1:5:2) use the following commands:

- 1) Issue `ioscan -kfnNC tgtpath` on the HP-UX host.

```
# ioscan -kfnNC tgtpath
Class      I H/W Path      Driver S/W State H/W Type   Description
=====
tgtpath    2 0/0/0/3/0.0x6  estp CLAIMED      TGT_PATH  parallel_scsi
target served by c8xx
driver
tgtpath    0 0/0/4/1/0.0x20420002ac000036  estp CLAIMED TGT_PATH
fibre_channel target
served by fcd driver
tgtpath    1 0/0/4/1/1.0x21520002ac000036  estp CLAIMED TGT_PATH
fibre_channel target
served by fcd driver
```

- 2) Issue `showport -i` on the HP 3PAR Storage System:

```
# showport -i
N:S:P Mode      State ----Node_WWN---- -Port_WWN/HW_Addr- Type
...
0:4:2 target    ready 2FF70002AC000036 20420002AC000036 host
1:5:2 target    ready 2FF70002AC000036 21520002AC000036 host
```

- 3) To determine the Fibre Channel HBA's model, hardware path, and the `fcd` driver instance, issue `ioscan -kfnNC fc`:

```
# ioscan -kfnNC fc
Class      I H/W Path      Driver S/W State   H/W Type   Description
=====
fc         5 0/0/4/1/0     fcd   CLAIMED   INTERFACE   HP AB379-60001
4Gb Dual Port PCI/PCI-X Fibre Channel Adapter (FC Port 1)
/dev/fcd5
fc         6 0/0/4/1/1     fcd   CLAIMED   INTERFACE   HP AB379-60001
4Gb Dual Port PCI/PCI-X Fibre Channel Adapter (FC Port 2)
/dev/fcd6
fc         7 0/0/6/1/0     td    CLAIMED   INTERFACE   HP Tachyon XL2
Fibre Channel Mass Storage Adapter
/dev/td7
fc         8 0/0/10/1/0    fcd   CLAIMED   INTERFACE   HP A6826-60001
2Gb Dual Port PCI/PCI-X Fibre Channel Adapter (FC Port 1)
/dev/fcd8
fc         9 0/0/10/1/1    fcd   CLAIMED   INTERFACE   HP A6826-60001
2Gb Dual Port PCI/PCI-X Fibre Channel Adapter (FC Port 2)
```

- 4) To determine the number of LUN paths for each DSF, issue `ioscan -m hwpath`:

```
# ioscan -m hwpath
Lun H/W Path      Lunpath H/W Path      Legacy H/W Path
=====
64000/0xfa00/0x0      0/0/0/3/0.0x6.0x0
64000/0xfa00/0x17     0/0/4/1/1.0x21520002ac000036.0x0
64000/0xfa00/0x18     0/0/4/1/0.0x20420002ac000036.0x0
64000/0xfa00/0x23e    0/0/4/1/0.0x20420002ac000036.0x4001000000000000
0/0/4/1/1.0x21520002ac000036.0x4001000000000000
64000/0xfa00/0x23f
```

```
0/0/4/1/0.0x20420002ac000036.0x4002000000000000
0/0/4/1/1.0x21520002ac000036.0x4002000000000000
```

In the LUN path the 16 bits address following the target port ID (0x20420002ac000036) represents the LUN number where the device is seen and the addressing mode. For example, for 0x4001 (which translates to 0100000000000001) the first two bits 01 represents VSA mode and the remaining 14 bits represent the LUN number, which is LUN 1 in this example.

The host uses `estp` driver for target paths, `eslpt` for LUN paths and `esdisk` as disk driver.

- 5) You can find the health of a device, target, LUN path and determine whether it is on or off line using the `-P` option. The `-C` option can be used to specify attributes such as target ports, disks, or individual LUN paths. The status `limited` means some paths are taken offline from the available multiple paths

```
# ioscan -P health -C tgtpath
Class      I  H/W Path          health
=====
tgtpath    2  0/0/0/3/0.0x6    online
tgtpath    0  0/0/4/1/0.0x20420002ac000036  online
tgtpath    1  0/0/4/1/1.0x21520002ac000036  offline

#ioscan -P health -C disk
Class      I  H/W Path          health
=====
disk       2  64000/0xfa00/0x0  online
disk       0  64000/0xfa00/0x23e  online
disk       1  64000/0xfa00/0x23f  online
disk       3  64000/0xfa00/0x240  limited
disk       4  64000/0xfa00/0x241  limited

# ioscan -P health -C lunpath
lunpath    0  0/0/4/1/0.0x20420002ac000036.0x0      online
lunpath    4  0/0/4/1/0.0x20420002ac000036.0x4001000000000000  online
lunpath    5  0/0/4/1/0.0x20420002ac000036.0x4002000000000000  online
lunpath    1  0/0/4/1/1.0x21520002ac000036.0x0      offline
lunpath    2  0/0/4/1/1.0x21520002ac000036.0x4001000000000000  offline
lunpath    9  0/0/4/1/1.0x21520002ac000036.0x4002000000000000  offline
```

5. A given DSF file (`/dev/disk/diskXX`) once allocated to a given unique device (HP 3PAR Storage System VV) remains persistent and will not be reused for any other devices (VVs) even after the original device (VV) is removed. Whenever the actual or original VV reappears, the same DSF name is allocated.

Example:

Issuing `showvlnun -a` on the HP 3PAR Storage System shows that the HP 3PAR Storage System VV `hpcheck` is exported as LUN 20.

```
# showvlnun -a
Lun VVname      Host      -Host_WWN/iSCSI_Name-  Port Type
20 hpcheck     sqahpit2  50060B00001D1192      1:5:2 host
20 hpcheck     sqahpit2  50060B000068D5A4      0:4:2 host
```

Issuing `ioscan -kfnNC lunpath` shows that host recognizes the VV as `/dev/disk/disk20`.

```
# ioscan -kfnNC lunpath
lunpath 15 0/0/4/1/0.0x20420002ac000036.0x4014000000000000 eslpt CLAIMED LUN_PATH
LUN path for disk20
lunpath 16 0/0/4/1/1.0x21520002ac000036.0x4014000000000000 eslpt NO_HW LUN_PATH
LUN path for disk20
```

Remove the LUN and reexport it as LUN 25 and you can see that `/dev/disk/disk20` is recreated for LUN 25 and the LUN path for LUN number 20 goes stale (NO_HW).

HP 3PAR Storage System:

```
# showvln -a
Lun VVname      Host      -Host_WWN/iSCSI_Name-  Port  Type
25 hpcheck      sqahpit2  50060B00001D1192      1:5:2 host
25 hpcheck      sqahpit2  50060B000068D5A4      0:4:2 host
```

HP-UX host:

```
# ioscan -kfnNC lunpath
lunpath 15 0/0/4/1/0.0x20420002ac000036.0x4014000000000000 eslpt NO_HW LUN_PATH
LUN path for disk20
lunpath 17 0/0/4/1/0.0x20420002ac000036.0x4019000000000000 eslpt CLAIMED LUN_PATH
LUN path for disk20
lunpath 16 0/0/4/1/1.0x21520002ac000036.0x4014000000000000 eslpt NO_HW LUN_PATH
LUN path for disk20
lunpath 18 0/0/4/1/1.0x21520002ac000036.0x4019000000000000 eslpt CLAIMED LUN_PATH
LUN path for disk20
```

6. HP-UX 11i v3 provides the `scsimgr` command, which provides generic management and diagnostic capabilities for the SCSI subsystem of the mass storage stack. Use the `scsimgr` command to obtain the SCSI disk status information, statistics, change multipath options, set attributes, inquiry information and to perform other task management functions such as LUN and target resets.

Example:

- a. Issue the `scsimgr` command to obtain the relationship between the hardware LUN path, device special file (DSF), and HP 3PAR VV.

```
# scsimgr -p get_attr all_lun -a hw_path -a device_file -a wwid -a
serial_number -a vid

64000/0xfa00/0x17:/dev/pt/pt11::00000000:3PARdata
64000/0xfa00/0x18:/dev/pt/pt4::00000000:3PARdata
64000/0xfa00/0x23e:/dev/rdisk/disk0:0x50002ac002480036:02480036:3PARdata
64000/0xfa00/0x23f:/dev/rdisk/disk1:0x50002ac002490036:02490036:3PARdata
64000/0xfa00/0x240:/dev/rdisk/disk3:0x50002ac0024a0036:024A0036:3PARdata
```

- b. On the HP 3PAR Storage System, issue `showvv -d` and `showvln -lvw`.

```
# showvv -d
Id          Name Rd  Mstr Prnt  Roch  Rwch  PPrnt  PBlkRemain  -----VV_WWN-----
-----CreationTime-----
584        hpcluster.0 RW 0/1/-  ---  ---  ---  ---  - 50002AC002480036
Tue Oct 23 12:53:36 PDT 2007
```



```

585      hpcluster.1 RW 1/0/- --- --- --- --- - 50002AC002490036
Tue Oct 23 12:53:36 PDT 2007
586      hpcluster.2 RW 0/1/- --- --- --- --- - 50002AC0024A0036
Tue Oct 23 12:53:36 PDT 2007

# showvln -lvw
Active VLUNs
Lun VVname      -----VV_WWN----- Host      -Host_WWN/iSCSI_Name-  Port Type
  1 hpcluster.0 50002AC002480036 sqahpit2 50060B000068D5A4      0:4:2 host
  2 hpcluster.1 50002AC002490036 sqahpit2 50060B000068D5A4      0:4:2 host
  3 hpcluster.2 50002AC0024A0036 sqahpit2 50060B000068D5A4      0:4:2 host
  1 hpcluster.0 50002AC002480036 sqahpit2 50060B00001D1192      1:5:2 host
  2 hpcluster.1 50002AC002490036 sqahpit2 50060B00001D1192      1:5:2 host
  3 hpcluster.2 50002AC0024A0036 sqahpit2 50060B00001D1192      1:5:2 host

```

The output above shows that `/dev/rdisk/disk0` is a device special file for HP 3PAR Storage System VV `hpcluster.0` exported as LUN 1 and verified from HP 3PAR Storage System CLI `showvv` and `showhost` commands.

- c. To obtain information about the number of paths for a given disk, issue `scsimgr lun_map` or `scsimgr lun_map -D /dev/rdisk/disk6`:

```

# scsimgr lun_map -D /dev/rdisk/disk6

          LUN PATH INFORMATION FOR LUN : /dev/rdisk/disk6

Total number of LUN paths      = 2
World Wide Identifier(WWID)    = 0x50002ac0024d0036

LUN path : lunpath13
Class                          = lunpath
Instance                       = 13
Hardware path                  = 0/0/4/1/0.0x20420002ac000036.0x400a000000000000
SCSI transport protocol       = fibre_channel
State                          = UNOPEN
Last Open or Close state      = ACTIVE

LUN path : lunpath14
Class                          = lunpath
Instance                       = 14
Hardware path                  = 0/0/4/1/1.0x21520002ac000036.0x400a000000000000
SCSI transport protocol       = fibre_channel
State                          = UNOPEN
Last Open or Close state      = ACTIVE

```

- d. To determine all device attributes such as the multipathing policy, timeout values and device capacity, issue `scsimgr getinfo all_lun` or `scsimgr get_info -D /dev/rdisk/disk6`:

```

# scsimgr get_info -D /dev/rdisk/disk6

          STATUS INFORMATION FOR LUN : /dev/rdisk/disk6

Generic Status Information

SCSI services internal state   = UNOPEN
Device type                    = Direct_Access
EVPD page 0x83 description code = 1
EVPD page 0x83 description association = 0
EVPD page 0x83 description type = 3
World Wide Identifier (WWID)   = 0x50002ac0024d0036

```

```

Serial number                = 024D0036
Vendor id                    = 3PARdata
Product id                   = VV
...
I/O load balance policy     = round_robin
...
Driver esdisk Status Information :

Capacity in number of blocks = 2097152
Block size in bytes         = 512
Number of active IOs        = 0
Special properties          =
Maximum number of IO retries = 45
IO transfer timeout in secs = 30
FORMAT command timeout in secs = 86400
START UNIT command timeout in secs = 60
Timeout in secs before starting failing IO = 120
IO infinite retries         = false

```

- e. The default load balancing policy is round robin. HP offers other load balancing options. HP 3PAR has tested the `round_robin` and `least_cmd_load` load balancing options. The load balancing policy can be changed globally or for an individual disk.

Example: Issue the following commands to globally change from `round_robin` to `least_cmd_load`:

```

# scsimgr get_attr -N /escsi/esdisk -a load_bal_policy
SCSI ATTRIBUTES FOR SETTABLE ATTRIBUTE SCOPE : /escsi/esdisk

name = load_bal_policy
current = round_robin
default = round_robin
saved =

# scsimgr set_attr -N /escsi/esdisk -a load_bal_policy=least_cmd_load

Verify it is changed

# scsimgr get_attr -N /escsi/esdisk -a load_bal_policy
SCSI ATTRIBUTES FOR SETTABLE ATTRIBUTE SCOPE : /escsi/esdisk

name = load_bal_policy
current = least_cmd_load
default = round_robin
saved =

Save the load_bal_policy so the change is intact even with reboots.

# scsimgr save_attr -N /escsi/esdisk -a load_bal_policy=least_cmd_load

Verify the change made

# scsimgr get_attr -N /escsi/esdisk -a load_bal_policy

                SCSI ATTRIBUTES FOR SETTABLE ATTRIBUTE SCOPE : /escsi/esdisk

name = load_bal_policy
current = least_cmd_load
default = round_robin
saved = least_cmd_load

# scsimgr get_attr -a load_bal_policy -D /dev/rdisk/disk6

```

```
SCSI ATTRIBUTES FOR LUN : /dev/rdisk/disk6

name = load_bal_policy
current = round_robin
default = least_cmd_load
saved =
```

- f. If the `load_bal_policy` needs to be changed to default, issue the following commands.

```
# scsimgr save_attr -N /escsi/esdisk -a load_bal_policy=default
# scsimgr get_attr -N /escsi/esdisk -a load_bal_policy

SCSI ATTRIBUTES FOR SETTABLE ATTRIBUTE SCOPE : /escsi/esdisk

name = load_bal_policy
current = round_robin
default = round_robin
saved =
```

⚠ CAUTION: Do not change any other default values such as path failover and I/O retry values.

- g. LUN 0, which is used as a special Array Controller mode when talking with the HP initiator, is seen as a pass through device (`pt`) created by the `esctl` driver which only supports `path_lockdown` load balancing policy. Do not change any of these attributes for LUN 0.

```
# ioscan -kfnNC lunpath
lunpath 0 0/0/4/1/0.0x20420002ac000036.0x0          eslpt CLAIMED

LUN_PATH      LUN path for ctl4
lunpath 4 0/0/4/1/0.0x20420002ac000036.0x4001000000000000 eslpt CLAIMED

LUN_PATH      LUN path for disk0

# scsimgr get_attr all_lun

...
SCSI ATTRIBUTES FOR LUN : /dev/pt/pt4
Device type           = Array_Controller
Serial number         = 00000000
Vendor id             = 3PARdata
Product id            = ARRAY
Product revision      = 0000
I/O load balance policy = path_lockdown
LUN Path used when policy is path_lockdown =
0/0/4/1/0.0x20420002ac000036.0x0
```

- h. You can use the `get_stat` option to obtain the statistics of a given device and for debug purposes.

```
# scsimgr get_stat -D /dev/rdisk/disk6

STATISTICS FOR LUN :/dev/rdisk/disk6

Generic Statistics:
```

```

...
I/O transfer Statistics:

Bytes read                = 22816
Bytes written             = 912
Total I/Os processed     = 512
Asynchronous IO read failures = 0
Asynchronous IO write failures = 0

```

- i. In HP-UX 11i v3, a device WWN (HP 3PAR Storage System VV) is closely tied to its exported LUN ID (HP 3PAR Storage System VLUN). When seeing a different device WWN (HP 3PAR Storage System VV) on a previously used LUN ID (VLUN) to prevent data corruption, the host puts the LUN into an **authentication failure** state where the LUN path cannot be used for I/O transfer. This state causes the host to log a message in `/var/adm/syslog/syslog.log` and on the console to alert the user. The user should rely on these messages and should apply the recommended corrective action, which usually consists of running the `scsimgr replace_wwid` command.

NOTE: `scsimgr replace_wwid` replaced the `fcmsutil replace_dsk` option used in earlier HP-UX releases.

Example: issuing `showremovevln` and `createvln` shows that the HP 3PAR Storage System volume `oracle1` is exported as LUN 6 and seen as `/dev/rdisk/disk22` on the host.

```

# showvv -d

590          oracle1 RW 0/1/-  ---  ---  ---  ---          - 50002AC0024E0036
Tue Oct
30 19:31:59 PDT 2007
591          oracle2 RW 1/0/-  ---  ---  ---  ---          - 50002AC0024F0036
Tue Oct
30 19:32:01 PDT 2007

# showvln -a
Lun VVname      Host          -Host_WWN/iSCSI_Name-  Port  Type
6  oracle1      sqahpit2     50060B000068D5A4      0:4:2 host
6  oracle1      sqahpit2     50060B00001D1192      1:5:2 host

```

On the host, the following `ioscan` commands show that the host recognizes the VV.

```

# ioscan -kfnNC disk
Class I H/W Path Driver S/W State H/W Type Description
=====
disk 22 64000/0xfa00/0x244 esdisk CLAIMED DEVICE 3PARdataVV
          /dev/disk/disk22 /dev/rdisk/disk22

# ioscan -kfnNC lunpath
Class I H/W Path Driver S/W State H/W Type Description
=====
....
lunpath 19 0/0/4/1/0.0x20420002ac000036.0x4006000000000000 eslpt CLAIMED
LUN_PATH LUN path for disk22
lunpath 20 0/0/4/1/1.0x21520002ac000036.0x4006000000000000 eslpt CLAIMED
LUN_PATH LUN path for disk22

# scsimgr get_attr -D /dev/rdisk/disk22
...
current = 0x50002ac0024e0036 --> Oracle1

```

Remove the VLUN oracle1, and export oracle2 on the same LUN ID 6.

```
# removevln oracle1 6 sqahpit2
# createvln oracle2 6 sqahpit
```

Issuing `ioscan` on the HP-UX 11i v3 host shows the `scsimgr replace_wwid` in the `syslog.log` file and that the LUN path instances (19, 20) have failed the authentication.

```
# ioscan
# tail -f /var/adm/syslog/syslog.log
sqahpit2 vmunix: class : lunpath, instance 19
sqahpit2 vmunix: Evpd inquiry page 83h/80h failed or the current page 83h/80h
data do not match the previous known page 83h/80h data on LUN id 0x0 probed
beneath the target path (class = tgtpath, instance = 0) The lun path is
(class = lunpath, instance 19).Run 'scsimgr replace_wwid' command to validate
the change
sqahpit2 vmunix: An attempt to probe existing LUN id 0x4006000000000000 failed
with errno of 14.
sqahpit2 vmunix: class : lunpath, instance 20
sqahpit2 vmunix: class : lunpath, instance 19
sqahpit2 vmunix: Evpd inquiry page 83h/80h failed or the current page 83h/80h
data do not match the previous known page 83h/80h data on LUN id 0x0 probed
beneath the target path (class = tgtpath, instance = 1) The lun path is
(class = lunpath, instance 20).Run 'scsimgr replace_wwid' command to validate
the change
```

You can use oracle2 volume with the same device name (`/dev/rdisk/disk22`), which was previously allocated to oracle1 and have the same LUN path instance (19, 20). This feature is very useful for cases where applications, volume manager, file system do not need to be reconfigured. Then, use the DSF option as part of the `scsimgr replace_wwid` command which will preserve and reuse the existing device name (`/dev/rdisk/disk22`).

Not using the DSF option will generate a new DSF names example (`/dev/rdisk/disk23`) using the same LUN path instances.

```
# scsimgr replace_wwid -D /dev/rdisk/disk22 dsf
scsimgr:WARNING: Performing replace_wwid on the resource may have some
impact on system operation.
Do you really want to replace? (y/[n])? y
scsimgr: Successfully validated binding of LUN paths with new LUN.
# ioscan -kfnNC disk
Class      I  H/W Path  Driver S/W State   H/W Type      Description
=====
disk       22  64000/0xfa00/0x244  esdisk  CLAIMED  DEVICE      3PARdataVV
                                     /dev/disk/disk22  /dev/rdisk/disk22

# ioscan -kfnNC lunpath
Class      I  H/W Path  Driver S/W State   H/W Type      Description
=====
....
lunpath   19  0/0/4/1/0.0x20420002ac000036.0x4006000000000000  eslpt
CLAIMED   LUN_PATH      LUN path for disk22
lunpath   20  0/0/4/1/1.0x21520002ac000036.0x4006000000000000  eslpt
CLAIMED   LUN_PATH      LUN path for disk22

# scsimgr get_attr -D /dev/rdisk/disk22
...
current = 0x50002ac0024f0036 --> Oracle2
```

```

Without using the dsf option

# scsimgr replace_wwid -D /dev/rdisk/disk22
scsimgr:WARNING: Performing replace_wwid on the resource may have some
impact on system operation.
Do you really want to replace? (y/[n])? y
scsimgr: Successfully validated binding of LUN paths with new LUN.

# ioscan -kfnNC disk
Class      I  H/W Path  Driver S/W State  H/W Type      Description
=====
...
disk      22  64000/0xfa00/0x244  esdisk  NO_HW      DEVICE        3PARdataVV
                /dev/disk/disk22  /dev/rdisk/disk22
disk      23  64000/0xfa00/0x245  esdisk  CLAIMED    DEVICE        3PARdataVV
                /dev/disk/disk23  /dev/rdisk/disk23

# ioscan -kfnNC lunpath
Class      I  H/W Path  Driver S/W State  H/W Type      Description
=====
lunpath   19  0/0/4/1/0.0x20420002ac000036.0x4006000000000000  eslpt
CLAIMED   LUN_PATH    LUN path for disk23
lunpath   20  0/0/4/1/1.0x21520002ac000036.0x4006000000000000  eslpt
CLAIMED   LUN_PATH    LUN path for disk23

# scsimgr get_attr -D /dev/rdisk/disk23
...
current = 0x50002ac0024f0036 --> Oracle2

```

- j. In cases where all the LUNs below the target port are put in authentication state, which can happen when the target port was moved but the LUNs are same, then the target port must be authenticated. Use the following command to authenticate a target:

```

# scsimgr -f replace_wwid -C tgtpath -I 3
scsimgr: Successfully validated binding of LUN paths with new LUN

The target instance can be obtained using the "ioscan -kfnNC tgtpath" command

```

- k. You can change the DSF name to a new name or to an existing stale device using the `io_redirect_dsf` command.

The following example shows the host converting `/dev/disk/disk23` to the stale `/dev/disk/disk22`.

⚠ CAUTION: All I/O should be paused and the disk reconfigured from Volume Manger or Application before changing the name. For details, consult the appropriate HP documentation.

```

# io_redirect_dsf -d /dev/disk/disk23 -n /dev/disk/disk22
# ioscan
# ioscan -kfnNC disk
..
disk      23  64000/0xfa00/0x244  esdisk  NO_HW      DEVICE        3PARdataVV
                /dev/disk/disk23  /dev/rdisk/disk23
disk      22  64000/0xfa00/0x245  esdisk  CLAIMED    DEVICE        3PARdataVV
                /dev/disk/disk22  /dev/rdisk/disk22

```

```
# scsimgr get_attr -D /dev/rdisk/disk22
...
current = 0x50002ac0024f0036 --> Oracle2
```

- I. You can give alias names for the disk as a way of tracking the device names with the HP 3PAR Storage System volume name using the alias option for set_attr in the scsimgr command.

```
# ioscan -kfnNC disk
Class      I  H/W Path  Driver S/W State  H/W Type  Description
=====
...
disk      22  64000/0xfa00/0x245  esdisk  CLAIMED  DEVICE      3PARdataVV
                /dev/disk/disk22  /dev/rdisk/disk22

# scsimgr get_attr -D /dev/rdisk/disk22
...
current = 0x50002ac0024f0036 --> Oracle2 (InServ VV name)

# scsimgr set_attr -D /dev/rdisk/disk22 -a alias=oracle2
# scsimgr save_attr -D /dev/rdisk/disk22 -a alias=oracle2

# scsimgr -p get_attr all_lun -a device_file -a alias
...
/dev/rdisk/disk23:oracle2
```

7. You can list and remove all stale devices in the system using the following commands:

```
# ioscan -s --> lists all stale devices
Class      I  H/W Path  Driver
=====
disk      19  0/0/0/3/0.6.0  sdisk
fcp        0  0/0/4/1/0.18  fcd_fcp
ext_bus   11  0/0/4/1/0.18.1.0.0  fcd_vbus
disk       7  0/0/4/1/0.18.1.0.0.0.1  sdisk
disk       8  0/0/4/1/0.18.1.0.0.0.2  sdisk

# lssf -s --> also lists stale devices

# rmsf -x --> remove all stale device entries
rmsf: Removing stale entry at 0/0/0/3/0.6.0 for sdisk
rmsf: Removing stale entry at 0/0/4/1/0.18 for fcd_fcp
rmsf: Removing stale entry at 0/0/4/1/0.18.1.0.0 for fcd_vbus
rmsf: Removing stale entry at 0/0/4/1/0.18.1.0.0.0.1 for sdisk
```

8. The maximum volume size that can be created and exported on the storage server port is currently 2096128 MB (2047G). HP-UX is capable of registering a VV of this size. Use the diskinfo or scsimgr command or SAM tool to display the volume size of the exported LUN.

```
# diskinfo /dev/rdisk/disk3
SCSI describe of /dev/rdisk/disk3:
    vendor: 3PARdata
    product id: VV
    type: direct access
    size: 5242880 Kbytes
    bytes per sector: 512
```

```
# scsimgr get_info -D /dev/rdisk/disk3
Driver esdisk Status Information :

Capacity in number of blocks           = 10485760
Block size in bytes                     = 512
```

9. Some of the LVM commands such as `vgimport` require the `-N` option to be specified to use the new DSF device name (`/dev/disk/disk`). All display commands will show the persistent DSF name.

```
# ioscan -kfnNC disk
Class      I  H/W Path  Driver S/W State   H/W Type      Description
=====
disk       0  64000/0xfa00/0x23e  esdisk  CLAIMED  DEVICE      3PARdataVV
                /dev/disk/disk0  /dev/rdisk/disk0

# vgdisplay -v

VG Name                /dev/vgcluster
VG Write Access        read/write
VG Status               available
...

--- Physical volumes ---
PV Name                /dev/disk/disk0
PV Status               available
Total PE                1279
Free PE                 1279
Autoswitch              On
Proactive Polling       On
```

Setting Up Multipathing Software on 11i v2

1. For multipath load balancing and failover using the VERITAS DMP driver, install VERITAS Volume Manager using the instructions given in the VERITAS Volume Manager installation and administrator guides, available from:
www.VERITAS.com
or
<http://docs.hp.com>
2. The base VxVM package is installed as part of the HP-UX Operating System installation. To enable VxDMP, also install the following product bundle:
Patch bundle B9116AA on the HP-UX 11i v1 or v2 application Software CD or DVD for the appropriate installed OS release.

NOTE: This is licensed software. Contact HP or Veritas for the license.

3. After installation, use the `swlist` command to display the installed software:

```
#swlist (Itanium Server)
Base-VXVM B.04.10.011 Base VERITAS Volume Manager Bundle 4.1 for HP-UX
4.1.010.1 VERITAS Volume Manager 4.1 for HP-UX
# swlist (PA-RISC Server)
B9116AA 3.50 VERITAS Volume Manager 3.5 for HP-UX
Base-VXVM B.03.50.5 Base VERITAS Volume Manager Bundle 3.5 for HP-UX
```


4. To configure the VERITAS vxddm driver to manage the HP 3PAR Storage System server paths for path failure management and dynamic load balancing, register the storage server as a generic JBOD device using the following case-sensitive VERITAS command:

```
# vxddladm addjbod vid-3PARdata
```
5. To confirm the VERITAS vxddm driver has registered the HP 3PAR Storage System as a generic JBOD device, issue the following VERITAS command:

```
# vxddladm listjbod
VID          PID          Opcode   Page Code   Page Offset  SNO length
-----
3PARdata    ALL PIDs      18       -1          36          12
```

6. PVLinks, a component of Logical Volume Manager (LVM), can be used with storage server VVs that are exported on multiple paths to the host server to provide path failure management. PVLinks is an alternate pathing scheme where a primary and one or more alternate paths are defined for a device. The primary path is used until it fails, which causes one of the alternate paths to be used until the primary path is restored. In order for path failover with PVLinks to work, host I/O must be pointed at the LVM Logical Volume device, not at the raw or block special files in `/dev/rdisk` and `/dev/dsk`.

⚠ WARNING! Because HP-UX sees every path to a device (i.e., a single storage server VLUN) as a different device (e.g., `cxt0d0` and `cyt0d0`), the potential to overwrite data on a LUN exists if I/O is performed directly to the `/dev/dsk/` or `/dev/rdisk/` special files. The PVLinks feature is part of LVM volume management. Refer to HP LVM documentation (available at <http://docs.hp.com>) for information on using PVLinks. One such reference is the following HP document: *Managing Systems and Workgroups: A Guide for HP-UX System Administrators* HP, 9000, Computers Edition 5 Manufacturing Part Number: B2355-90742 Chapter 6: *Administering a System: Managing Disks and Files* Section: *Setting Up Alternate Links to a Physical Volume*.

Alternate links (paths) to a volume are defined at the volume group level using the `vgcreate` command or by using the SAM GUI.

```
# sam > Disk and File systems > Volume Groups & Logical Volumes
```

The order of failover paths specified during volume creation is important, as the failover priority will be considered in the same order as used when the volume was created. For example:

```
# vgcreate <volume name> <path1> <path2> <path3>...<pathn>
```

The failover path for the primary active path will be increased by 1 up to path `n`.

NOTE: If you are using the SAM utility to create volume groups, it creates all possible alternate links by default.

After the primary link has recovered, LVM will automatically switch the active I/O from the alternate path to the primary path unless you previously instructed it not to by using the `pvchange` LVM command.

After initial volume-group setup, path management is manipulated at the physical-volume level using HP-UX `pv...` commands. To display the paths to a device, and the status of each path, use HP-UX's `pvdisplay /dev/dsk/...` command. To display the paths to all devices within a volume-group, use HP-UX's `vgdisplay -v` command. The following example show partial output from these commands:

```
# vgdisplay -v
--- Logical volumes ---
```

```

LV Name           /dev/testdg/testvol1
LV Status         available/syncd
LV Size (Mbytes)  10000
Current LE       2500
Allocated PE     2500
Used PV          1
--- Physical volumes ---

PV Name          /dev/dsk/c120d1
PV Name          /dev/dsk/c14t0d1 Alternate Link
PV Status        available
Total PE         2559
Free PE          0
Autoswitch       On

```

NOTE: Refer to HP documentation at <http://docs.hp.com> for complete information on using the PVLinks feature to manage device paths.

- If the VERITAS Volume Manager's DMP driver is to be used, make the newly-registered VLUNs visible to the DMP layer using the following command which causes VxVM to rebuild its view of the device nodes:

```
# vxdctl enable
```

NOTE: LVM and VxVM may coexist on the same system but should not be used to manage the same devices.

NOTE: Remember to create raw and block device paths for the exported VLUNs using HP-UX's `ioscan` and `insf` commands before executing any LVM and VxVM commands for the new devices.

NOTE: The driver for AB379A, A6826A is `fcd` and driver for A6795A, A5158A is `td`. Replace `fcd` to `td` if using the A6795 or A5158 HBA in the below examples. The below example is for the A6826A HBA.

- The `fcmsutil` utility can be used to display important information about each HBA port using the port's `/dev/fcd<instance>` device node. The `fcd` instance number is shown in the output of the `ioscan -fun` command.

```

# ioscan -fun
Class  I H/W Path      Driver  S/W State  H/W Type      Description
=====
fc     0 0/0/8/1/0    fcd     CLAIMED   INTERFACE     HP A6826-60001
2Gb Dual Port PCI/PCI-X Fibre Channel Adapter (FC Port 1)

```

NOTE: Topology will be `PRIVATE_LOOP` for Direct connect and `PTTOPT_FABRIC` for Fabric connect. The below example is for Fabric.

```

# fcmsutil /dev/fcd0 (for Fabric connect)

Vendor ID is = 0x001077
Device ID is = 0x002312
PCI Sub-system Vendor ID is = 0x00103c
PCI Sub-system ID is = 0x0012ba
PCI Mode = PCI-X 133

MHz

ISP Code version = 3.3.153/

```

```

ISP Chip version = 3
Topology =
PTTOPT_FABRIC
Link Speed = 2Gb
Local N_Port_id is = 0x050200
Previous N_Port_id is = 0x050200
N_Port Node World Wide Name =
0x50060b00001d5845
N_Port Port World Wide Name =
0x50060b00001d5844
Switch Port World Wide Name =
0x200200051e3534c9
Switch Node World Wide Name =
0x100000051e3534c9
Driver state = ONLINE
Hardware Path is = 0/0/8/1/0
Maximum Frame Size = 2048
Driver-Firmware Dump Available = NO
Driver-Firmware Dump Timestamp = N/A
Driver Version = @(#) libfcd.a HP Fibre Channel ISP 23xx &
24xx Driver
B.11.23.04 /ux/core/isu/FCD/kern/src/common/wsio/fcd_init.c:Oct 18
2005,08:21:11

```

9. The Vital Product Data (VPD), including firmware version (Engineering Data Code), is shown using the vpd option of fcmsutil for A6826A HBA on the Itanium Server.

```

# fcmsutil /dev/fcd0 vpd
V I T A L P R O D U C T D A T A
-----
Product Description : "Dual Port 2Gbps/1Gbps Fibre Channel Universal
PCI-X Adapter"
Part number : "A6826-60001"
Engineering Date Code : "A-4408"
Part Serial number : "US00015487"
Misc. Information : "PW=15W;PCI 66MHZ;PCI-X 133MHZ"
Mfd. Date : "4410"
Check Sum : 0xbc
EFI version : "001.47"
ROM Firmware version : "003.003.154"
Asset Tag : "NA"

```

10. Use fcmsutil to find out other command fabric service parameters and connected storage server port WWNs. Here is an example for Fabric Connect:

```

# fcmsutil /dev/fcd0 get remote all
Target N_Port_id is = 0x050300
Target state = DSM_READY
Symbolic Name = LSI7202XP-LC A.1 03-00021-02B
FW:01.02.18 Port 1
Port Type = N_PORT
FCP-2 Support = NO
Target Port World Wide Name = 0x20110002ac00003e
Target Node World Wide Name = 0x2ff70002ac00003e
Common Service parameters (all values shown in hex):
*****
Common Features : 8800 RO_Bitmap: f
Total Conseq: ff
Class 3 Service parameters (all values shown in hex):
*****
Open Sequences/Exchg: 1 Conseq: ff

```

```

Recipient Control Flags: 0 Rxsz: 800
Example for Direct Connect
# fcmsutil /dev/fcd0 get remote all
    Target N_Port_id is = 0x0000ef
    Target Loop_id is = 0
    Target state = DSM_UNOPENED
    Symbolic Name =
    Port Type = NL_PORT
    FCP-2 Support = NO
    Target Port World Wide Name = 0x20020002ac00003e
    Target Node World Wide Name = 0x2ff70002ac00003e
Common Service parameters (all values shown in hex):
^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
Common Features : 8800 RO_Bitmap: fe
Total Conseq: ff
Class 3 Service parameters (all values shown in hex):
^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
    Open Sequences/Exchg: 1 Conseq: ff
    Recipient Control Flags: 0 Rxsz: 800

```

11. To find the storage volume serial number for the corresponding disk id on the HP-UX host, use the `cstm` command. The HP Online diagnostic tool must be installed to access the `cstm` command. For example:

```

# cstm
# selclass type disk
# info
# infolog
. . .
Hardware path: 0/2/0/0.8.0.0.0.4
The selected device is not supported by this tool.
Inaccurate information could be displayed by the tool.
Product Id:      VV      Vendor:      3PARdata
Device Type:     SCSI Disk      Firmware Rev: 0000
Device Qualifier: 3PARdataVV      Logical Unit: 4
Serial Number:   003B003E
Capacity (M Byte):  4096.00
Block Size:       512
Max Block Address:  8388607
. . .

```

Check the `ioscan -fun disk` for the given hardware path and use the HP 3PAR Storage System CLI command `showvln -lvw` or `showvv -d` to get the volume name. The data which matches is in bold font:

```

# showvln -lvw -host <hostname>
. . .
Active VLUNs
Lun VVname -----VV_WWN----- Host ----Host_WWN---- Port Type
 4 hpuxN.0 50002AC0003B003E      hp 50060B0000101A4C 1:0:3 host
 4 hpuxN.0 50002AC0003B003E      hp 50060B00000670A8 2:1:1 host
. . .

```

12. If an HP 3PAR Storage System node is rebooted or an HP 3PAR Storage System Cluster is rebooted and the connection type is Direct, performing an `ioscan` or `I/O` on any storage volume connected to the Agilent A6795A, A5158A HBA is required in order to see the host WWN with the `showhost` command. This is because the HPUX host driver log's into the target port only on doing one of the above operations.

Optional Instructions for Multipathing

1. For multipath load balancing and failover using the VERITAS DMP driver, install VERITAS Volume Manager using the instructions given in the VERITAS Volume Manager installation and administrator guides, available from:

www.VERITAS.com

or

<http://docs.hp.com>

2. The base VxVM package is installed as part of the HP-UX Operating System installation. To enable VxDMP, also install the following product bundle:

Patch bundle B9116AA on the HP-UX 11i v1 or v2 application Software CD or DVD for the appropriate installed OS release

NOTE: This is licensed software. Contact HP or Veritas for the license.

3. After installation, use the swlist command to display the installed software:

```
#swlist (Itanium Server)
Base-VXVM B .04.10.011 Base VERITAS Volume Manager Bundle 4.1 for HPUXB9116BA
4.1.010.1 VERITAS Volume Manager 4.1 for HP-UX
# swlist (PA-RISC Server)
B9116AA 3.5o VERITAS Volume Manager 3.5 for HP-UX
Base-VXVM B.03.50.5 Base VERITAS Volume Manager Bundle 3.5 for HP-UX
```

4. To configure the VERITAS vxdmp driver to manage the InServ storage server paths for path failure management and dynamic load balancing, register the storage server as a generic JBOD device using the following case-sensitive VERITAS command:

```
# vxddladm addjbod vid=3PARdata
```

5. To confirm the VERITAS vxdmp driver has registered the HP 3PAR Storage System as a generic JBOD device, issue the following VERITAS command:

```
# vxddladm listjbod
VID          PID          Opcode Page Code          Page Offset          SNO length
=====
3PARdata    ALL PIDs     18           -1           36           12
```

Using the ioscan Command with Multipathing Software to Verify HBA Connections

1. PVLinks, a component of Logical Volume Manager (LVM), can be used with storage server VVs that are exported on multiple paths to the host server to provide path failure management. PVLinks is an alternate pathing scheme where a primary and one or more alternate paths are defined for a device. The primary path is used until it fails, which causes one of the alternate paths to be used until the primary path is restored. In order for path failover with PVLinks to

work, host I/O must be pointed at the LVM Logical Volume device, not at the raw or block special files in `/dev/rdisk` and `/dev/dsk`.

⚠ WARNING! Because HP-UX sees every path to a device (i.e., a single storage server VLUN) as a different device (e.g., `cxt0d0` and `cyt0d0`), the potential to overwrite data on a LUN exists if I/O is performed directly to the `/dev/dsk/` or `/dev/rdisk/` special files. The PVLinks feature is part of LVM volume management. Refer to HP LVM documentation (available at <http://docs.hp.com>) for information on using PVLinks. One such reference is the following HP document: *Managing Systems and Workgroups: A Guide for HP-UX System Administrators, HP 9000 Computers Edition 5*, Manufacturing Part Number: B2355-90742, Chapter 6, "Administering a System: Managing Disks and Files," Section, "Setting Up Alternate Links to a Physical Volume."

Alternate links (paths) to a volume are defined at the volume group level using the `vgcreate` command or by using the SAM GUI.

```
# sam > Disk and File systems > Volume Groups & Logical Volumes
```

The order of failover paths specified during volume creation is important, as the failover priority will be considered in the same order as used when the volume was created. For example:

```
# vgcreate <volume name> <path1> <path2> <path3>...<pathn>
```

The failover path for the primary active path will be increased by 1 up to path n.

NOTE: If you are using the SAM utility to create volume groups, it creates all possible alternate links by default.

After the primary link has recovered, LVM will automatically switch the active I/O from the alternate path to the primary path unless you previously instructed it not to by using the `pvchange` LVM command.

After initial volume-group setup, path management is manipulated at the physical-volume level using HP-UX `pv...` commands. To display the paths to a device, and the status of each path, use HP-UX's `pvdisplay /dev/dsk/...` command. To display the paths to all devices within a volume-group, use HP-UX's `vgdisplay -v` command. The following example shows partial output from these commands:

```
# vgdisplay -v
-- Logical volumes --
LV Name   /dev/testdg/testvol1
LV Status   available/syncd
LV Size (Mbytes) 10000
Current LE 2500
Allocated PE 2500
Used PV    1
-- Physical volumes --
PV Name   /dev/dsk/c120d1
PV Name   /dev/dsk/c14t0d1 Alternate Link
PV Status available
Total PE 2559
Free PE   0
Autoswitch On
```

NOTE: Refer to HP documentation at <http://docs.hp.com> for complete information on using the PVLlinks feature to manage device paths.

2. If the VERITAS Volume Manager's DMP driver is to be used, make the newly-registered VLUNs visible to the DMP layer using the following command, which causes VxVM to rebuild its view of the device nodes:

```
# vxdctl enable
```

NOTE: LVM and VxVM may coexist on the same system but should not be used to manage the same devices.

NOTE: Remember to create raw and block device paths for the exported VLUNs using HP-UX's `ioscan` and `insf` commands before executing any LVM and VxVM commands for the new devices.

NOTE: The driver for AB379A, AD194A is `fcd` and driver for A6795A, AH402A is `td`. Replace `fcd` to `td` if using the A6795 or AH402A HBA in the examples below. The example below is for the AD194A HBA.

3. The `fcmsutil` utility can be used to display important information about each HBA port using the port's `/dev/fcd<instance>` device node. The `fcd` instance number is shown in the output of the `ioscan -fun` command.

```
# ioscan -fun
Class | H/W Path | Driver | S/W State | H/W Type | Description
-----|-----|-----|-----|-----|-----
fc 0 0/0/8/1/0 fcd CLAIMED INTERFACE HP AD194-60001
2Gb Dual Port PCI/PCI-X Fibre Channel Adapter (FC Port 1)
```

NOTE: Topology will be `PRIVATE_LOOP` for Direct connect and `PTTOPT_FABRIC` for Fabric connect. The example below is for Fabric.

```
# fcmsutil /dev/fcd0 (for Fabric connect)
Vendor ID is = 0x001077
Device ID is = 0x002312
PCI Sub-system Vendor ID is = 0x00103c
PCI Sub-system ID is = 0x0012ba
PCI Mode = PCI-X 133 MHz
ISP Code version = 3.3.153
ISP Chip version = 3
Topology = PTTOPT_FABRIC
Link Speed = 2Gb
Local N_Port_id is = 0x050200
Previous N_Port_id is = 0x050200
N_Port Node World Wide Name = 0x50060b00001d5845
N_Port Port World Wide Name = 0x50060b00001d5844
Switch Port World Wide Name = 0x200200051e3534c9
Switch Node World Wide Name = 0x100000051e3534c9
Driver state = ONLINE
Hardware Path is = 0/0/8/1/0
Maximum Frame Size = 2048
Driver-Firmware Dump Available = NO
Driver-Firmware Dump Timestamp = N/A
Driver Version = @(#) libfcd.a HP Fibre Channel ISP 23xx & 24xx Driver
B.11.23.04 /ux/core/isu/FCD/kern/src/common/wsio/fcd_init.c:Oct 18
2005,08:21:11
```


6. To find the storage volume serial number for the corresponding disk id on the HP-UX host, use the `cstm` command. The HP Online diagnostic tool must be installed to access the `cstm` command. For example:

```
# cstm
# selclass type disk
# info
# infolog
...
Hardware path: 0/2/0/0.8.0.0.0.4
The selected device is not supported by this tool.
Inaccurate information could be displayed by the tool.

Product Id:  VV  Vendor:  3PARdata
Device Type:  SCSI Disk  Firmware Rev:  0000
Device Qualifier:  3PARdataVV  Logical Unit:  4
Serial Number:  003B003E
Capacity (M Byte):  4096.00
Block Size:  512
Max Block Address:  8388607
...
```

Check the `ioscan -fun disk` for the given hardware path and use the HP 3PAR Storage System CLI command `showvlun -lvw` or `showvv -d` to get the volume name. The data which matches is in bold font:

```
# showvlun -lvw -host <hostname>
...
Active VLUNs
Lun VVname -----VV_WWN----- Host --- Host_WWN--- Port Type
4 hpuxN.0 50002AC0003B003E hp 50060B0000101A4C 1:0:3 host
4 hpuxN.0 50002AC0003B003E hp 50060B00000670A8 2:1:1 host
...
```

7. If an InServ node is rebooted or InServ Cluster is rebooted and the connection type is Direct, performing an `ioscan` or I/O on any storage volume connected to the Agilent A6795A, AH402A HBA is required in order to see the host WWN with the `showhost` command. This is because the HPUX host driver logs into the target port only on performing one of the above operations.

5 Removing HP 3PAR Devices on the Host Server

To remove a VV from the HP-UX 11i v3 or 11i v2 host, complete the following steps

1. Consult the appropriate HP-UX document about how to remove a specific volume type (e.g., VxVM, LVM).
2. Remove the VLUN from the HP 3PAR Storage System by issuing `removevln <VVname> <LUN> <host>`.

```
# removevln testvln 0 hpux-host
```

6 Booting the Host from the HP 3PAR Storage System

Refer to HP-UX boot over SAN from <http://docs.hp.com> to learn the benefits of configuring HP-UX to boot from the HP 3PAR Storage System.

HP 3PAR Storage System Setup Requirements

Booting from the HP 3PAR Storage System is supported in fabric and direct connect modes.

Make sure you have allocated enough space when creating your virtual volumes to be able to install your HP-UX OS.

To configure the HP 3PAR Storage System, see “Configuring the HP 3PAR Storage System Running InForm OS 3.1.x and OS 2.3.x” (page 6). After creating your first virtual volume, you must export it to your HP-UX host.

HP-UX Itanium Host HBA Considerations

You need to use the HBA's EFI version at the required minimum to handle booting from the HP 3PAR Storage System.

1. To prepare host, install required firmware for host HBAs to enable boot from the HP 3PAR Storage System. Collect and record the WWN of HBAs installed on the host. Check the memory size and give plenty of swap space on the boot volume. Decide the capacity of the boot volume before OS installation.

NOTE: For Itanium systems, install the supported EFI firmware for the AB379A/B, A6826A, A6795A cards. The firmware is downloadable from <http://www.hp.com> by searching the HBA model. Those versions of firmware are essential to enable the boot over SAN feature.

Here are the firmware and driver information for 3 major types of HBA on HP hosts.

Table 2 HBA and EFI Version

HBA	EFI Version
AB379B	2.20
AH402A	4.00A8
AD193A	2.20

The following example shows the HBA and EFI version in bold.

```
For AH402A
# fcmsutil /dev/fcd8 vpd
          V I T A L   P R O D U C T   D A T A
          -----
Product Description      : "HP 8Gb Single Channel PCI-e 2.0 FC HBA"
Part number              : "AJ762-63001"
Engineering Date Code    : "A-4408"
Part Serial number       : "MY19084VLN"
Misc. Information        : "PW=10.1 W; PCIE X8 GEN 2"
Mfd. Date                : "4908"
Check Sum                : 0xb7
EFI version              : "UU5.03A10"
ROM Firmware version     : "1.11X7 SLI-3 (U3D1.11X7)"
Asset Tag                 : "NA"
```

2. Prepare boot volume on HP 3PAR Storage System.
Refer to "Creating Storage on the HP 3PAR Storage System" (page 17) to setup the boot volume and export it to the host. Use the WWN recorded in Step 1.
3. Connect cable between host HBA port and HP 3PAR Storage System HBA port. Both direct and fabric connections are supported.
4. Power on host and check MP firmware level, refer to section 7 for requirements. Upgrade firmware if needed. Then insert installation DVD and boot from DVD to this point:

Installation from HP-UX 11i v2 or 11i v3 DVDs

Use the procedure described in *HP-UX 11i v2 and 11i v3 Implementation Guide* from <http://docs.hp.com>.

1. Insert the DVD into the HP-UX host server, and the following screen appears:

```

Welcome to the HP-UX installation/recovery process!

Use the <tab> key to navigate between fields, and the arrow keys
within fields. Use the <return/enter> key to select an item.
Use the <return/enter> or <space-bar> to pop-up a choices list. If the
menus are not clear, select the "Help" item for more information.

Hardware Summary:      System Model: 9000/800/rp7420
+-----+-----+-----+-----+-----+-----+-----+-----+
| Disks: 1 ( 33.9GB) | Floppies: 0 | LAN cards: 3 |                               |
| CD/DVDs: 1         | Tapes: 0   | Memory: 2040Mb  |                               |
| Graphics Ports: 0 | IO Buses: 7 | CPUs: 4         |                               |
+-----+-----+-----+-----+-----+-----+-----+
                               [ Scan Again ]
                               [ H/W Details ]
                               [ Install HP-UX ]
                               [ Run an Expert Recovery Shell ]
                               [ Advanced Options ]
                               [ Reboot ]
                               [ Help ]

```

2. Select **H/W Details** to verify that the HP 3PAR Storage System VV is visible.

```

[ H/W Details ]
Disk Drives:
  Model              Capacity(Mb)  WWID
  HP_36.4GST33675   34732       0x0011c6fffe28ddfc
    1/0/0/3/0.0x6.0x0

  3PARdataVV        36864       0x50002ac0001000b4
    1/0/6/1/0.0x21410002ac0000b4.0x4320000000000000

```

3. Select **Root Disk** then select **3PARdataVV**.

```

/opt/ignite/bin/itool ()  +
+-----+-----+-----+-----+-----+-----+-----+-----+
| Basic || Software || System || File System || Advanced |
| \-----+-----+-----+-----+-----+-----+-----+
| Configurations: [ HP-UX B.11.31 Default ->] [ Description... ]
| Environments: [ HP-UX Data Center Operatin ->] (HP-UX B.11.31)
| [ Root Disk ] HP_36.4GST336753LC, 1/0/0/3/0.0x6.0x0, 3>
| File System: [ Logical Volume Manager (LVM) with VxFS ->]

```

```

| [ Root Swap (MB)... ] 2048 Physical Memory (RAM) = 2040 MB
| [ Languages... ] English [ Keyboards... ] [ Additional... ]
+-----+
| [ Show Summary... ] [ Reset Configuration ]
+-----+
| [ Go! ] [ Cancel ] [ Help ]
+-----+
| [ Root Disk ]
| [ Root Disk ] 3PARdataVV, 1/0/6/1/0.0x21410002ac0000b4>

```

The following screen shows that the HP 3PAR Storage System is selected as the root disk.

```

/opt/ignite/bin/itool () +
+-----+
| Basic || Software || System || File System || Advanced |
| \-----+
| Configurations: [ HP-UX B.11.31 Default ->] [ Description... ]
| Environments: [ HP-UX Data Center Operatin ->] (HP-UX B.11.31)
| [ Root Disk ] 3PARdataVV, 1/0/6/1/0.0x21410002ac0000b4>
| File System: [ Logical Volume Manager (LVM) with VxFS ->]
| [ Root Swap (MB)... ] 2048 Physical Memory (RAM) = 2040 MB
| [ Languages... ] English [ Keyboards... ] [ Additional... ]
+-----+
| [ Show Summary... ] [ Reset Configuration ]
+-----+
| [ Go! ] [ Cancel ] [ Help ]
+-----+

```

4. The installation process will start to install files to the boot volume and set it to be the primary boot path. HP recommends that you have an HA redundant boot path.

A HP-UX Software List Command Output

Different servers may have different patch requirements. HP Itanium Servers boot over SAN running HP-UX 11i v3 March 2011 Data Center OE and HP-UX 11i v2 June 2008 Mission Critical OE installed with AB379A/B, AH402A, and AD193A HBA Cards. The list below shows all the products installed on our test server. The following products are part of the operating system installation, as well as other specific patches mentioned in the Host Server Setup section.

For HP-UX 11i v3:

```
# swlist
```

```
#
```

```
# Bundle(s):
```

```
B6848BA 1.4.gm.46.13 Ximian GNOME 1.4 GTK+ Libraries for HP-UX
B9073BA B.11.23.08.03.00.22 HP-UX iCOD Instant Capacity (iCAP)
B9901AA A.11.23.15.01 HP IPFilter 3.5alpha5
BUNDLE11i B.11.23.0409.3 Required Patch Bundle for HP-UX 11i v2 (B.11.23), September
2004
Base-VXFS 4.1.002 VERITAS File System Bundle 4.1 for HP-UX
Base-VXVM B.04.10.011 Base VERITAS Volume Manager Bundle 4.1 for HP-UX
CDE-English B.11.23.0409 English CDE Environment
CommonIO B.11.23.0712 Common IO Drivers
DSAUilities C.01.00.11 HP-UX Distributed Systems Administration Utilities
DynRootDisk A.3.0.0.1027 Dynamic Root Disk
EnableVxFS B.11.23.07 File-System library, commands enhancements for VxFS4.1 and 5.0
FDDI-00 B.11.23.01 PCI FDDI;Supptd HW=A3739B;SW=J3626AA
FEATURE11i B.11.23.0712.070 Feature Enablement Patches for HP-UX 11i v2, December
2007
FIREFOX 2.0.0.4ar.00 Firefox for HP-UX
FIREFOXsrc 2.0.0.4ar.00 Firefox Source distribution
FibrChanl-00 B.11.23.0712 PCI FibreChannel;Supptd HW=A6795A,A5158A
FibrChanl-01 B.11.23.08.02
FibrChnl;SupptdHW=A6826A,A9782A,A9784A,AB378A,AB379A,AB465A,AD193A,AD194A,AD300A
FibrChanl-02 B.11.23.0712 PCIe FibreChannel;Supptd HW=AD299A,AD355A
GTK 2.6.8.00.01 GTK+ 2.6 The Gnome GUI Runtime Toolkit
GTKsrc 2.6.8.00.01 Gtk Source distribution
GigEther-00 B.11.23.0512 PCI GigEther;Supptd
HW=A4926A/A4929A/A6096A;SW=J1642AA
GigEther-01 B.11.23.0712 PCI GigEther;Supptd
HW=A6825A/A6794A/A6847A/A8685A/A9782A/A9784A/A7109A/AB465A
GuestAVIOStor B.11.23.0712 HPVM Guest AVIO Storage Software
GuestAvioLan B.11.23.0712 HPVM Guest AVIO LAN Software
HPUX11i-OE-MC B.11.23.0712 HP-UX Mission Critical Operating Environment Component
HPUXBaseAux B.11.23.0712 HP-UX Base OS Auxiliary
HPUXBaseOS B.11.23 HP-UX Base OS
HPUXBastille B.3.0.29 Bastille Security Hardening Tool
HWEnable11i B.11.23.0712.070 Hardware Enablement Patches for HP-UX 11i v2, December
2007
HostAVIOStor B.11.23.0712 HPVM Host AVIO Storage Software
HostAvioLan B.11.23.0712.01 HPVM Host AVIO LAN Software
IEther-00 B.11.23.0712 PCI/PCI-X/PCIe IEther
ISEEPlatform A.03.95.510.46.03 ISEE Platform
Java15JDK 1.5.0.09.00 Java 1.5 JDK for HP-UX
Java15JDKadd 1.5.0.09.00 Java 1.5 JDK -AA addon for HP-UX
Java15JRE 1.5.0.09.00 Java 1.5 JRE for HP-UX
Java15JREadd 1.5.0.09.00 Java 1.5 JRE -AA addon for HP-UX
Judy B.11.23.04.17 Judy Library and Related files
LVMPProvider R.11.23.009 CIM/WBEM Provider for LVM
```

MOZILLA 1.7.13.01.00 Mozilla for HP-UX
 MOZILLAsrc 1.7.13.01.00 Mozilla Source distribution
 OnlineDiag B.11.23.10.05 HPUX 11.23 Support Tools Bundle, December 2007
 ParMgr B.23.02.01.03 Partition Manager - HP-UX
 ProviderDefault B.11.23.0712 Select WBEM Providers
 QPKAPPS B.11.23.0712.070a Applications Patches for HP-UX 11i v2, December 2007
 QPKBASE B.11.23.0712.070a Base Quality Pack Bundle for HP-UX 11i v2, December 2007
 RAID-01 B.11.23.0806 RAID SA; Supptd HW=A7143A/A9890A/A9891A
 Sec00Tools B.01.04.10 Install-Time security infrastructure.
 SerialSCSI-00 B.11.23.0806 PCI-X/PCI-E SerialSCSI
 SwAssistant C.01.02 HP-UX Software Assistant
 SysFaultMgmt B.05.00.05.01 HPUX System Fault Management
 SysMgmtWeb A.2.2.7 HP-UX Web Based System Management User Interfaces
 T1456AA 1.4.2.15.00 Java2 1.4 SDK for HP-UX
 T1456AAaddon 1.4.2.15.00 Java2 1.4 SDK -AA addon for HP-UX
 T1457AA 1.4.2.15.00 Java2 1.4 RTE for HP-UX
 T1457AAaddon 1.4.2.15.00 Java2 1.4 RTE -AA addon for HP-UX
 T1471AA A.04.50.021 HP-UX Secure Shell
 TBIRD 2.0.0.6.00 Thunderbird for HP-UX
 TBIRDsrc 2.0.0.6.00 Thunderbird Source distribution
 USB-00 C.01.04.07 USB Subsystem and Drivers
 VMGuestLib A.03.50 Integrity VM Guest Support Libraries
 hpuxwsApache B.2.0.59.01 HP-UX Apache-based Web Server
 hpuxwsTomcat B.5.5.23.00 HP-UX Tomcat-based Servlet Engine
 hpuxwsWebmin A.1.070.10 HP-UX Webmin-based Admin
 hpuxwsXml A.2.03 HP-UX XML Web Server Tools
 perl D.5.8.8.B 5.8.8 Perl Programming Language
 scsiU320-00 B.11.23.0712 PCI-X SCSI U320; Supptd HW=A7173A/AB290A

For HP-UX 11i v2:

swlist

#

Bundle(s):

B6848BA 1.4.gm.46.13 Ximian GNOME 1.4 GTK+ Libraries for HP-UX
 B9073BA B.11.23.08.03.00.22 HP-UX iCOD Instant Capacity (iCAP)
 B9901AA A.11.23.15.01 HP IPFilter 3.5alpha5
 BUNDLE11i B.11.23.0409.3 Required Patch Bundle for HP-UX 11i v2 (B.11.23), September 2004
 Base-VXFS v4.1.002 VERITAS File System Bundle 4.1 for HP-UX
 Base-VXVM B.04.10.011 Base VERITAS Volume Manager Bundle 4.1 for HP-UX
 CDE-English B.11.23.0409 English CDE Environment
 CommonIO B.11.23.0712 Common IO Drivers
 DSAUtilities C.01.00.11 HP-UX Distributed Systems Administration Utilities
 DynRootDisk A.3.0.0.1027 Dynamic Root Disk
 EnableVxFS B.11.23.07 File-System library, commands enhancements for VxFS4.1 and 5.0
 FDDI-00 B.11.23.01 PCI FDDI;Supptd HW=A3739B;SW=J3626AA
 FEATURE11i B.11.23.0712.070 Feature Enablement Patches for HP-UX 11i v2, December 2007
 FIREFOX 2.0.0.4ar.00 Firefox for HP-UX
 FIREFOXsrc 2.0.0.4ar.00 Firefox Source distribution
 FibrChanl-00 B.11.23.0712 PCI FibreChannel;Supptd HW=A6795A,A5158A
 FibrChanl-01 B.11.23.08.02
 FibrChnl;SupptdHW=A6826A,A9782A,A9784A,AB378A,AB379A,AB465A,AD193A,AD194A,AD300A
 FibrChanl-02 B.11.23.0712 PCIe FibreChannel;Supptd HW=AD299A,AD355A
 GTK 2.6.8.00.01 GTK+ 2.6 The Gnome GUI Runtime Toolkit
 GTKsrc 2.6.8.00.01 Gtk Source distribution
 GigEther-00 B.11.23.0512 PCI GigEther;Supptd
 HW=A4926A/A4929A/A6096A;SW=J1642AA

GigEther-01 B.11.23.0712 PCI GigEther;Supptd
 HW=A6825A/A6794A/A6847A/A8685A/A9782A/A9784A/A7109A/AB465A
 GuestAVIOStor B.11.23.0712 HPVM Guest AVIO Storage Software
 GuestAvioLan B.11.23.0712 HPVM Guest AVIO LAN Software
 HPUX11i-OE-MC B.11.23.0712 HP-UX Mission Critical Operating Environment Component
 HPUXBaseAux B.11.23.0712 HP-UX Base OS Auxiliary
 HPUXBaseOS B.11.23 HP-UX Base OS
 HPUXBastille B.3.0.29 Bastille Security Hardening Tool
 HWEnable11i B.11.23.0712.070 Hardware Enablement Patches for HP-UX 11i v2, December 2007
 HostAVIOStor B.11.23.0712 HPVM Host AVIO Storage Software
 HostAvioLan B.11.23.0712.01 HPVM Host AVIO LAN Software
 IEther-00 B.11.23.0712 PCI/PCI-X/PCIe IEther
 ISEEPlatform A.03.95.510.46.03 ISEE Platform
 Java15JDK 1.5.0.09.00 Java 1.5 JDK for HP-UX
 Java15JDKadd 1.5.0.09.00 Java 1.5 JDK -AA addon for HP-UX
 Java15JRE 1.5.0.09.00 Java 1.5 JRE for HP-UX
 Java15JREadd 1.5.0.09.00 Java 1.5 JRE -AA addon for HP-UX
 Judy B.11.23.04.17 Judy Library and Related files
 LVMPProvider R11.23.009 CIM/WBEM Provider for LVM
 MOZILLA 1.7.13.01.00 Mozilla for HP-UX
 MOZILLAsrc 1.7.13.01.00 Mozilla Source distribution
 OnlineDiag B.11.23.10.05 HPUX 11.23 Support Tools Bundle, December 2007
 ParMgr B.23.02.01.03 Partition Manager - HP-UX
 ProviderDefault B.11.23.0712 Select WBEM Providers
 QPKAPPS B.11.23.0712.070a Applications Patches for HP-UX 11i v2, December 2007
 QPKBASE B.11.23.0712.070a Base Quality Pack Bundle for HP-UX 11i v2, December 2007
 RAID-01 B.11.23.0806 RAID SA; Supptd HW=A7143A/A9890A/A9891A
 Sec00Tools B.01.04.10 Install-Time security infrastructure.
 SerialSCSI-00 B.11.23.0806 PCI-X/PCI-E SerialSCSI
 SwAssistant C.01.02 HP-UX Software Assistant
 SysFaultMgmt B.05.00.05.01 HPUX System Fault Management
 SysMgmtWeb A.2.2.7 HP-UX Web Based System Management User Interfaces
 T1456AA 1.4.2.15.00 Java2 1.4 SDK for HP-UX
 T1456AAaddon 1.4.2.15.00 Java2 1.4 SDK -AA addon for HP-UX
 T1457AA 1.4.2.15.00 Java2 1.4 RTE for HP-UX
 T1457AAaddon 1.4.2.15.00 Java2 1.4 RTE -AA addon for HP-UX
 T1471AA A.04.50.021 HP-UX Secure Shell
 TBIRD 2.0.0.6.00 Thunderbird for HP-UX
 TBIRDsrc 2.0.0.6.00 Thunderbird Source distribution
 USB-00 C.01.04.07 USB Subsystem and Drivers
 VMGuestLib A.03.50 Integrity VM Guest Support Libraries
 hpuxwsApache B.2.0.59.01 HP-UX Apache-based Web Server
 hpuxwsTomcat B.5.5.23.00 HP-UX Tomcat-based Servlet Engine
 hpuxwsWebmin A.1.070.10 HP-UX Webmin-based Admin
 hpuxwsXml A.2.03 HP-UX XML Web Server Tools
 perl D.5.8.8.B 5.8.8 Perl Programming Language
 scsiU320-00 B.11.23.0712 PCI-X SCSI U320; Supptd HW=A7173A/AB290A