

FCP HP-UX® Attach Kit 1.1

Installation and Setup Guide

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Preface

About this guide	This guide describes how to set up the interaction between an HP-UX host and a Network Appliance™ storage appliance (filer) running Data ONTAP™ software with the Fibre Channel Protocol (FCP) for SCSI licensed.
Audience	This guide is for system installers and administrators who are familiar with the HP-UX operating system. It assumes that you understand how to configure and administer a filer and use the filer-licensed SAN protocol, FCP, to store and retrieve data on a filer.
Terminology	This guide uses the following terms: ◆ <i>LUN</i> (Logical Unit Number) refers to a logical unit of storage identified by a number. ◆ <i>LUN ID</i> refers to the numerical identifier for a LUN. ◆ <i>NetApp storage</i>, <i>storage appliance</i>, or <i>Filer</i> refers to a NetApp® storage appliance that incorporates the CompactFlash™ unit and supports FCP. ◆ <i>Type</i> refers to pressing one or more keys on the keyboard. ◆ <i>Enter</i> refers to pressing one or more keys and then pressing the Enter key.
Filer command conventions	You can enter filer commands on either the system console or from any host system that can access the filer using a remote login, such as the <code>telnet</code> command.
Keyboard conventions	When describing key combinations, this guide uses the hyphen (-) to separate individual keys. For example, “Ctrl-D” means pressing the “Control” and “D” keys simultaneously. Also, this guide uses the term “Enter” to refer to the key that generates a carriage return, although the key is named “Return” on some keyboards.

Typographic conventions

The following table describes typographic conventions used in this guide.

Convention	Type of information
<i>Italic type</i>	◆ Words or characters that require special attention. ◆ Placeholders for information you must supply. For example, if the guide says to enter the <code>lun show -v lunpath</code> command, you enter the characters “lun show -v” followed by the actual path to the LUN. ◆ Book titles listed in cross-references.
Monospaced font	◆ Command and daemon names. ◆ Information displayed on the system console or other computer monitors. ◆ The contents of files.
Bold monospaced font	◆ Words or characters you type. What you type is always shown in lowercase letters, unless you must type it in uppercase letters.

Special messages

This guide contains the following types of special messages:

Note

A note contains important information that helps you install or operate the system efficiently.

Caution

A caution contains instructions that you must follow to avoid damage to the equipment, a system crash, or loss of data.

WARNING

A warning contains instructions that you must follow to avoid personal injury.

About this chapter This chapter provides a brief explanation of the host and filer communication and supported configurations.

Topics covered in this chapter This chapter presents the following topics:

- ◆ “[Understanding host and filer \(NetApp storage\) communication](#)” on page 2
- ◆ “[Supported configurations](#)” on page 3
- ◆ “[How target FCP ports process traffic for a cluster](#)” on page 5

Understanding host and filer (NetApp storage) communication

How the host and storage appliance communicate

The HP-UX host uses the SCSI protocol over Fibre Channel (FCP) to access data on filers running NetApp's Data ONTAP software. The filers are target FCP storage appliances. Each host must have Fibre Channel host bus adapters (HBAs) that use FCP to access logical unit numbers (LUNs) on a storage appliance to store and retrieve data.

Note

You should install the HBA on the host before you install the NetApp software package. Make sure that you use an HBA supported by NetApp. See the NetApp Fibre Channel Host Support Matrix at http://now.netapp.com/NOW/knowledge/docs/san/fcp_iscsi_config/fcp_support.shtml for more information.

On a host, a World Wide Port Name (WWPN) identifies each physical and virtual port on the HBA. You supply the WWPNs when you create initiator groups (igroups) on a filer. An igroup permits the host access to specific LUNs on a filer.

Each target HBA on a storage appliance has two ports—Port A and Port B. Port A is always active. Whether Port B is active depends on the following:

- ◆ If it is part of a clustered pair, the `cfmode` setting of the storage appliances determines when Port B is active.

Note

For information about `cfmode` settings, see the *Data ONTAP Block Access Management Guide*.

- ◆ If it is a stand-alone storage appliance, Port B is always active.

Supported configurations

Configuration components

NetApp supports several types of configurations consisting of different components.

Host configuration components: The HP-UX host can have up to four initiator HBAs.

Connection topology components: The connection topology between the NetApp storage appliance and the host can be one of the following:

- ◆ A direct connection where each host HBA is directly connected to the target HBA port.
- ◆ Switched fabric (SAN) consisting of either one Fibre Channel switch or a pair of redundant Fibre Channel switches

Multipathing software: The complete configuration can consist of multiple hosts and multiple storage appliances connected directly or using either a single SAN fabric or several separate SAN fabrics.

Configurations that use two or more physical paths to the same LUN must have multipathing software installed on the host. The FCP HP-UX Attach Kit supports:

- ◆ HP PVLlinks
- ◆ VERITAS Storage Foundation Suite 3.5 DMP for Multipathing software

Data requirements for supported configurations

The type of configuration you deploy depends on your data requirements, as listed in the following table:

Data requirements	Recommended configuration
Highly critical data, critical data availability and/or production environment	Fully redundant configuration with two FCP switches
Less critical data and/or less critical business applications	Direct FCP connection or single switch (non-redundant) configuration

Example production topologies

NetApp recommends the following configurations for production environments. For additional information about supported configurations, including topology and cabling examples, see the FCP Configuration Guide at http://now.netapp.com/NOW/knowledge/docs/san/fcp_iscsi_config/QuickRef/FCPConfigurationGuide.pdf.

F8xx or FAS9xx series storage appliances: Production configurations consist of a storage appliance cluster, one or more hosts, and redundant fabrics. Each host is multi-attached so that it has one or more connections to each switch. Each storage appliance has two or more connections to each switch.

These configurations require that you have multipathing software installed on the host.

By combining multipathing, redundant fabrics, and NetApp storage clustering, these configurations create a no-single-point-of-failure solution between the host and the storage appliances.

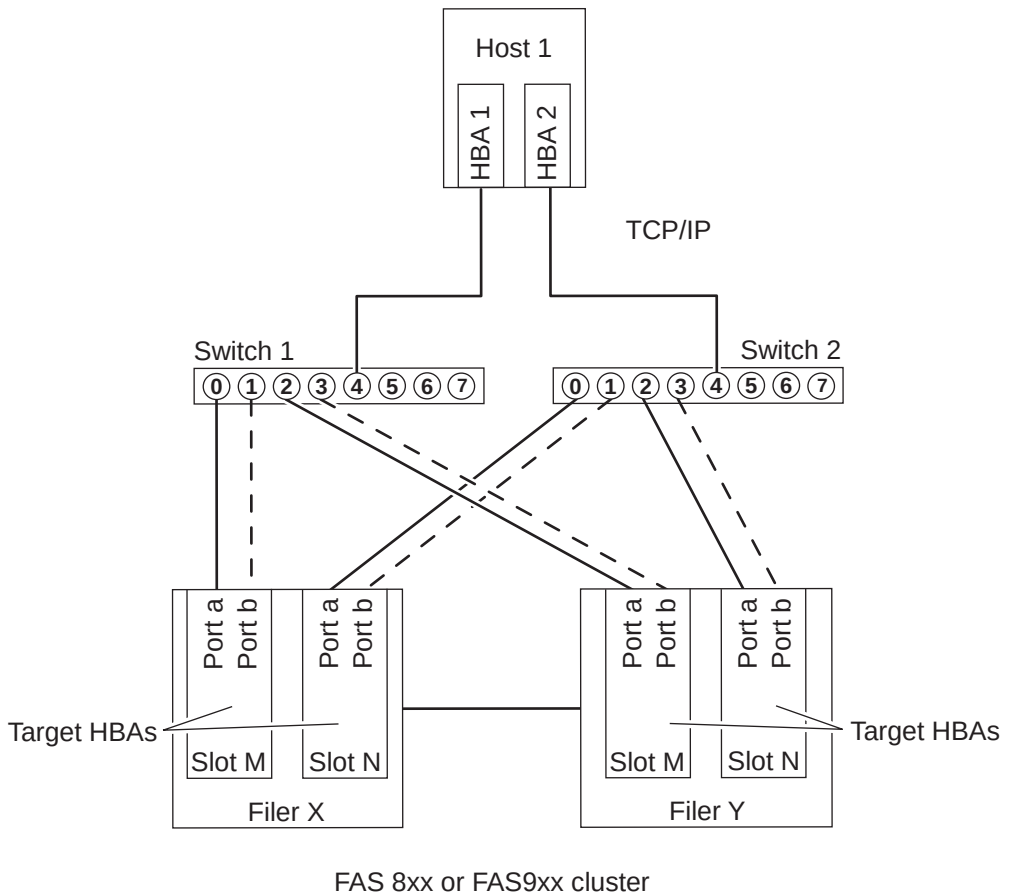
FAS270 storage appliances: Production configurations consist of a FAS270 cluster, one or more multi-attached hosts, and two switches. A FAS270 cluster consists of two storage appliances integrated into a NetApp disk shelf. Each storage appliance has one connection to each switch. FAS270 cluster configurations also require that you have multipathing software on the host.

How target FCP ports process traffic for a cluster

Default target port settings for F8xx or FAS9xx clusters

Each target HBA on an F8xx or a FAS9xx model has two ports that are labeled Port A and Port B.

When you have the default target port settings (that is, the cfmode is set to partner), Port A provides access to local LUNs, and Port B provides access to LUNs on the partner. The following figure shows a sample configuration with a multi-attached host connecting to a cluster. The solid lines represent paths to LUNs on the local node; the dotted lines represent paths to partner LUNs.



Multipathing software must be installed on the host when the target ports operate in this mode because each LUN is accessible over multiple paths. The multipathing software reports Port A as a primary path and Port B as a secondary path.

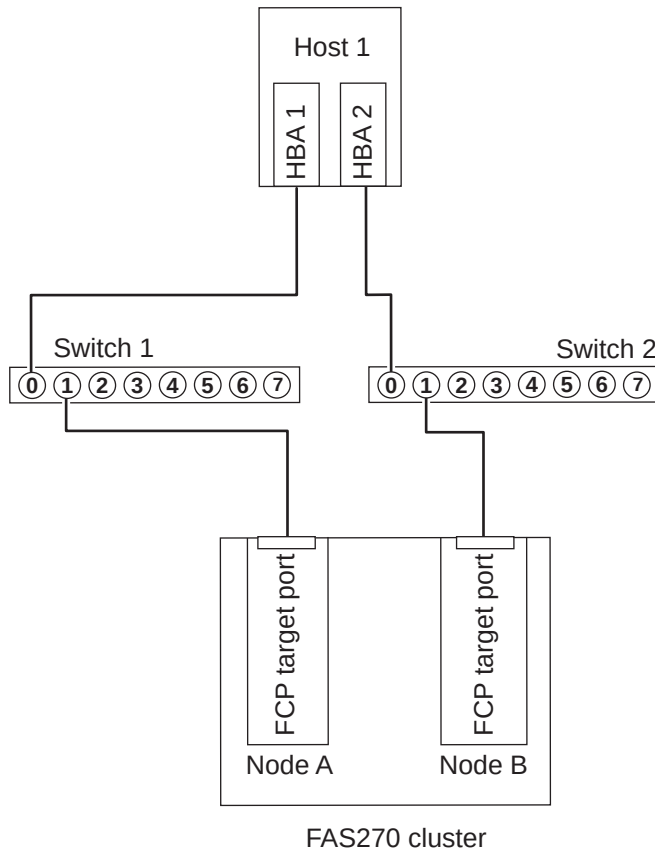
The table shows paths to a LUN on each storage appliance in the configuration example.

	Type of path	Target FCP ports
Filer X LUN	Local/Primary	Port A, Slot M on Filer X Port A, Slot N on Filer X
	Partner/Secondary	Port B, Slot M on Filer Y Port B, Slot N on Filer Y
Filer Y LUN	Local/Primary	Port A, Slot M on Filer Y Port A, Slot N on Filer Y
	Partner/Secondary	Port B, Slot N on Filer X Port B, Slot N on Filer X

Default target port settings for FAS270 clusters

A FAS270 cluster consists of two storage appliances integrated into a DS14 disk shelf. Each storage appliance has two Fibre Channel ports. The port labeled Fibre Channel 1 operates as a Fibre Channel target port after you license the FCP service and reboot the storage appliance. The port labeled Fibre Channel 2 is used to connect additional disk shelves to the FAS270 cluster.

The following figure shows a configuration example using the default target port settings where a multi-attached host accesses a FAS270 cluster.



On FAS270 clusters, the FCP target ports log into the fabric using loop topology. Each physical port supports a virtual local port, which provides access to local LUNs, and a virtual partner port, which provides access to LUNs on the partner node.

The virtual ports enable the FAS270, which has only one target FCP port, to support traffic for both nodes in the cluster. For example, if Switch 1 fails, the multipathing software on the host uses Switch 2 to access the partner port on Node B. When the cluster is in a takeover state, the virtual partner port on the takeover node provides access to LUNs on both nodes.

About this chapter This chapter describes the tasks you should perform before installing the NetApp Host Attach Kit on the HP-UX host.

Topics in this chapter This chapter discusses the following topics:

- ◆ [“Overview of the host attach kit installation and setup”](#) on page 10
- ◆ [“Completing the pre-installation tasks”](#) on page 12
- ◆ [“Where to go for more information”](#) on page 17

Overview of the host attach kit installation and setup

Checklist of tasks to perform

Installing the host attach kit and setting up your system involves numerous steps that are performed on both the storage appliance and the host. The following is a high-level checklist of the tasks you must perform and the machines involved.

Note

The instructions in this document use HP-UX commands to perform tasks, not the HP-UX GUI System Administration tool (SAM). This is because you cannot perform all the tasks using SAM. Some tasks, such as setting up alternate links to a physical volume, must be performed using HP-UX commands.

Step	Action	Machine	Details
Preparing to install the NetApp software package			
1	Review the information on the supported configurations and plan your configuration.		Chapter 1
2	Get a copy of the host attach kit and review its contents.		Chapter 2
3	Verify that your system meets the system requirements and that you have the HBA installed. Note _____ NetApp does not supply the host HBA.	Host	Chapter 2
4	Verify that the NetApp storage appliance is set up and configured as outlined in the <i>SAN Setup Overview</i> . This document is included with your host attach kit.	storage appliance	<i>SAN Setup Overview</i> , Chapter 2
5	Verify that the switch, if you're using a fabric connection, is set up correctly and, if appropriate for your system, zoned.	Switch, storage appliance, Host	Chapter 2, <i>SAN Setup Overview</i> , <i>FCP/iSCSI Configuration Guide</i>
6	Verify that the power to the switches, disk shelves, storage appliances, and hosts is turned on in the correct order.	Switch, Disk shelves, storage appliance, Host	Chapter 2

Step	Action	Machine	Details
7	Verify that the host and storage appliance can communicate.	storage appliance, Host	Chapter 2
Installing the NetApp software package			
8	Get a copy of the NetApp software package, either by downloading it from the NOW site or from the CD.		Chapter 3
9	Uncompress the NetApp software package file using the <code>gunzip</code> command.	Host	Chapter 3
10	Install the NetApp software package, which is a standard HP-UX depot file.	Host	Chapter 3
11	If you want to manage LUNs by using VERITAS® Volume Manager (VxVM) software, install the Array Support Library 3.5 for HP-UX® and NetApp® Storage	Host	<i>Installing and Managing VERITAS® Array Support Library 3.5 for HP-UX® and NetApp® Storage</i>
Creating and configuring LUNs			
12	If you have a NetApp cluster, verify that the <code>cfmode</code> is correct.	storage appliance	Chapter 4
13	Create igroups that contain the WWPNs of host HBAs.	storage appliance	Chapter 4
14	Create LUNs and map them to igroups.	storage appliance	Chapter 4
15	Discover the LUNs on the host.	Host	Chapter 4
16	Configure the LUNs under the control of one of the following volume manager products: ◆ HP-UX Logical Volume Manager (LVM) ◆ VERITAS Volume Manager (VxVM)	Host	Chapter 4

Completing the pre-installation tasks

Tasks to perform

This section describes the following tasks you should perform in preparation to installing the NetApp software and setting up your system, including:

- ◆ Verify the contents of the attach kit.
- ◆ Verify that your host meets the system requirements.
- ◆ Verify that the storage appliance is installed and configured.
- ◆ Verify that the switch is installed and configured.
- ◆ Verify that the storage appliance is cabled to the switch according to the topology requirements of your configuration.
- ◆ Verify that the host and storage appliance can communicate over a management connection.

Verifying the contents of the host attach kit,

To verify the contents of the host attach kit complete the following step.

Step	Action
1	Open the host attach kit and check for the following items: ◆ <i>FCP HP-UX® Attach Kit 1.1 Installation and Setup Guide</i> (this guide) ◆ Media package ❖ <i>FCP HP-UX® Attach Kit 1.1 Release Notes</i> ❖ CD-ROM with the <code>ntap_hpux_fcp_1_1.depot.gz</code> file that contains the <code>sanlun</code> utility and other scripts that NetApp supplies with this release (you can also download this file from the NOW site) ❖ CD-ROM for NetApp Array Support Library (ASL) 3.5 ❖ <i>Installing and Managing VERITAS® Array Support Library 3.5 for HP-UX® and NetApp® Storage</i> document ❖ License agreement

Verify that your host meets the system requirements

Verify that the components in your configuration are qualified and supported by NetApp by checking the online NetApp Fibre Channel Host Support Matrix at http://now.netapp.com/NOW/knowledge/docs/san/fcp_iscsi_config/fcp_support.shtml. The support matrix provides information about the following components:

- ◆ Hardware platforms
- ◆ OS version and patch requirements
- ◆ Supported HBAs and firmware
- ◆ Supported versions of Data ONTAP
- ◆ Supported configurations
- ◆ SAN booting OS and firmware requirements
- ◆ Supported versions of VERITAS Volume Manager (VxVM) and VERITAS Cluster Server (VCS)
- ◆ VERITAS patch requirements

Verify that the host HBA is installed

The host HBAs should be installed before you install the NetApp software package. If you have not installed the HBA, complete the following steps.

Step	Action
1	Verify that the host meets system and OS requirements by checking the online NetApp Fibre Channel Host Support Matrix at http://now.netapp.com/NOW/knowledge/docs/san/fcp_iscsi_config/fcp_support.shtml. Note_____ The HP-UX 11i version of the operating system includes the HBA drivers by default. _____
2	Power down your host machine.
3	Install the HBA card(s). See the documentation that came with your HBA cards for information on doing this.
4	Restart the system.

Installing and configuring the storage appliance

To install and configure the storage appliance, complete the following steps.

Step	Action
1	Confirm that the storage appliance is racked and configured as described in the following documents: ◆ <i>Installation and Setup Instructions</i> flyer that shipped with your system. ◆ Hardware Cluster Guide, which is available on NOW at http://now.netapp.com/NOW/knowledge/docs/docs.shtml. Caution_____ The storage appliance must be set up and configured before creating initiator groups and LUNs. _____
2	Install the FCP target HBAs in the storage appliance, if needed.
3	Cable the storage appliance to the switch or the host according to your configuration topology. You can cable a host and storage appliance in the following ways: ◆ Fabric-attached, where a host is cabled to a NetApp cluster through a single or dual-fabric. ◆ Direct-attached, where a single-attached with one HBA or multi-attached host with multiple HBAs is cabled directly to a stand-alone storage appliance.
4	Set up and configure Data ONTAP on the storage appliance. For detailed information, see the <i>Data ONTAP Software Setup Guide</i> at http://now.netapp.com/NOW/knowledge/docs/docs.shtml .
5	Licensed and enabled the FCP protocol.
6	Created working volumes and qtrees (if desired) on the storage appliance.

Verify the switch is installed and configured

If you have fabric-attached configuration, verify that the switch is installed and configured by completing the following step.

Step	Action
1	Check that the switch is set up and configured. You should have completed the following tasks: ◆ Installed the switch in a system cabinet or rack. ◆ Configured the network parameters for the switch, including its serial parameters and IP address.

Determining whether to use switch zoning

If you have a fabric-attached configuration, determine whether switch zoning is appropriate for your system setup.

The Logical Volume Manager limits the number of paths to per LUN in a volume group to a maximum of eight. If your host has more than eight paths, you can use switch zoning to reduce the number of those paths that are visible to the LUN.

Zoning requires more configuration on the switch, but it results in the following:

- ◆ Configuring the host is simplified.
- ◆ Information becomes more manageable. When you use host tools such as `iostat` and `ioscan`, the output is easier to read because fewer paths are displayed.

If you have a high-availability configuration, make sure that there is at least one primary path and one secondary path through each switch for each LUN. For example, if you have two switches, you would have minimum of four paths per LUN.

For more information on zoning, see the *FCP Configuration Guide*, which is online at http://now.netapp.com/NOW/knowledge/docs/san/fcp_iscsi_config/fcp_support.shtml.

Correct order for powering up the equipment

The different pieces of hardware communicate with each other in a prescribed order, which means that problems occur if you turn on power to the equipment in the wrong order. Throughout the procedures that you use to set up and install the NetApp software package, here is the order you must follow when you power on equipment:

1. The configured Fibre Channel switches. It might take several minutes for the switches to boot.
2. Disk shelves.
3. Storage appliances.
4. Host.

Verify the host and storage can communicate

To verify that the host can issue commands to through the storage appliance's console or command line, complete the following step.

Step	Action
1	Verify the management connection by issuing a command from the host to the storage appliance. There are two ways to do this: ◆ Use a remote login, such as the <code>telnet</code> command, to connect with the storage appliance and enter a command at the command-line prompt. ◆ Go to the storage appliance console and enter a command.

Where to go for more information

Documentation relevant to this host attach kit

This guide provides information on the basic tasks involved in setting up an HP-UX host using Fibre Channel protocol with a NetApp storage appliance. The information in it is current as of its publication.

For more recent information or additional information, you might want to consult the following documents:

- ◆ *The Compatibility and Configuration Guide for NetApp's FCP and iSCSI Products*

This is a dynamic, online document that contains the most up-to-date information about NetApp's FCP HP-UX Attach Kit and its supported components.

It also provides the most current details about storage appliance and host platforms, cabling issues, switch issues, and configurations. This document is available at the NOW site:

http://now.netapp.com/NOW/knowledge/docs/san/fcp_iscsi_config/.

- ◆ *The FCP HP-UX Attach Kit 1.1 Release Notes*

This document contains any last-minute information that you need to get your configuration up and running smoothly. It also includes information about known problems and limitations. A printed copy of this document comes with the host attach kit. You can also download it from the NOW site.

- ◆ *System Configuration Guide*

This is an online document that contains information about supported HBAs and slot assignments. It is available at the NOW site:

<http://now.netapp.com/NOW/knowledge/docs/docs.shtml>.

- ◆ *Data ONTAP Block Access Management Guide*

This document provides information about how to manage LUNs, igroups, and the FCP service on the storage appliance.

- ◆ *Network Appliance FCP Quick Command Reference for HP-UX*

The quick reference summarizes the commands you use on an HP-UX system attached to a NetApp storage appliance. This document is available online at <http://now.netapp.com/NOW/knowledge/docs/san/>.

- ◆ Host operating system and HBA information

NetApp does not provide these documents. See the readme files and other documentation that you received when you got your HP-UX operating system.

About this chapter

This chapter describes procedures for installing the NetApp's software package for an HP-UX host connected to a NetApp storage appliance running Data ONTAP with FCP. It also includes instructions for uninstalling and upgrading the software.

Note

All installation procedures require root privileges. In addition, you must have the host and HBA set up before you install your NetApp software package.

Topics in this chapter

This chapter discusses the following topics:

- ◆ [“Obtaining the NetApp software package”](#) on page 20
- ◆ [“Installing the NetApp software package”](#) on page 23

Obtaining the NetApp software package

Contents of the NetApp software package

The NetApp software package is a standard HP-UX depot file that contains the following components:

- ◆ The NetApp `sanlun` command, which helps you manage LUNs and host HBAs
- ◆ The `ntap_config_paths` command, which adds missing paths to the volume groups containing the LUNs and reorders the paths if necessary.
- ◆ NetApp diagnostic and troubleshooting scripts. For more information about these scripts, see [Chapter 6](#), “[Troubleshooting](#)”.

Ways to obtain the NetApp software package

You can obtain the NetApp software package in two ways:

- ◆ Download it from the NOW site, which is detailed in the section “[Downloading the software from the NOW site](#)” on page 20.
- ◆ Get it from a CD provided with the media package for your NetApp FCP HP-UX Attach Kit 1.1. See “[Verifying the contents of the host attach kit](#),” on page 12.

Note

To verify that you have the latest NetApp software package, check the *FCP/iSCSI Configuration Guide*, which is online at <http://now.netapp.com/NOW/knowledge/docs/docs.shtml>.

Downloading the software from the NOW site

To download the software from the NOW site, complete the following steps.

Step	Action
1	Log in to the NOW site at http://now.netapp.com. In the fields on the right side of the page, complete the following steps: 1. Enter your user name and password. 2. From the Select Start Page list box, click Service and Support. 3. Click the Login button.

Step	Action
2	In the Software Download section, click Download Software.
3	Go to the SAN Host Attach Kit product row of the Software Download table and select HP-UX from the Select Platform drop-down list.
4	Click Go!
5	Follow the prompts to reach the Software Download page.
6	Download the software file to a local directory. Note_____ At the time this document was printed, the software was in a file called ntap_hpux_fcp_1_1.depot.gz. If you download the file to a different machine, you must copy it to directory on the HP-UX machine. You can do that using commands similar to the following: <pre># mkdir /tmp/hpux # cd /tmp/hpux # cp /u/hpux/HP-pkgs/ntap_hpux_1_1.depot.gz .</pre> Make sure you include the period at the end of the above command line.
7	Go to “Installing the NetApp software package” on page 23.

Getting the software from the CD-ROM

To get the software from the CD-ROM, complete the following steps.

Step	Action
1	Insert the CD-ROM into the CD-ROM drive.
2	Change to the directory containing the ntap_hpux_fcp_1_1.depot.gz file.

Step	Action
3	Copy the file to a directory on the host, such as the /tmp/hpux directory. For example, you might need to enter commands similar to the following: <pre># mkdir /tmp/hpux # mount /dev/cdrom /mnt/cdrom # cp /mnt/cdrom/ntap_hpux_fcp_1_1.depot.gz /tmp/hpux # cd /tmp/hpux</pre>

Installing the NetApp software package

Tasks involved in installing the NetApp software

NetApp provides a standard HP-UX depot file that contains the installation script. You can install it the same way you normally install an HP-UX depot file.

One method of installing the software, which is documented in the sections that follow, is to perform these steps:

- ◆ If you are upgrading, use the `swremove` command to uninstall the previous version of the software.
- ◆ Use the `gunzip` command to uncompress the files.
- ◆ Execute the `swinstall` command to install the NetApp software.

Note

You do not supply a path name to the installation directory to the `swinstall` command. The installation directory is determined by the depot file.

Actions performed by the installation script

The installation script performs the following actions:

- ◆ Checks your system to confirm that it meets the system requirements. The installation fails if your system does not meet the requirements.
- ◆ Installs NetApp's `sanlun` and `ntap_config_paths` commands and diagnostic tools in the appropriated directories. (You cannot specify which directories.)
- ◆ Adds paths to the NetApp utilities and man pages to the appropriate HP-UX search paths.

Upgrading from a previous release

If you are upgrading from a previous release of the Attach Kit, uninstall the software from the previous release before you install the new software.

To uninstall software from a previous release, complete the following steps.

Step	Action
1	Use the <code>swlist</code> command to find out if a previous version of the NetApp software is installed on the host. Example:<pre>bash-2.04# swlist # Initializing... # Contacting target "host-hp4"... # # Target: host-hp4:/ # # # Product(s) not contained in a Bundle: # santools 1.0 Network Appliance, Inc. SAN Host Attach Kit for HP-UX</pre>

Step	Action
2	Use the <code>swremove</code> command to remove the NetApp software. Example: The following example shows output you might see when you execute the <code>swremove</code> command after installing the NetApp software on an HP-UX host called <code>machine1</code>. <pre>bash-2.04# swremove santools ===== 06/20/05 16:25:06 EST BEGIN swremove SESSION (non-interactive) (jobid=machine1-0125) * Session started for user "root@machine1". * Beginning Selection * Target connection succeeded for "machine1:/". * Software selections: santools.command_itanium,l=/opt/NetApp/santools,r=1.0,fr= 1.1,fa=HP-UX_B.11.22_IA santools.command_parisc,l=/opt/NetApp/santools,r=1.0,fr=1 .1,fa=HP-UX_B.11.00_32/64 santools.man,l=/opt/NetApp/santools,r=1.0 santools.support_scripts,l=/opt/NetApp/santools,r=1.0 * Selection succeeded. * Beginning Analysis * Session selections have been saved in the file "/.sw/sessions/swremove.last". * The analysis phase succeeded for "machine1:/". * Analysis succeeded. * Beginning Execution * The execution phase succeeded for "machine1:/". * Execution succeeded. NOTE: More information may be found in the agent logfile using the command "swjob -a log machine1-0125 @ machine1:/". ===== 06/20/05 16:25:21 EST END swremove SESSION (non- interactive) (jobid=machine1-0125)</pre>
3	Go to “Installing the NetApp software” on page 26.

Installing the NetApp software

To install or update the NetApp software, complete the following steps.

Step	Action
1	Enter the following command to uncompress the ntap_hpux_fcp_1_1.depot.gz file: <pre># gunzip ntap_hpux_fcp_1_1.depot.gz</pre> Result: The system places the extracted software in the directory to which you downloaded or copied the ntap_hpux_fcp_1_1.depot.gz file.

Step	Action
2	Use the <code>swinstall</code> command to install the software. Do not supply a path name to the installation directory on the <code>swinstall</code> command line; the installation directory is determined by the depot file. Caution— The installation fails if your system does not meet the system requirements. See “Verify that the host HBA is installed” on page 13 a list of the requirements. Result: This command runs an installation script that verifies the status of your HP-UX setup. If your system meets the requirements, this script installs the NetApp <code>sanlun</code> utility and diagnostic scripts in the <code>/opt/NetApp/santools</code> directory. Example: The following output is similar to what you might see when you install the NetApp software for the first time. This example assumes that you uncompressed the files in the <code>/tmp/hpux</code> directory on an HP-UX host called <code>machine1</code>. <pre># swinstall -s /tmp/hpux/ntap_hpux_fcp_1.1.depot santools ===== 06/20/05 16:25:41 EST BEGIN swinstall SESSION (non-interactive) (jobid=machine1-0126) * Session started for user "root@machine1". * Beginning Selection * Target connection succeeded for "machine1:/". * Source: /tmp/hpux/ntap_hpux_fcp_1.1.depot * Targets: machine1:/ * Software selections: santools.command_itanium,r=1.0,fr=1.1,fa=HP-UX_B.11.22_IA santools.command_parisc,r=1.0,fr=1.1,fa=HP-UX_B.11.00_32/64 santools.man,r=1.0 santools.support_scripts,r=1.0 * Selection succeeded. * Beginning Analysis and Execution * Session selections have been saved in the file "/.sw/sessions/swinstall.last". * The analysis phase succeeded for "machine1:/". * The execution phase succeeded for "machine1:/". * Analysis and Execution succeeded.</pre> NOTE: More information may be found in the agent logfile using the command <code>"swjob -a log machine1-0126 @ machine1:/"</code>. <pre>===== 06/20/05 16:26:01 EST END swinstall SESSION (non-interactive) (jobid=machine1-0126)</pre>

Updates to the system search paths

By default, the installation script updates the system search paths. It adds the following paths:

- ◆ /opt/NetApp/santools/bin and /opt/NetApp/santools/man to the system search path.
- ◆ /opt/NetApp/santools/bin to /etc/PATH.
- ◆ /opt/NetApp/santools/man to /etc/MANPATH.

You might need to log out and log back in for these changes to take effect.

If you modified your startup to ignore /etc/PATH and /etc/MANPATH, you should manually add the santool paths to your search path.

Array Support Library (ASL)

If you want to manage LUNs by using VERITAS® Volume Manager (VxVM) software, you must install the Array Support Library 3.5 for HP-UX® and NetApp® Storage.

Before you install the ASL, make sure your system has both the Base-VxVM and Full VxVM (bundle B9116AA) software and the required VERITAS patch bundle.

For details see:

- ◆ *Installing and Managing VERITAS® Array Support Library for NetApp® Filers*. This document is included in print format with the Attach Kit documentation package and is in PDF format on the ASL CD-ROM.
- ◆ NetApp FibreChannel Host Support Matrix at http://now.netapp.com/NOW/knowledge/docs/san/fcp_iscsi_config/fcp_support.shtml for the most current information about software versions and patch bundles, and the order in which patches are installed.

About this chapter

This chapter provides the following information:

- ◆ Tasks required to add LUNs to systems with HP-UX hosts
- ◆ How to create initiator groups (igroups) and LUNs on the storage appliance
- ◆ How to configure LUNs and make them accessible by the host
- ◆ How to use the sanlun utility to manage host LUN and HBA information

Note

The procedures in this chapter require root privileges.

Topics in this chapter

This chapter discusses the following topics:

- ◆ [“Overview of adding LUNs to HP-UX”](#) on page 30
- ◆ [“Creating igroups and LUNs”](#) on page 32
- ◆ [“Configuring the LUNs”](#) on page 43
- ◆ [“Displaying LUN and HBA information”](#) on page 58

Overview of adding LUNs to HP-UX

Tasks you perform on the storage appliance

You perform the following tasks on the storage appliance when you add a LUN to an HP-UX host:

1. If you have a cluster, make sure the storage appliance is correctly set up for adding HP-UX LUNs by verifying that the `cfmode` is correctly set. You only need to do this once.
2. Create an igroup using HP-UX as the operating system type for the host HBAs.
3. Create a LUN and map it to the igroup.

Tasks you perform on the host

You must perform the following tasks on the HP-UX host when you add a LUN:

1. Discover the newly created LUNs.
2. Create device nodes (`/dev/dsk/` and `/dev/rdisk/`) for the newly discovered LUN.
3. Configure device nodes to be managed by either HP-UX Logical Volume Manager (LVM) or VERITAS Volume Manager (VxVM).

Note

To perform some of these tasks, you must use NetApp's `sanlun` utility. When you installed the NetApp software package on the host, the installation program placed the utility in `/opt/NetApp/santools/bin` and added it to the system search path (see [“Updates to the system search paths”](#) on page 28).

Preparing the storage appliance for HP-UX LUNs

Preparing the storage appliance

Before you create the igroups or LUNs, you must prepare the storage appliance by confirming that it has the correct FCP cluster failover mode (cfmode) setting. The cfmode value determines how a NetApp cluster handles a failover.

Correct cfmode settings for NetApp clusters

For an HP-UX host, the following cfmodes are the default settings:

- ◆ FAS270s: dual-fabric mode
- ◆ All other models and backup storage appliances: partner.

In some circumstances, you want to use a different cfmode setting. Consult with NetApp professional services if you have any questions about which mode you should use.

The standby cfmode setting is not supported in configurations with HP-UX hosts.

Determining the current cfmode

To check the current cfmode settings, complete the following step.

Step	Action
1	Enter the following command: <pre>fcpx show cfmode</pre> Result: The system displays the cfmode setting. Caution_____ If the cfmode is not set correctly, contact NetApp. Do not change the cfmode. _____

Creating igroups and LUNs

Tasks to create and map LUNs on the storage appliance

- Before you can complete your HP-UX setup with a NetApp storage appliance, you must perform the following tasks:
- ◆ Create an igroup on the storage appliance. An igroup is a collection of host WWPNs.
 - ◆ Create one or more LUNs on the storage appliance and map the LUNs to an igroup.

Rule for creating LUNs

Ensure that the LUNs are at the root of a qtree or a volume.

Best practices for creating LUNs

- The best practices for creating LUNs include the following:
- ◆ Each igroup should map to an application and should include all the initiators used by the application to access its data.
 - ◆ Do not put LUNs in the root volume. The default root volume is /vol/vol0.
 - ◆ Enable space reservations.
 - ◆ Disable scheduled auto snapshots.

For more information about creating and managing LUNs, see *Data ONTAP Block Access Administration* guide.

Creating an igroup

To create an igroup, complete the following steps.

Note_____

The examples used in these steps assume that the application is running on a single host, not a host cluster. They also assume that you have already attached the host and storage appliances to fabric.

Step	Action
1	Log in as root on the host.

Step	Action
2	Get the WWPN for each of the host's HBAs by entering the following command and then copying the resulting command line so you can enter it in step 4: <pre>sanlun fcp show adapter -c</pre> The -c option tells the sanlun utility to generate the output the storage appliance needs to create the igroup. Result: An igroup create command with the host's WWPNs appears on the screen when you execute the command. The igroup's name matches the name of the host. Example: Running sanlun fcp show adapter -c produces the following output on an HP-UX system called hostA. This example uses two WWPNs. Enter this filer command to create an initiator group for this system: <pre>igroup create -f -t hpux "hostA" 50060b000010a700 50060b000010a606</pre> Because the name of the host is "hostA," this command line produces an igroup called "hostA."
3	On the host in a different session, use the telnet command to access the storage appliance.
4	Copy the igroup create command from Step 2. Example: If you use the information in Step 2, you would copy the following command line: <pre>igroup create -f -t hpux "hostA" 50060b000010a700 50060b000010a606</pre>
5	Paste the command on the NetApp command line and press Enter. Result: The storage appliance creates the igroup and gives it the same name as the host name.

Step	Action
6	On the storage appliance command line, verify that the new igroup exists by entering the following command: <pre>igroup show</pre> Result: The storage appliance displays the newly created igroup with the host's WWPNs. Example: The following is output from the <code>igroup show</code> command displays. Note If you change the <code>ostype</code> attribute to <code>hpux</code> after you've created the igroup, you must manually set the <code>vsa</code> attribute, which HP-UX sets correctly by default. Chapter 6 contains information about how to do this. <pre>filerX> igroup show -v hostA hostA (FCP): OS Type: hpux Member: 50:06:0b:00:00:10:a7:00 Member: 50:06:0b:00:00:10:a6:06 filerX></pre>
	Example: The following example is for a direct-attached configuration. <pre>filerY> fcp show initiator Initiators connected on adapter 5a: Portname Group 50:06:0b:00:00:10:a7:00 hostA Initiators connected on adapter 5b: None connected. filerY></pre>

Creating a LUN using the interactive script

The `lun setup` command starts an interactive script that prompts you for information required to perform the following tasks:

- ◆ Create a LUN.
- ◆ Create a new igroup (or use the igroup you created in the previous section).

Note

If you use an existing igroup, you must still add the WWPNs during the LUN setup.

- ◆ Map the LUN to an igroup.

When a prompt displays a default in brackets [], you can press Enter to accept the default.

You can interrupt the `lun setup` command at any time by pressing Ctrl-C. Any information that you entered is discarded.

Note

You can also create a LUN using the `lun setup` command in command line mode. Instead of answering the prompts from the interactive script, you would supply those values as command line options using the following format:

```
lun create -s <size> [-t <type>] [-o noreserve] <lun_path>
```

To create LUNs on the storage appliance using the `lun setup` command interactive script, complete the following steps.

Step	Action
1	On the command line, start the LUN creation process by entering the following command: <pre>lun setup</pre> Result: The storage appliance starts an interactive script that prompts you for information needed to create a LUN. Example: This example shows the output that appears when you enter the <code>lun setup</code> command. <pre>filerX> lun setup This setup will take you through the steps needed to create LUNs and to make them accessible by initiators. You can type ^C (Control-C) at any time to abort the setup and no unconfirmed changes will be made to the system.</pre>
2	Enter y in response to the prompt: <pre>Do you want to create a LUN? [y]: y</pre>

Step	Action
3	Enter hpux to specify the host operating system: Multiprotocol type of LUN (image/solaris/windows/hpux/aix/linux) [image]: hpux
4	Enter the LUN path. Caution_____ Do not put LUNs in /vol/vol0 (the root volume). _____ A LUN path must be absolute. A LUN can only reside in a volume or qtree root. For example, to create a LUN with the name "lun0" in the qtree root /vol/vol1/q0, specify the path as "/vol/vol1/q0/lun0" Enter LUN path: <i>lun_path</i> <i>lun_path</i> is the path name to the LUN. Result: The name of the LUN (the LUN path) is defined. Example: Some examples of a <i>lun_path</i> are /vol/vol1/qtree1/lun_sdata or /vol/vol1/hostA_0. Enter LUN path: /vol/vol1/hostA_0
5	Enter y or n to specify whether you want to use space reservations. Note_____ NetApp strongly recommends that you enable space reservations. _____ A LUN can be created with or without space reservations being enabled. Space reservation guarantees that data writes to that LUN will never fail. Do you want the LUN to be space reserved? [y]: y Result: The LUN you are creating will use space reservations.

Step	Action
6	Enter the LUN size: Size for a LUN is specified in bytes. You can use single-character multiplier suffixes: b(sectors), k(KB), m(MB), g(GB) or t(TB). Enter LUN size: <code>x_x</code> <code>x_x</code> is the size you want the LUN to be. Result: The setup script accepts the value you enter here as the size for the LUN you are creating. The quantity of usable disk space by the host varies depending on the host's operating system and the application using the LUN. Example: An example of a size you might enter is 5g, meaning 5 GB of raw disk. Enter LUN size: 5g
7	Enter a comment string, if desired, or press Enter in response to the next prompt: You can add a comment string to describe the contents of the LUN. Please type a string (without quotes), or hit ENTER if you don't want to supply a comment. Enter comment string: _____ Note _____ If you press Enter and do not add a comment, you can add a comment later with the <code>lun comment</code> command. If you are using the FilerView® browser interface, a LUN description is the same as a comment. For more information about the <code>lun comment</code> command, see the Data ONTAP <code>na_lun (1)</code> man page. _____

Step	Action
8	Specify the igroup in one of the following ways: ◆ To use an existing igroup, enter that group's name. You can see the existing igroups by entering ? at the prompt. Go to step 12 to continue setting up a LUN. ◆ To create an igroup, enter a unique name for the group when prompted. Go to step 9 to continue setting up the LUN. ◆ To accept the default igroup (shown in brackets), press Enter. Go to step 12 to continue setting up a LUN. The LUN will be accessible to an initiator group. You can use an existing group name, or supply a new name to create a new initiator group. Enter '?' to see existing initiator group names. Name of initiator group [default_igroup]: <i>new_group_name</i> <i>new_group_name</i> is either the name of an existing igroup or the name of a group you want to create. A group name can be something similar to hpux_groupB or hostA. Result: The program either creates a new igroup or uses the existing group that you specify. Example 1: This example uses an existing igroup. This example is continued in step 12. <pre>Name of initiator group [hostA]: hostA An initiator group named "hostA" already exists. hostA (FCP) (ostype: hpux): 50:06:0b:00:00:10:a7:00 (logged in on: vtic) 50:06:0b:00:00:10:a6:06 (logged in on: vtic) Do you want to use this existing group? [n]: y</pre> Example 2: This example creates a new igroup called hpuxB. This example is continued in Step 9. <pre>Name of initiator group [hostA]: hpuxB</pre>

Step	Action
9	When you create an igroup (as illustrated in Example 2 in the previous step), you must specify setup information for the igroup. Press Enter to accept FCP as the protocol: Type of initiator group <i>new_group_name</i> (FCP/iSCSI) [FCP]: Result: Choosing FCP means that the initiator WWPNs in this igroup are using FCP to access the LUN. Note_____ If you created an igroup as shown in “Creating an igroup” on page 32, you would have already specified this information, so you would not see this prompt or any other prompts until step 12. _____

Step	Action
10	Enter comma-separated port names in response to the next prompt: A Fibre Channel Protocol (FCP) initiator group is a collection of initiator port names. Each port name (WWPN) is 16 hexadecimal digits, separated (only) by optional colon (:) characters. You can separate port names by commas. Enter '?' to display a list of connected initiators. Hit ENTER when you are done adding port names to this group. Enter comma separated portnames: Note Enter ? to see the list of initiator WWPNs connected to the target HBAs and associated igroups (if they exist). The sanlun fcp show adapter command runs on the host and lists the host's initiator HBAs and their WWPNs. Example: <pre>Enter comma separated portnames:? Initiators connected on adapter 5a: Portname Group 50:06:0b:00:00:10:a7:00 hostA 50:06:0b:00:00:10:a6:06 hostA Initiators connected on adapter 7a: None connected.</pre> Enter comma separated portnames:50:06:0b:00:00:10:a7:00 Enter comma separated portnames: In this example, the initiator HBA with WWPN 50:06:0b:00:00:10:a7:00 is added to the igroup you are creating (new_group_name).
11	Enter hpux in response to the next prompt: OS type of initiator group "new_group_name" (default/solaris/windows/hpux/aix/linux) : hpux Result: The operating system for the igroup is defined.

Step	Action
12	Enter the LUN ID for the LUN that is mapped to the igroup in response to the next prompt. The program supplies the next available LUN ID. (Enter ? to display the LUNs already in use.) Note Make sure you record the LUN ID associated with the <i>lun_path</i> and the igroup name (<i>new_group_name</i>). The LUN will be accessible to all the initiators in the initiator group. Enter '?' to display LUNs already in use by one or more initiators in group "new_group_name". LUN ID at which initiator group "new_group_name" sees "lun_path" [0]: Result: The LUN ID is assigned to the LUN (LUN path) and mapped to the igroup. Example: This example contains output you might see in response to this prompt. The LUN will be accessible to all the initiators in the initiator group. Enter '?' to display LUNs already in use by one or more initiators in group "hostA". LUN ID at which initiator group "hostA" sees "/vol/vol0/foobar" [0]: 3333 <pre> LUN Path : /vol/vol0/foobar OS Type : hpux Size : 2g (2147483648) Comment : test lun Initiator Group : hostA Initiator Group Type : FCP Initiator Group Members : 50:06:0b:00:00:10:a7:00 : 50:06:0b:00:00:10:a6:06 Mapped to LUN-ID : 3333 </pre>
13	Respond to the next prompt by entering y to accept the configuration or n to discard the configuration: Do you want to accept this configuration? [y]: Result: If you enter y, the LUN is mapped to the specified igroup and all changes to the system are committed. At this point, Ctrl-C cannot undo the changes.

Step	Action
14	Terminate this session or continue to create additional LUNs by responding to the final prompt: Do you want to create another LUN? [n] :

Verifying the mapped LUN

To verify the mapped LUN, complete the following step.

Step	Action
1	On the command line, display information about the mapped LUN by entering the following command: <pre>lun show -v lun-path</pre> <i>lun-path</i> is the path to a specific LUN. Result: The information for the specified LUN is displayed. Example: The following example shows information about the LUN hostA. <pre>filerX> lun show -v /vol/vol1/hostA /vol/vol1/hostA 2g (2147483648) (r/w, online, mapped) Serial#: OcABC1234ABC Share: none Multiprotocol Type: hpux Maps: hostA=3333 filerX></pre>

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Step	Action
3	Create the device entries on the HP-UX host by entering the following command: <pre>ioinit -i</pre> If the <code>ioinit -i</code> command doesn't create device entries, use the <code>insf -e</code> command to install the device special files. Note_____ Do not use these disk device entries yet. They are not yet under the control of a volume manager. _____ Example: The following is an abbreviated example of the type of output you might see when you run the <code>ioinit -i</code> command. <pre># ioinit -i insf: Installing special files for sdisk instance 1 address 0/4/0/0.1.5.0.26.0.5 insf: Installing special files for sctl instance 4 address 0/4/0/0.1.5.255.0.0.0 insf: Installing special files for sdisk instance 3 address 0/4/0/0.1.6.0.26.0.5 insf: Installing special files for sctl instance 6 address 0/4/0/0.1.6.255.0.0.0 insf: Installing special files for sdisk instance 2 address 0/6/2/0.1.13.0.26.0.5 insf: Installing special files for sctl instance 5 address 0/6/2/0.1.13.255.0.0.0 insf: Installing special files for sdisk instance 4 address 0/6/2/0.1.14.0.26.0.5 insf: Installing special files for sctl instance 7 address 0/6/2/0.1.14.255.0.0.0</pre>

Step	Action
4	Check to see which disk devices map to which HBA devices by entering the following command: <pre>tdlist</pre> Note_____ HP-UX automatically handles mapping and records the information in the /etc/ioconfig file. _____ Note_____ You can also use the <code>fcclist</code> command for your HBA supports the <code>fc</code> driver. _____ Example: The <code>tdlist</code> command produces output similar to the following. This list has been truncated list to fit on this page. <pre># tdlist /dev/td0 0/4/0/0.1.5.255.0.0.0 fcpdev 0x010500 CLAIMED DEVICE NETAPP VSA CONTROLLER /dev/rscsi/c33t0d0 /dev/td0 0/4/0/0.1.6.255.0.0.0 fcpdev 0x010600 CLAIMED DEVICE NETAPP VSA CONTROLLER /dev/rscsi/c36t0d0 /dev/td0 0/4/0/0.1.4.214.0 fcparray 0x0104d6 /dev/td0 0/4/0/0.1.4.214.26 fcparray 0x0104d6 /dev/td0 0/4/0/0.1.5.0.26 fcparray 0x010500 CLAIMED DEVICE NETAPP LUN /dev/dsk/c31t0d5 /dev/rdisk/c31t0d5 /dev/td0 0/4/0/0.1.5.214.0 fcparray 0x0105d6 /dev/td0 0/4/0/0.1.5.214.26 fcparray 0x0105d6 /dev/td0 0/4/0/0.1.6.0.26 fcparray 0x010600 CLAIMED DEVICE NETAPP LUN /dev/dsk/c34t0d5 /dev/rdisk/c34t0d5 /dev/td0 0/4/0/0.1.6.218.0 fcparray 0x0106da /dev/td0 0/4/0/0.1.6.218.26 fcparray 0x0106da /dev/td0 0/4/0/0.1.7.218.0 fcparray 0x0107da /dev/td0 0/4/0/0.1.7.218.26 fcparray 0x0107da</pre>

Step	Action																																											
5	Display information about the device nodes by entering the following command: <pre>sanlun lun show -p all</pre> Write down which paths are primary; you need this information later in these steps. Example: The following example shows the type of output you see using the <code>sanlun lun show</code> command before you configure the LUN by using a volume manager. <pre># sanlun lun show -p all</pre> <pre>filerX:/vol/vol0/511 (LUN 511) VG: none 2g (2147483648) lun state: GOOD</pre> ----- <table><tr><td>path</td><td>path</td><td>/dev/dsk</td><td>host</td><td>target</td><td>partner</td></tr><tr><td>state</td><td>type</td><td>filename</td><td>HBA</td><td>port</td><td>port</td></tr><tr><td colspan="6">-----</td></tr><tr><td>up</td><td>primary</td><td>/dev/dsk/c35t0d5</td><td>td1</td><td>5a</td><td></td></tr><tr><td>up</td><td>secondary</td><td>/dev/dsk/c30t0d5</td><td>td1</td><td></td><td>5b</td></tr><tr><td>up</td><td>primary</td><td>/dev/dsk/c34t0d5</td><td>td0</td><td>4a</td><td></td></tr><tr><td>up</td><td>secondary</td><td>/dev/dsk/c31t0d5</td><td>td0</td><td></td><td>4b</td></tr></table>		path	path	/dev/dsk	host	target	partner	state	type	filename	HBA	port	port	-----						up	primary	/dev/dsk/c35t0d5	td1	5a		up	secondary	/dev/dsk/c30t0d5	td1		5b	up	primary	/dev/dsk/c34t0d5	td0	4a		up	secondary	/dev/dsk/c31t0d5	td0		4b
path	path	/dev/dsk	host	target	partner																																							
state	type	filename	HBA	port	port																																							

up	primary	/dev/dsk/c35t0d5	td1	5a																																								
up	secondary	/dev/dsk/c30t0d5	td1		5b																																							
up	primary	/dev/dsk/c34t0d5	td0	4a																																								
up	secondary	/dev/dsk/c31t0d5	td0		4b																																							
6	If...	Then...																																										
	You want to use the HP-UX Logical Volume Manager (LVM) to manage the LUNs	Go to “ Managing the LUNs by using LVM ” on page 47																																										
	You want to use VERITAS Volume Manager (VxVM) to manage the LUNs	Go to “ Managing LUNs by using VxVM ” on page 53																																										

Managing the LUNs by using LVM To configure the LUNs as disks by using the Logical Volume Manager (LVM), complete the following steps.

Step	Action
1	Create a physical volume on the LUN by entering the following command: <pre>pvcreate /dev/rdisk/primary_path_disk_device</pre> <i>primary_path_disk_device</i> is the path to the disk device that contains the LUN. This must be a primary path. Note_____ You only need to perform this process once, even if you have multiple paths to the LUN. _____ Example: The <code>pvcreate</code> command produces output similar to the following: <pre># pvcreate /dev/dsk/c35t0d5 Physical volume "/dev/dsk/c35t0d5" has been successfully created.</pre>
2	Check the minor numbers of all existing volume groups by entering the following command: <pre>ls -l /dev/*/group</pre> The LVM requires a unique minor number for each volume group device entry. Example: The <code>ls -l /dev/*/group</code> command provides output similar to the following. In this example, the next unused minor device number is 0x010000. <pre># ls -l /dev/*/group crw-r----- 1 root sys 64 0x000000 Aug 12 2002 /dev/vg00/group #</pre>
3	Use the <code>mkdir</code> command to create a <code>/dev</code> entry: <pre>mkdir /dev/directory_name</pre> Example: This example continues the previous example and specifies a directory name that ends with the number '01', which is the next minor device number. Using the same minor number as the volume group number is an HP-UX convention; it is not a requirement. <pre># mkdir /dev/vg_ntap01</pre>

Step	Action
4	Create a device node on the host for the physical volume group using the <code>mknod</code> command. You must supply a unique minor device number. Don't enter a number that another volume group is using. Note_____ The device node you create is used only for volume group and logical volume operations; it is not used for I/O. _____ Example: This example creates a device node using the unique minor number 0x010000. <pre>mknod /dev/vg_ntap01/group c 64 0x010000</pre>
5	Use the <code>vgcreate</code> command to create a volume group with one primary path. Use a regular or block disk device node. Do not use raw disk devices. <code>vgcreate vg_name primary_path_to_disk</code> <code>vg_name</code> is a volume group name, with or without the <code>/dev/</code> prefix. Note_____ Volume groups must follow a specific order for paths. The first path to the volume group, which you specify using the <code>vgcreate</code> command, must use a disk device node that corresponds to a primary path. See the next step for information on adding paths to the volume group. _____ Example: In this example, the <code>vgcreate</code> command sets up a primary path to the volume group. <pre># vgcreate /dev/vg_ntap01 /dev/dsk/c35t0d5 Volume group "/dev/vg_ntap01" has been successfully created. Volume Group configuration for /dev/vg_ntap01 has been saved in /etc/lvmconf/vg_ntap01.conf</pre>

Step	Action
6	Specify the remaining paths to the volume group using NetApp's <code>ntap_config_paths</code> utility, which is in the <code>/opt/netapp/santools/bin/</code> directory. Enter the following command: <pre>ntap_config_paths</pre> Note_____ This utility sets up paths in the correct order. It specifies the disk device nodes that correspond to the primary paths first and then the device nodes that correspond to the secondary paths. For more information about the <code>ntap_config_paths</code> utility, see “Correcting volume group multipathing with ntap_config_paths” on page 93. Example: The <code>ntap_config_paths</code> utility adds the rest of the paths using the <code>vgextend</code> command. You can verify the path ordering by using the <code>vgdisplay -v volume_group</code> command. <pre># ntap_config_paths Getting information from sanlun... Adding missing path with: vgextend /dev/vg_ntap01 /dev/dsk/c34t0d5 Volume group "/dev/vg_ntap01" has been successfully extended. Volume Group configuration for /dev/vg_ntap01 has been saved in /etc/lvmconf/vg_ntap01.conf Adding missing path with: vgextend /dev/vg_ntap01 /dev/dsk/c30t0d5 Current path "/dev/dsk/c34t0d5" is an alternate link, skip. Volume group "/dev/vg_ntap01" has been successfully extended. Volume Group configuration for /dev/vg_ntap01 has been saved in /etc/lvmconf/vg_ntap01.conf Adding missing path with: vgextend /dev/vg_ntap01 /dev/dsk/c31t0d5 Current path "/dev/dsk/c34t0d5" is an alternate link, skip. Current path "/dev/dsk/c30t0d5" is an alternate link, skip. Volume group "/dev/vg_ntap01" has been successfully extended. Volume Group configuration for /dev/vg_ntap01 has been saved in /etc/lvmconf/vg_ntap01.conf #</pre>

Step	Action
7	Create one or more logical volumes in the volume group using the following command line: <pre>lvcreate [-L -l] <size> <volume_group></pre> <size> with an uppercase -L option is the total size of the logical volume in megabytes. <size> with a lowercase -l option is the number of physical extents that you want to assign to the logical volume. The value you supply for <size> must not equal or exceed the available free physical extents in the volume group. The LUN reserves an area for physical volume, volume group, and LVM information. The <code>lvcreate</code> and the <code>lvextend</code> commands fail if the size you specify here does not fit into the volume group. You can check the available free physical extents by using the <code>vgdisplay -v volume_group</code> command. Note _____ After you create a logical volume, PVLinks multipathing is in effect on the logical volume device node so you can use it for I/O. NetApp recommends, though, that you create a file system on the logical volume first before using it for I/O. _____ Example: The following example on the next page creates a logical volume for <code>/dev/vg_ntap01</code> that uses all the physical extents available for that volume. The <code>vgdisplay</code> command displays the number of available physical extents (511). The <code>lvcreate</code> command with a lowercase -l option assigns them to the logical volume. See the <code>man</code> pages for more information about <code>vgdisplay</code> and <code>lvcreate</code>.

Step	Action
	<pre> # vgdisplay /dev/vg_ntap01 --- Volume groups --- VG Name /dev/vg_ntap01 VG Write Access read/write VG Status available Max LV 255 Cur LV 0 Open LV 0 Max PV 16 Cur PV 1 Act PV 1 Max PE per PV 1016 VGDA 2 PE Size (Mbytes) 4 Total PE 511 Alloc PE 0 Free PE 511 Total PVG 0 Total Spare PVs 0 Total Spare PVs in use 0 # lvcreate -l 511 /dev/vg_ntap01 Logical volume "/dev/vg_ntap01/lvol1" has been successfully created with character device "/dev/vg_ntap01/rlvol1". Logical volume "/dev/vg_ntap01/lvol1" has been successfully extended. Volume Group configuration for /dev/vg_ntap01 has been saved in /etc/lvmconf/vg_ntap01.conf # </pre>

Step	Action
8	Create a file system on the logical volume device node using the <code>newfs</code> command. <pre>newfs -F vxfs /dev/<i>character_device</i></pre> <i>character_device</i> is the character device listed in the output of the <code>vgdisplay -v volume_group</code> command. Example: The following example creates a file system on the logical volume <code>/dev/vg_ntap01</code>: <pre># newfs -F vxfs /dev/vg_ntap01/rlvol1 version 4 layout 2093056 sectors, 2093056 blocks of size 1024, log size 1024 blocks unlimited inodes, largefiles not supported 2093056 data blocks, 2091440 free data blocks 64 allocation units of 32768 blocks, 32768 data blocks last allocation unit has 28672 data blocks #</pre>
9	Create a mount point for the new file system. Example: <pre># mkdir /mnt/vg_ntap01_lv1</pre>
10	Mount the new file system using the <code>mount</code> command. <pre>mount <i>logical_volume mount_point</i></pre> Example: This example mounts the file system you created in the previous step. <pre># mount /dev/vg_ntap01/rlvol1 /mnt/vg_ntap01_lv1 # ls -l /mnt/vg_ntap01_lv1 total 0 drwxr-xr-x 2 root root 96 Oct 30 18:10 lost+found #</pre>

Step	Action																																																						
11	Verify that the LUN is visible to the host by entering the following command: <pre>sanlun lun show -p all</pre> Example: This example shows the type of output you see using the <code>sanlun</code> command. Note that the output shows the multipathing policy and the PVLlinks order of the paths to the LUN. <pre># sanlun lun show -p all</pre> <pre>filerX:/vol/vol1/lun3 (LUN 3) VG: /dev/vg_natap01 2g (2147483648) lun state: GOOD Filer_CF_State: Cluster Enabled Multipath_Policy: A/P Multipath-provider: HP PVLlinks</pre> <table><tr><th>host</th><th>filer</th><th></th><th>primary</th><th>partner</th><th>PVLlinks</th></tr><tr><th>path</th><th>path</th><th>/dev/dsk</th><th>host</th><th>filer</th><th>filer</th></tr><tr><th>state</th><th>type</th><th>filename</th><th>HBA</th><th>port</th><th>port</th></tr><tr><th></th><th></th><th></th><th></th><th></th><th>path failover</th></tr><tr><th></th><th></th><th></th><th></th><th></th><th>priority</th></tr><tr><td>up</td><td>primary</td><td>/dev/dsk/c35t0d5</td><td>td1</td><td>5a</td><td></td></tr><tr><td>up</td><td>primary</td><td>/dev/dsk/c34t0d5</td><td>td0</td><td>4a</td><td></td></tr><tr><td>up</td><td>secondary</td><td>/dev/dsk/c30t0d5</td><td>td1</td><td></td><td>5b</td></tr><tr><td>up</td><td>secondary</td><td>/dev/dsk/c31t0d5</td><td>td0</td><td></td><td>4b</td></tr></table>	host	filer		primary	partner	PVLlinks	path	path	/dev/dsk	host	filer	filer	state	type	filename	HBA	port	port						path failover						priority	up	primary	/dev/dsk/c35t0d5	td1	5a		up	primary	/dev/dsk/c34t0d5	td0	4a		up	secondary	/dev/dsk/c30t0d5	td1		5b	up	secondary	/dev/dsk/c31t0d5	td0		4b
host	filer		primary	partner	PVLlinks																																																		
path	path	/dev/dsk	host	filer	filer																																																		
state	type	filename	HBA	port	port																																																		
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up	primary	/dev/dsk/c35t0d5	td1	5a																																																			
up	primary	/dev/dsk/c34t0d5	td0	4a																																																			
up	secondary	/dev/dsk/c30t0d5	td1		5b																																																		
up	secondary	/dev/dsk/c31t0d5	td0		4b																																																		

Managing LUNs by using VxVM

Prerequisites for using VxVM: To manage LUNs using VxVM, make sure you installed the required VxVM software, VERITAS patch bundle, and the NetApp Array Support Library. For details, see

- ◆ *Installing and Managing VERITAS® Array Support Library for NetApp® Filers.* This document is included in print format with the Attach Kit documentation package and is in PDF format on the ASL CD-ROM.
- ◆ NetApp FibreChannel Host Support Matrix at http://now.netapp.com/NOW/knowledge/docs/san/fcp_iscsi_config/fcp_support.shtml for the most current information about software versions and patch bundles, and the order in which patches are installed.

If you do not have a rootdg: If you are installing VxVM for the first time, you must define the rootdg. If you want to use a NetApp LUN as the rootdg, complete the following steps:

Step	Action																				
1	Make sure you have a NetApp LUN on the storage appliance that is mapped to the host's igroup.																				
2	Make sure you run the ioscan and ioinit commands to make the LUN visible to the host.																				
3	Enter the following command. vxinstall																				
4	Respond to the installation prompts as follows: ◆ Use enclosure-based naming, if it is desired for your configuration. ◆ Do not rename the enclosures. ◆ Specify the LUN as a new disk. ◆ Select the one disk at a time installation option. ◆ Use default disk names.																				
5	Verify that the LUN is the rootdg by entering the following command: vxdisk list Example: The following example shows a LUN that is online and listed as the rootdg. <table><tr><td>DEVICE</td><td>TYPE</td><td>DISK</td><td>GROUP</td><td>STATUS</td></tr><tr><td>Disk_0</td><td>simple</td><td>-</td><td>-</td><td>LVM</td></tr><tr><td>F8800_0</td><td>simple</td><td>-</td><td>-</td><td>LVM</td></tr><tr><td>F8801_0</td><td>simple</td><td>disk01</td><td>rootdg</td><td>online</td></tr></table>	DEVICE	TYPE	DISK	GROUP	STATUS	Disk_0	simple	-	-	LVM	F8800_0	simple	-	-	LVM	F8801_0	simple	disk01	rootdg	online
DEVICE	TYPE	DISK	GROUP	STATUS																	
Disk_0	simple	-	-	LVM																	
F8800_0	simple	-	-	LVM																	
F8801_0	simple	disk01	rootdg	online																	

Putting a new LUN under VxVM management: To put new or additional LUNs under VxVM management, complete the following steps.

Step	Action
1	Make sure you ran the <code>ioscan</code> and <code>ioinit</code> commands to ensure that the host detects the new LUN. See “Getting the host to discover the new LUNs” on page 43 for details.
2	Enter the following command to enable VxVM to detect the new LUN. vxctl enable

Step	Action
3	Enter the following command to verify that VxVM detects the LUN. <pre>vxdisk list</pre> Result: The new disk devices are listed in the output of the <code>vxdisk list</code> command as online invalid disks. If you are using enclosure-based naming, then the NetApp storage model is displayed in the <code>DEVICE</code> column. If you are using disk-based naming, then the controller or disk name (for example, <code>c0t0d3</code>) is displayed. Example: <pre># vxdisk list DEVICE TYPE DISK GROUP STATUS Disk_0 simple - - LVM F8800_0 simple - - LVM F8801_0 simple disk01 rootdg online F8801_1 simple - - online invalid F8801_1 simple - - online invalid F8801_1 simple - - online invalid F8801_1 simple - - online invalid</pre>
4	Stop and restart the VxVM configuration daemon by entering the following commands. <pre>vxctl stop vxconfigd</pre> Result: These commands ensure that VxVM does not treat each path to the LUN as a separate DMP device.
5	Enter the <code>vxdisk list</code> command again to verify that VxVM consolidates all paths to the LUN as one DMP device. If the paths are not consolidated, repeat Step 4. Example: <pre># vxdisk list DEVICE TYPE DISK GROUP STATUS Disk_0 simple - - LVM F8800_0 simple - - LVM F8801_0 simple disk01 rootdg online F8801_1 simple - - online invalid</pre>
6	Enter the following command to initialize the disk for VxVM. <pre>/usr/lib/vxvm/bin/vxdisksetup -i device_name</pre> <i>device_name</i> is the name listed for the LUN in the <code>DEVICE</code> column of the <code>vxdisk list</code> command output you obtained in Step 5.

Step	Action
7	Enter the following command to create a disk group for the LUN. <pre>vx dg init dg_name diskname=device_name</pre> <i>dg_name</i> is the name you assign to the disk group. <i>diskname</i> is the disk name you assign to the device you are adding to the disk group. The <i>diskname</i> represents the device. <i>device_name</i> is the controller name listed for the LUN in the DEVICE column of the <code>vx disk list</code> command output. Example: <pre># vx dg init lun_dg lun_dg01=F8801_1</pre>
8	Enter the following command to create a logical volume. <pre>vxassist -g dg_name make vol_name size</pre> <i>dg_name</i> is the name of the disk group that you defined in step 6. <i>vol_name</i> is the name you assign to the logical volume. <i>size</i> is the volume size. For example, 50m. Size cannot be equal to or exceed size of the LUN. Example: <pre># vxassist -g lun_dg make lun_vol 50m</pre>
9	Create a file system on the volume by entering the following command. <pre>mkfs -F vxfs /dev/vx/rdisk/dg_name/vol_name</pre> <i>dg_name</i> is the name of the disk group that you defined in step 6. <i>vol_name</i> is the name you assigned to the logical volume in step 7.
10	Create a mount point for the new file system. Example: <pre># mkdir /mnt/new_lun</pre>
11	Mount the new file system. Example: <pre>mount /dev/vx/dsk/lun_dg/lun_vol /mnt/new_lun</pre>

Step	Action
12	Verify the paths to the LUN by entering the following command: <pre>sanlun lun show -p all</pre> Example: The following example shows output for the <code>sanlun</code> command and includes information about the VERITAS DMP multipathing policy. If you are using enclosure based naming, the NetApp storage model name is listed as the DMP-NODE. If you are using disk device based naming, the DMP-NODE is listed in device-name format (for example, <code>c16t0d1</code>). Note that the output shows the VERITAS path I/O policy as <code>Not Applicable</code>. The policy is single active but <code>sanlun</code> does not identify which path is currently active. <pre>filer_x:/vol/vol1/lun_1(LUN 3) DMP-NODE: (F8801_1) 50m (56214400) lun state: GOOD Filer_CF_State: Cluster Enabled Multipath_Policy: A/PG Multipath-provider: Veritas DMP 3.5</pre> <pre>----- host filer primary partner Veritas path path /dev/dsk host filer filer path I/O state type filename HBA port port policy ----- up primary /dev/dsk/c35t0d5 td1 5a Not Applicable up secondary /dev/dsk/c30t0d5 td0 4b Not Applicable up primary /dev/dsk/c34t0d5 td0 4a Not Applicable up secondary /dev/dsk/c31t0d5 td1 5b Not Applicable</pre>

Increasing the Powerfail Timeout on disk groups

The VxVM Powerfail Timeout is a timeout value set for a disk group. The default timeout is 30 seconds. If a disk does not respond to requests within 30 seconds, the device is marked as failed. For disk groups containing NetApp LUNs, the timeout must be set to 120 seconds so that I/O is not disrupted. To increase the timeout value, complete the following step:

Step	Action
1	For each disk group that contains NetApp LUNs, enter the following command: <pre>/opt/VRTS/bin/vxpfcto -g dg_name -t 120</pre>

Displaying LUN and HBA information

Utility for displaying information

The `sanlun` command is a NetApp HP-UX host tool that collects and reports information about host and NetApp storage configuration. For example, you can use the `sanlun` command to show the mapping between LUNs and host drives. You can also use this command to display information about the host HBA.

For detailed information

For detailed information, see the following topics:

- ◆ [“Displaying host LUN information”](#) on page 59
- ◆ [“Displaying host HBA information”](#) on page 62

Displaying LUN and HBA information

Displaying host LUN information

Displaying host LUN information To display host LUN information, complete the following steps.

Step	Action
1	Log in as root on the host.
2	At the host command line, use the <code>sanlun lun show</code> command to display LUN information. This command has two basic formats: ◆ <code>sanlun lun show -p [-v] [filer_name:filer_pathname filer_name all]</code> Note _____ You must use the <code>-p</code> version of the command if you want to see information about the primary and secondary paths. You cannot use the <code>-d</code> option if you use the <code>-p</code> option. ◆ <code>sannlun lun show [-v] [-d host_device_filename all filer_name filer_name:filer_pathname]</code> <code>-p</code> provides information about the primary and secondary paths available to the LUN when you are using multipathing. It lists the multipathing software being used to access the LUN (HP PVlinks or VERITAS DMP) and the multipathing policy. For example, if you are using PVlinks, the <code>-p</code> option provides information about PVlinks priority. If you are using DMP, the <code>-p</code> option provides information about the DMP multipathing policy. <code>-v</code> option produces verbose output. <code>-d</code> specifies the special device file on the host (<i>host_device_filename</i>); for example, <code>-d /dev/rdisk/c4t0d7</code>. <i>filer_name</i> is the name of the target storage appliance. <i>filer_pathname</i> is the path to the LUN on the filer. <code>all</code> displays information for all LUNs that are currently attached to the host. If you enter <code>sanlun lun show</code>, <code>sanlun lun show -p</code>, or <code>sanlun lun show -v</code> without any parameters, the utility responds as if you had included the <code>all</code> parameter.

Step	Action
	The command line you enter depends on the information you want to view: ◆ To display a listing of the paths and multipathing policy associated with the LUN, enter the following command line: <code>sanlun lun show -p</code> This information from this command line is useful if you need to view path ordering for PVLlinks or DMP, or to troubleshoot a problem with path ordering. ◆ To display the summary listing of the storage appliance LUN(s) associated with the host device /dev/rdsdsk/c3t4d2s2, enter the following command line: <code>sanlun lun show -d /dev/rdsdsk/c3t4d2s2</code> ◆ To display verbose output for all the LUNs currently available on the host enter the following command line: <code>sanlun lun show -v all</code> ◆ To display a summary listing of all the LUNs available to the host served by a storage appliance called toaster, enter the following command line: <code>sanlun lun show filer</code> ◆ To display a list of paths between the host and a specific LUN on the storage appliance (for example, lun0) on the storage appliance toaster, enter the following command line: <code>sanlun lun show filer:lun_path</code> Note_____ When you specify either the <code>sanlun lun show <filer name></code> or the <code>sanlun lun show <filer name:filer pathname></code> command, the utility displays only the LUNs that were discovered by the host. LUNs that were created on the storage appliance and have not been discovered by the host are not displayed. _____ Example 1: This example displays output you might see when you execute the <code>sanlun lun show</code> command with the <code>-p</code> option prior to running the <code>ntap_config_paths</code> utility, as shown in Step 11 of the section “Verifying the mapped LUN” on page 42. Keep the following information in mind as you look at the output: ◆ A primary path type indicates a connection that goes straight to the primary storage system, either via a SAN switch or a direct attached connection. This is the preferred route for I/O to the LUN. A secondary path type indicates a path through a second storage system. This path is used only when one cluster node fails. ◆ The filer port column refers to the port on the filer on which the LUN is accessed. It always represents a primary path. The partner port column refers to the port on the partner in the cluster. It always represents a secondary path

Step	Action																																																										
	◆ The LUNs are managed by LVM and PVlinks multipathing. The PVlinks failover priority column shows the PVlinks order of the paths to the LUN. # sanlun lun show -p filerX:/vol/vol1/3333 (LUN 3333) VG: none 2g (2147483648) lun state: GOOD Filer_CF_State: Cluster Enabled Multipath_Policy: A/P Multipath-provider: HP PVlinks <table><tr><td>host</td><td>filer</td><td></td><td>primary</td><td>partner</td><td>PVlinks</td></tr><tr><td>path</td><td>path</td><td>/dev/dsk</td><td>host</td><td>filer</td><td>filer</td></tr><tr><td>state</td><td>type</td><td>filename</td><td>HBA</td><td>port</td><td>port</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>failover</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>priority</td></tr></table><table><tr><td>up</td><td>primary</td><td>/dev/dsk/c35t0d5</td><td>td1</td><td>5a</td><td></td><td>0</td></tr><tr><td>up</td><td>primary</td><td>/dev/dsk/c34t0d5</td><td>td0</td><td>4a</td><td></td><td>1</td></tr><tr><td>up</td><td>secondary</td><td>/dev/dsk/c30t0d5</td><td>td1</td><td></td><td>5b</td><td>2</td></tr><tr><td>up</td><td>secondary</td><td>/dev/dsk/c31t0d5</td><td>td0</td><td></td><td>4b</td><td>3</td></tr></table> Example 2: The following example shows an excerpt of output you might see when you enter the sanlun with the -v option only. # sanlun lun show -v filer: lun-pathname device filename adapter lun size lun state filerX /vol/vol1/3333 /dev/rdsk/c31t0d5 td0 2g (2147483648) GOOD Serial number: OdHNI3miy7QO Filer FCP nodename:50a980000200f2fa Filer FCP portname:50a9800a0200f2cc Filer adapter name: v.4b Filer IP address: 10.97.102.55 Filer volume name:vol1 FSID:0x2500f2cc Filer qtree name:/vol/vol1 ID:0x0 Filer snapshot name: ID:0x0	host	filer		primary	partner	PVlinks	path	path	/dev/dsk	host	filer	filer	state	type	filename	HBA	port	port						failover						priority	up	primary	/dev/dsk/c35t0d5	td1	5a		0	up	primary	/dev/dsk/c34t0d5	td0	4a		1	up	secondary	/dev/dsk/c30t0d5	td1		5b	2	up	secondary	/dev/dsk/c31t0d5	td0		4b	3
host	filer		primary	partner	PVlinks																																																						
path	path	/dev/dsk	host	filer	filer																																																						
state	type	filename	HBA	port	port																																																						
					failover																																																						
					priority																																																						
up	primary	/dev/dsk/c35t0d5	td1	5a		0																																																					
up	primary	/dev/dsk/c34t0d5	td0	4a		1																																																					
up	secondary	/dev/dsk/c30t0d5	td1		5b	2																																																					
up	secondary	/dev/dsk/c31t0d5	td0		4b	3																																																					

Displaying LUN and HBA information

Displaying host HBA information

Displaying host HBA information

To display the host HBA information, complete the following steps.

Step	Action
1	Log in as root on the host.
2	At the host command line, use the <code>sanlun</code> command to display host HBA information. This command has the following format: <pre>sanlun fcp show adapter [-c [-v] [adapter name all]]</pre> <code>-v</code> option produces verbose output. <code>-c</code> gives configuration information that you can use to create igroups. <code>all</code> lists information for all FCP adapters. <i>adapter name</i> lists adapter information for the adapter you specify. Examples: The following example shows the type of output you see when you use different versions of the <code>sanlun fcp show adapter</code> command line. <pre># sanlun fcp show adapter td0 WWPN:50060b000010a4fa td1 WWPN:50060b000010a53c # sanlun fcp show adapter -c Enter this filer command to create an initiator group for this system: igroup create -f -t hpux "netapp" 50060b000010a4fa 50060b000010a53c #</pre>

Step	Action
	<pre># sanlun fcp show adapter -v td0 WWPN:50060b000010a700 WWNN: 50060b000010a701 driver name: td model: A6795A model description: Fibre Channel Mass Storage Adapter (PCI) - 2 Gig serial number: Not Available hardware version: 2.2 driver version: @(#) PATCH_11.11: libtd.a : Jun 28 2002, 11:08:35, PHSS_26799 firmware version: Not Available Number of ports: 1 port type: Fabric port state: Operational supported speed: 2 GBit/sec negotiated speed: 2 GBit/sec OS device name: /dev/td0 td1 WWPN:50060b000010a606 WWNN: 50060b000010a607 driver name: td model: A6795A model description: Fibre Channel Mass Storage Adapter (PCI) - 2 Gig serial number: Not Available hardware version: 2.2 driver version: @(#) PATCH_11.11: libtd.a : Jun 28 2002, 11:08:35, PHSS_26799 firmware version: Not Available Number of ports: 1 port type: Fabric port state: Operational supported speed: 2 GBit/sec negotiated speed: 2 GBit/sec OS device name: /dev/td1</pre>

About this chapter

SAN booting is using a SAN-attached disk, such as a NetApp LUN, as a boot device for a host. SAN booting provides the following advantages:

- ◆ You can remove the hard drives from your servers and use the SAN for your boot needs, thereby eliminating the costs associated with maintaining and servicing hard drives.
- ◆ Consolidation and centralization—The host uses the SAN for both storage and boot needs.

This chapter describes procedure examples for the following methods for creating a bootable SAN LUN.

- ◆ Migrating an existing system disk using the HP MirrorDisk/UX tool
- ◆ Scratch installing the HP-UX OS on a boot LUN using an HP Ignite Server or an installation CD-ROM

For detailed information about supported components of SAN booting configurations (volume managers, OS versions, and host hardware) see the NetApp Fibre Channel Host Support Matrix at http://now.netapp.com/NOW/knowledge/docs/san/fcp_iscsi_config/fcp_support.

Topics covered in this chapter

This chapter discusses the following topics:

- ◆ “[Overview of SAN booting procedures](#)” on page 66
- ◆ “[Creating the boot LUN](#)” on page 68
- ◆ “[Migrating an existing OS disk by using MirrorDisk/UX on PA-RISC systems](#)” on page 75
- ◆ “[Installing the OS by using an Ignite Server or installation CD-ROM on PA-RISC systems](#)” on page 82

Overview of SAN booting procedures

Procedure assumptions

The procedures in this chapter assume the following:

- ◆ You are configuring a PA-RISC server.
 - Itanium systems use partitions for the boot device. This means that some of the procedures might be different for Itanium systems.
- ◆ The host is booting from an existing internal OS disk. It is not a diskless server.
- ◆ You manage the boot LUN with HP-UX Logical Volume Manager (LVM).
- ◆ The FCP HP-UX Attach Kit 1.1 software is installed on the host. The Attach Kit software contains the following tools, which you need for managing paths to the boot LUN. These tools are located in the `/opt/NetApp/santools/bin` directory.
 - ❖ `sanlun`—You use the `sanlun` tool to determine which storage device represents the boot LUN and to list the paths to that device.
 - ❖ `ntap_config_paths`—You use the `ntap_config_paths` tool to add missing paths to the volume groups containing the NetApp LUN and reorder the paths if necessary.

Note

These procedures are intended as examples or guidelines for creating a bootable SAN LUN. There are other methods for creating a bootable SAN LUN that are not described in this document. For example, you can migrate an existing system disk to a NetApp LUN without the MirrorDisk/UX tool by using `cpio` and `boot device` commands. You can also configure a diskless server to boot from a NetApp LUN. For more details, see the documentation for your version of HP-UX.

How Itanium systems partition boot devices

Itanium systems partition the boot device into three slices:

- ◆ `s0` represents the whole disk, for example `c0t0d0s0`.
- ◆ `s1` represents the EFI (Extensible Firmware Interface) system partition. This is an interface between HP-UX and Itanium BIOS. An example device is `c0t0d0s1`.
- ◆ `s2` represents the HP-UX partition and is equivalent to the whole disk device file for a PA-RISC boot disk. An example device is `c0t0d0s2`. In a NetApp environment, `s2` is used as the device file for the NetApp LUN. This means

that if you create a bootable LUN from a NetApp LUN on Itanium systems, you configure the OS on the device file with the s2 designation. In addition, the output of the `ioscan` and `sanlun` commands show the slices of the boot device. The following `sanlun` output example shows the paths to a bootable LUN on an Itanium system.

```
filer_a:/vol/vol1/bootlun (LUN 101) VG: /dev/vg00
  18g (19327352832)   lun state: GOOD
Filer_CF_State: Cluster Enabled  Multipath_Policy: A/P
Multipath-provider: HP PVlinks
```

host	filer		primary	partner	PVlinks	
path	path	/dev/dsk	host	filer	filer	path failover
state	type	filename	HBA	port	port	priority
up	primary	/dev/dsk/c7t12d5s2	td0	4a		0
up	primary	/dev/dsk/c13t12d5s2	td1	5a		1
up	secondary	/dev/dsk/c11t12d5s2	td1		5b	2
up	secondary	/dev/dsk/c5t12d5s2	td0		4b	3

Note

For details about creating bootable devices on Itanium systems, see your HP documentation for your OS and server.

Procedure overview

To create a bootable SAN LUN, you complete the following tasks:

- ◆ Create the LUN on which you want to install the HP-UX Operating System (OS). This includes determining the boot LUN's size, mapping it to the host's igroup, and discovering the new LUN on the host.
- ◆ Configure the HP-UX OS on the boot LUN by either:
 - ❖ Migrating an existing OS disk to the boot LUN by using MirrorDisk/UX.
 - ❖ Installing the OS by using an Ignite Server or the HP installation CD-ROM.
- ◆ Set the host's boot environment by defining the primary and alternate boot paths.

Creating the boot LUN

Determining the size of the boot LUN

If you are installing the OS on the boot LUN: Create a LUN that is large enough to provide enough space for the version of HP-UX you are using. For details, see the documentation for your version of HP-UX.

If you are mirroring an existing host boot disk: Create a LUN that is at least as large as the allocated space used by the existing system boot disk. To determine the size of the system boot disk complete the following steps.

Step	Action
1	On the host, use the <code>vgdisplay</code> command to obtain information about the root volume group (vg00) and determine which disk is used as the system OS disk. <pre>vgdisplay -v vg00</pre> Result : The output under <code>Physical volumes</code> shows the paths to the system disk. Example: The following example shows the path to the system disk. <pre>--- Physical volumes --- PV Name /dev/dsk/clt15d0 PV Status available Total PE 4340 Free PE 2136 Autoswitch On</pre>
2	On the host, use the <code>diskinfo</code> command to display the size of the system disk: <pre>diskinfo /dev/rdisk/raw_device_node</pre> <code>raw_device_node</code> is the system disk device in <code>Physical volumes</code> section in the output of the <code>vgdisplay</code> command you used in Step 1. Example: The following example shows that the size of the system disk is approximately 18 GB. Your boot LUN must be at least 18 GB. <pre>diskinfo /dev/rdisk/clt15d0 SCSI describe of /dev/rdisk/clt15d0: vendor: HP 18.2G product id: MAN3184MC type: direct access size: 17783240 Kbytes bytes per sector: 512</pre>

Configuring the NetApp igroup and boot LUN

After you determine the size of the boot LUN, create the boot LUN on the NetApp storage appliance, map it to an igroup, and assign it a LUN ID.

Creating the igroup: To create the igroup, complete the following steps. If you already have an existing HP-UX igroup that contains the WWPNs of the host's HBAs, proceed to "[Creating the boot LUN](#)" on page 71.

Step	Action
1	Log in as root on the host.
2	Get the WWPN for each of the host's HBAs by entering the following <code>sanlun</code> command. The <code>sanlun</code> command is in the <code>/opt/NetApp/santools/bin</code> directory. <pre>sanlun fcp show adapter -c</pre> Result: The <code>-c</code> option tells the <code>sanlun</code> command to generate on the host console a complete <code>igroup create</code> command that includes the host's WWPNs. The igroup's name in the <code>igroup create</code> command matches the name of the host. You can copy this command from the host console and use it to create the igroup in Step 4. Example: The <code>sanlun fcp show adapter -c</code> command produces the following output on the console of an HP-UX system called <code>boothost</code>. This example uses two WWPNs. Enter this filer command to create an initiator group for this system: <pre>igroup create -f -t hpux "boothost" 50060b000010a700 50060b000010a606</pre> Because the name of the host is "boothost," this command line produces an igroup called "boothost."
3	On the host in a different session, use the <code>telnet</code> command to access the NetApp storage appliance.
4	Copy the <code>igroup create</code> command from Step 2. Example: If you use the information in Step 2, you would copy the following command line: <pre>igroup create -f -t hpux "boothost" 50060b000010a700 50060b000010a606</pre>

Step	Action
5	Paste the command on the storage appliance command line and press Enter. Result: The storage appliance creates the igroup and gives it the same name as the host name.
6	On the storage appliance command line, verify that the new igroup is created by entering the following command: igroup show Result: The console displays the newly created igroup with the host's WWPNs. Example: The following is output from the <code>igroup show</code> command displays. <pre>netapp_1> igroup show -v boothost boothost (FCP): OS Type: hpux Member: 50:06:0b:00:00:10:a7:00 Member: 50:06:0b:00:00:10:a6:06</pre>

Creating the boot LUN: To create the boot LUN, complete the following steps:

Step	Action
1	On the storage appliance command line, enter the following command: <pre>lun create -s <i>size</i> -t <i>ostype</i> <i>lun-path</i></pre> <i>size</i> is the size of the LUN, which you obtained in “Determining the size of the boot LUN” on page 68. You can use one of the following characters to establish the size: c (bytes), w (words or double bytes), b (512), k (kilobytes), m (megabytes), g (gigabytes), t (terabytes). -t <i>ostype</i> indicates the type of operating system running on the host that accesses the boot LUN. Enter hpux. <i>lun-path</i> is the LUN’s path name that includes the volume and qtree. Example: <pre>lun create -s 18g -t hpux /vol/bootvol/bootlun1</pre>
2	Enter the following command to map the LUN to the initiator group. <pre>lun map <i>lun-path</i> <i>igroup-name</i> <i>LUN-ID</i></pre> <i>lun-path</i> is the path name of the LUN you created. <i>igroup-name</i> is the name of the initiator group you created. <i>LUN-ID</i> is the identification number that you specify. The host associates the LUN ID with the location and path name of the LUN. If you do not specify a LUN ID, Data ONTAP automatically assigns one. The default LUN ID begins with 0 and increments by 1 for each additional LUN that is created. If you have existing LUNs, Data ONTAP assigns the next available LUN ID. Example: <pre>lun map /vol/bootvol/bootlun1 boothost 0</pre>

Step	Action
3	Verify that the LUN is online and mapped to the igroup by entering the following command: <pre>lun show -v</pre> Example: <pre>netapp_1> lun show -v /vol/bootvol/bootlun1 18g (19327352832) (r/w,online, mapped) Serial#: OdCtSYv7Y6w3 Share: none Space Reservation: enabled Multiprotocol Type: hpx Maps: boothost=0</pre>

Discovering the new LUN as a host device

After you create the boot LUN and map it to the igroup, discover the LUN as a host device by completing the following steps:

Step	Action																																																								
1	On the host, enter the following command: <pre>ioscan -fn -C disk</pre> Example: In this example, the output from the command shows the following information: ◆ The LUN is visible to the host and ready to use because its state is CLAIMED ◆ There are no device entries for the NetApp LUN ◆ The storage appliance is in cfmode partner because there are four instances (paths) to the NetApp LUN you created. If your storage appliance is set to another cfmode supported by HP-UX (mixed or dual_fabric), then you might see a different number of paths to the boot LUN. <pre># ioscan -fn -C disk</pre> <table><tr><th>Class</th><th>I</th><th>H/W Path</th><th>Driver</th><th>S/W State</th><th>H/W Type</th><th>Description</th></tr><tr><td colspan="7">=====</td></tr><tr><td>disk</td><td>0</td><td>0/0/1/1.15.0</td><td>sdisk</td><td>CLAIMED</td><td>DEVICE</td><td>HP 18.2GMAN3184MC</td></tr><tr><td></td><td></td><td></td><td>/dev/dsk/c1t15d0</td><td>/dev/rdsk/c1t15d0</td><td></td><td></td></tr><tr><td>disk</td><td>14</td><td>0/4/0/0.1.4.0.0.0.0</td><td>sdisk</td><td>CLAIMED</td><td>DEVICE</td><td>NETAPP LUN</td></tr><tr><td>disk</td><td>28</td><td>0/4/0/0.1.7.0.0.0.0</td><td>sdisk</td><td>CLAIMED</td><td>DEVICE</td><td>NETAPP LUN</td></tr><tr><td>disk</td><td>37</td><td>0/6/2/0.1.4.0.0.0.0</td><td>sdisk</td><td>CLAIMED</td><td>DEVICE</td><td>NETAPP LUN</td></tr><tr><td>disk</td><td>46</td><td>0/6/2/0.1.7.0.0.0.0</td><td>sdisk</td><td>CLAIMED</td><td>DEVICE</td><td>NETAPP LUN</td></tr></table>	Class	I	H/W Path	Driver	S/W State	H/W Type	Description	=====							disk	0	0/0/1/1.15.0	sdisk	CLAIMED	DEVICE	HP 18.2GMAN3184MC				/dev/dsk/c1t15d0	/dev/rdsk/c1t15d0			disk	14	0/4/0/0.1.4.0.0.0.0	sdisk	CLAIMED	DEVICE	NETAPP LUN	disk	28	0/4/0/0.1.7.0.0.0.0	sdisk	CLAIMED	DEVICE	NETAPP LUN	disk	37	0/6/2/0.1.4.0.0.0.0	sdisk	CLAIMED	DEVICE	NETAPP LUN	disk	46	0/6/2/0.1.7.0.0.0.0	sdisk	CLAIMED	DEVICE	NETAPP LUN
Class	I	H/W Path	Driver	S/W State	H/W Type	Description																																																			
=====																																																									
disk	0	0/0/1/1.15.0	sdisk	CLAIMED	DEVICE	HP 18.2GMAN3184MC																																																			
			/dev/dsk/c1t15d0	/dev/rdsk/c1t15d0																																																					
disk	14	0/4/0/0.1.4.0.0.0.0	sdisk	CLAIMED	DEVICE	NETAPP LUN																																																			
disk	28	0/4/0/0.1.7.0.0.0.0	sdisk	CLAIMED	DEVICE	NETAPP LUN																																																			
disk	37	0/6/2/0.1.4.0.0.0.0	sdisk	CLAIMED	DEVICE	NETAPP LUN																																																			
disk	46	0/6/2/0.1.7.0.0.0.0	sdisk	CLAIMED	DEVICE	NETAPP LUN																																																			
2	Enter the following command to install special files and create device entries on the host. <pre>ioinit -i</pre> If the <code>ioinit -i</code> command doesn't create device entries, use the <code>insf -e</code> command to install the device special files.																																																								

Step	Action	
3	If...	Then...
	You want to migrate an existing system boot disk to the LUN by using MirrorDisk/UX	Proceed to “ Migrating an existing OS disk by using MirrorDisk/UX on PA-RISC systems ” on page 75
	You want to install the OS from scratch by using an Ignite Server or an installation CD-ROM	Proceed to “ Installing the OS by using an Ignite Server or installation CD-ROM on PA-RISC systems ” on page 82

Migrating an existing OS disk by using MirrorDisk/UX on PA-RISC systems

Mirroring an existing system disk

If you created a new LUN for the boot device, and you want to migrate the existing system disk to the LUN, complete the following steps.

Step	Action																																										
1	On the host, enter the <code>sanlun</code> command to determine which paths to the boot LUN are primary paths. The <code>sanlun</code> command is in the <code>/opt/NetApp/santools/bin</code> directory. For example, when the <code>cfmode</code> of the storage appliance is <code>partner</code> and the host has two HBAs, the <code>sanlun</code> command shows two primary paths to the NetApp storage. You use a primary path from one HBA to the LUN to create a physical volume and add it to the root volume group. <pre>sanlun lun show -p</pre> Note When the <code>cfmode</code> of the storage appliance is <code>mixed</code> or <code>dual_fabric</code>, the <code>sanlun</code> command might show a different number of primary paths. You have to choose one primary path from a host HBA to the boot LUN. You add only a primary path to the root volume group. Example: In this example, the device <code>c24t0d0</code> is a primary path you can use for the root volume group. This device is used throughout this procedure example as the boot LUN. <pre># sanlun lun show -p boothost:/vol/vol1/bootlun1 (LUN 0) VG: none 18g (19327352832) lun state: GOOD Filer_CF_State: Cluster Enabled Multipath_Policy: A/PG Multipath-provider: HP PV Links</pre> <table><tr><th>host</th><th>filer</th><th></th><th>primary</th><th>partner</th><th>PVLinks</th></tr><tr><th>path</th><th>path</th><th>/dev/dsk host</th><th>filer</th><th>filer</th><th>path failover</th></tr><tr><th>state</th><th>type</th><th>filename HBA</th><th>port</th><th>port</th><th>priority</th></tr><tr><td>up</td><td>secondary</td><td>/dev/dsk/c44t0d0</td><td>td1</td><td>5b</td><td></td></tr><tr><td>up</td><td>primary</td><td>/dev/dsk/c46t0d0</td><td>td1</td><td>5a</td><td></td></tr><tr><td>up</td><td>secondary</td><td>/dev/dsk/c26t0d0</td><td>td0</td><td>4b</td><td></td></tr><tr><td>up</td><td>primary</td><td>/dev/dsk/c24t0d0</td><td>td0</td><td>4a</td><td></td></tr></table>	host	filer		primary	partner	PVLinks	path	path	/dev/dsk host	filer	filer	path failover	state	type	filename HBA	port	port	priority	up	secondary	/dev/dsk/c44t0d0	td1	5b		up	primary	/dev/dsk/c46t0d0	td1	5a		up	secondary	/dev/dsk/c26t0d0	td0	4b		up	primary	/dev/dsk/c24t0d0	td0	4a	
host	filer		primary	partner	PVLinks																																						
path	path	/dev/dsk host	filer	filer	path failover																																						
state	type	filename HBA	port	port	priority																																						
up	secondary	/dev/dsk/c44t0d0	td1	5b																																							
up	primary	/dev/dsk/c46t0d0	td1	5a																																							
up	secondary	/dev/dsk/c26t0d0	td0	4b																																							
up	primary	/dev/dsk/c24t0d0	td0	4a																																							

Step	Action
2	Create a bootable physical volume on the LUN by entering the following command: <pre>pvccreate -fB /dev/rdisk/<i>ntap_device</i></pre> <i>ntap_device</i> is the raw disk device on the primary path to the LUN. Use the raw device node for the device you found in Step 1. -fB forces the creation of the physical volume and creates space for a boot area on the LUN. Example: <code>pvccreate -fB /dev/rdisk/c24t0d0</code>
3	Add the LUN to the root volume group (vg00). Use a block disk device node, not a raw disk device. <pre>vgextend vg00 /dev/dsk/<i>ntap_device</i></pre> <i>ntap_device</i> is the disk device file for the primary path to the LUN. Use the device you found in Step 1. Example: <code>vgextend vg00 /dev/dsk/c24t0d0</code>
4	Add the remaining paths to the LUN to the root volume group by using NetApp's <code>ntap_config_paths</code> utility, which is in the <code>/opt/NetApp/santools/bin</code> directory. <pre>ntap_config_paths vg00</pre>
5	Enter the following command to copy boot utilities to the boot LUN. <pre>mkboot /dev/rdisk/<i>ntap_device</i></pre> <i>ntap_device</i> is the device used for the boot LUN, for example, <code>c24t0d0</code>.
6	Enter the following commands to make sure that the host will boot if either the boot LUN or the system disk is unavailable. <pre>mkboot -a "hpux -lq" /dev/dsk/<i>system_disk_device</i> mkboot -a "hpux -lq" /dev/dsk/<i>ntap_device</i></pre> <i>system_disk_device</i> is the path to the system disk device node, for example, <code>c1t15d0</code>. <i>ntap_device</i> is the device node on the primary path to the boot LUN, for example <code>c24t0d0</code>.

Step	Action
7	Enter the following command to display the logical volumes on the existing system boot disk (vg00). The logical volumes are displayed under the --- Logical volumes --- line in the command output. You mirror the logical volumes to the boot LUN. <pre>vgdisplay -v vg00</pre> Example: The following example is partial output from the <code>vgdisplay</code> command to show how two logical volumes are listed. <pre>--- Logical volumes --- LV Name /dev/vg00/lvol1 LV Status available/syncd LV Size (Mbytes) 300 Current LE 75 Allocated PE 75 Used PV 1 LV Name /dev/vg00/lvol2 LV Status available/syncd LV Size (Mbytes) 2048 Current LE 512 Allocated PE 512 Used PV 1</pre>
8	For each logical volume, use the <code>lvextend</code> command to mirror the logical volume from the existing system boot disk (vg00) to the boot LUN. <pre>lvextend -m 1 lv_path /dev/dsk/ntap_device</pre> <code>-m 1</code> specifies to mirror one logical volume. <code>lv_path</code> is the path to the logical volume, for example, <code>/dev/vg00/lvol2</code> <code>ntap_device</code> is the device on the primary path to the boot LUN, for example, <code>c24t0d0</code>. Example: This example mirrors logical volume 1 to the boot LUN (<code>/dev/dsk/c24t0d0</code>). <pre>lvextend -m 1 /dev/vg00/lvol1 /dev/dsk/c24t0d0</pre> The newly allocated mirrors are now being synchronized. This operation will take some time. Please wait Logical volume "/dev/vg00/lvol1" has been successfully extended. Volume Group configuration for /dev/vg00 has been saved in /etc/lvmconf/vg00.conf
9	Update the Boot Device Reserved Area (BDRA) by entering the following command: <pre>lvlnboot -R</pre>

Step	Action
10	Using <code>vi</code> or another text editor, add a line to the <code>/stand/bootconf</code> file to identify the boot disk to the SDUX utility. Use the path to the block device node. <pre>1 /dev/dsk/<i>ntap_device</i></pre> <i>ntap_device</i> is the device used for the boot LUN. Example: 1 /dev/dsk/c24t0d0

Setting the host's boot paths

After you mirror the boot disk to the boot LUN, set the primary and alternate boot paths for the host by using the `setboot` command on the host. When you use the `setboot` command, you specify hardware paths to a device. This means that you have to identify the primary and secondary paths to the boot LUN by using the `sanlun` command, and then identify which hardware paths they correspond to by using the `ioscan` command.

To ensure system availability, the primary boot path must use a primary path to the boot LUN. The alternate boot path must use a secondary path to the boot LUN.

When you define the primary boot path, make sure you use the device that you identified in [Step 1](#) of “[Mirroring an existing system disk](#)” on page 75. This is the device you added to the root volume group and copied the HP-UX boot utilities to.

To set the host boot paths, complete the following steps.

Step	Action																																			
1	Display the paths to the boot LUN by entering the following command: <pre>sanlun lun show -p</pre> Example: In this example, the primary path to the boot LUN from host is /dev/dsk/c24t0d0. This is the device to which you mirrored logical volumes and copied HP-UX boot utilities in “Mirroring an existing system disk” on page 75. A secondary path to the boot LUN from the host is /dev/dsk/c44t0d0. These paths are used for the remainder of this procedure example. <pre># sanlun lun show -p boothost:/vol/vol1/bootlun (LUN 0) VG: /dev/vg00 18g (19327352832) lun state: GOOD Filer_CF_State: Cluster Enabled Multipath_Policy: A/P Multipath-provider: HP PVlinks</pre> <table><tr><th>path state</th><th>path type</th><th>/dev/dsk filename</th><th>host HBA</th><th>target port</th><th>partner port</th><th>PVlinks priority</th></tr><tr><td>up</td><td>primary</td><td>/dev/dsk/c24t0d0</td><td>td0</td><td>4a</td><td></td><td>0</td></tr><tr><td>up</td><td>primary</td><td>/dev/dsk/c46t0d0</td><td>td1</td><td>5a</td><td></td><td>1</td></tr><tr><td>up</td><td>secondary</td><td>/dev/dsk/c44t0d0</td><td>td1</td><td></td><td>5b</td><td>2</td></tr><tr><td>up</td><td>secondary</td><td>/dev/dsk/c26t0d0</td><td>td0</td><td></td><td>4b</td><td>3</td></tr></table>	path state	path type	/dev/dsk filename	host HBA	target port	partner port	PVlinks priority	up	primary	/dev/dsk/c24t0d0	td0	4a		0	up	primary	/dev/dsk/c46t0d0	td1	5a		1	up	secondary	/dev/dsk/c44t0d0	td1		5b	2	up	secondary	/dev/dsk/c26t0d0	td0		4b	3
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Step	Action																																																																																				
2	Enter the following command to determine which hardware paths correspond to the primary and secondary paths to the boot LUN, which you displayed in step 1. <pre>ioscan -funC disk</pre> Example: In this example, the hardware path for the primary path to the boot LUN is 0/4/0/0.1.4.0.0.0.0. Use this hardware path for the host’s primary boot path. The hardware path for the secondary path to the boot LUN is 0/6/2/0.1.7.0.0.0.0. Use this hardware path for the host’s alternate boot path. <pre># ioscan -funC disk</pre> <table><tr><th>Class</th><th>I</th><th>H/W Path</th><th>Driver</th><th>S/W State</th><th>H/W Type</th><th>Description</th></tr><tr><td colspan="7">=====</td></tr><tr><td>disk</td><td>0</td><td>0/0/1/1.15.0</td><td>sdisk</td><td>CLAIMED</td><td>DEVICE</td><td>HP 18.2GMAN3184MC</td></tr><tr><td></td><td></td><td></td><td>/dev/dsk/c1t15d0</td><td></td><td>/dev/rdsk/c1t15d0</td><td></td></tr><tr><td>disk</td><td>14</td><td>0/4/0/0.1.4.0.0.0.0</td><td>sdisk</td><td>CLAIMED</td><td>DEVICE</td><td>NETAPP LUN</td></tr><tr><td></td><td></td><td></td><td>/dev/dsk/c24t0d0</td><td></td><td>/dev/rdsk/c24t0d0</td><td></td></tr><tr><td>disk</td><td>28</td><td>0/4/0/0.1.7.0.0.0.0</td><td>sdisk</td><td>CLAIMED</td><td>DEVICE</td><td>NETAPP LUN</td></tr><tr><td></td><td></td><td></td><td>/dev/dsk/c26t0d0</td><td></td><td>/dev/rdsk/c26t0d0</td><td></td></tr><tr><td>disk</td><td>37</td><td>0/6/2/0.1.4.0.0.0.0</td><td>sdisk</td><td>CLAIMED</td><td>DEVICE</td><td>NETAPP LUN</td></tr><tr><td></td><td></td><td></td><td>/dev/dsk/c46t0d0</td><td></td><td>/dev/rdsk/c46t0d0</td><td></td></tr><tr><td>disk</td><td>46</td><td>0/6/2/0.1.7.0.0.0.0</td><td>sdisk</td><td>CLAIMED</td><td>DEVICE</td><td>NETAPP LUN</td></tr><tr><td></td><td></td><td></td><td>/dev/dsk/c44t0d0</td><td></td><td>/dev/rdsk/c44t0d0</td><td></td></tr></table>	Class	I	H/W Path	Driver	S/W State	H/W Type	Description	=====							disk	0	0/0/1/1.15.0	sdisk	CLAIMED	DEVICE	HP 18.2GMAN3184MC				/dev/dsk/c1t15d0		/dev/rdsk/c1t15d0		disk	14	0/4/0/0.1.4.0.0.0.0	sdisk	CLAIMED	DEVICE	NETAPP LUN				/dev/dsk/c24t0d0		/dev/rdsk/c24t0d0		disk	28	0/4/0/0.1.7.0.0.0.0	sdisk	CLAIMED	DEVICE	NETAPP LUN				/dev/dsk/c26t0d0		/dev/rdsk/c26t0d0		disk	37	0/6/2/0.1.4.0.0.0.0	sdisk	CLAIMED	DEVICE	NETAPP LUN				/dev/dsk/c46t0d0		/dev/rdsk/c46t0d0		disk	46	0/6/2/0.1.7.0.0.0.0	sdisk	CLAIMED	DEVICE	NETAPP LUN				/dev/dsk/c44t0d0		/dev/rdsk/c44t0d0	
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3	Set the host’s primary boot path by entering the following command: <pre>setboot -p prim_hw_path_to_lun</pre> <i>prim_hw_path_to_lun</i> is the primary hardware path to the boot LUN from the host’s HBA1, which you displayed in step 2. Example: The following example shows how to set the primary boot path to the boot LUN by using the hardware path that corresponds to /dev/dsk/c24t0d0, the primary path. <pre>setboot -p 0/4/0/0.1.4.0.0.0.0</pre>																																																																																				

Step	Action	
4	Set the host's alternate boot path by entering the following command: <pre>setboot -a sec_hw_path_to_lun</pre> <i>sec_hw_path_to_lun</i> is the secondary hardware path to the boot LUN from the host's HBA2, which you displayed in step 2. Example: The following example shows how to set the alternate boot path to the boot LUN by using the hardware path that corresponds to /dev/dsk/c44t0d0, the secondary path. <pre>setboot -a 0/6/2/0.1.7.0.0.0.0</pre>	
5	Test the primary boot path by shutting down and rebooting the system. Note_____ If Autoboot is disabled (set to OFF) for your system, you will have to boot the system from the Boot Control Handler (BCH) menu. _____ <pre>shutdown -r -y 0</pre>	
6	If...	Then...
	You cannot reboot the system.	Proceed to “ Troubleshooting sanboot configurations with PA-RISC systems ” on page 87
	You can reboot the system	Proceed to “ Testing the alternate boot path for PA-RISC systems ” on page 86.

Installing the OS by using an Ignite Server or installation CD-ROM on PA-RISC systems

Identifying paths to the boot LUN

When you install the OS on the boot LUN, you need to specify a primary path to the boot LUN as the Root Disk. The installation process uses the `setboot` command to define the primary path to the boot LUN as the host's primary boot path. After the installation is complete, you manually enter the `setboot` command to define an alternate boot path. This means that you have to identify the primary and secondary paths to the boot LUN, and their corresponding hardware paths, before you begin the installation.

To identify the primary and secondary paths to the boot LUN, complete the following steps.

Step	Action																																										
1	Display the primary and secondary paths to the boot LUN by entering the <code>sanlun</code> command, which is in the <code>/opt/NetApp/santools/bin</code> directory: <pre>sanlun lun show -p</pre> Example: In this example, a primary path to the boot LUN from the host is <code>/dev/dsk/c24t0d0</code>. A secondary path to the boot LUN from the host is <code>/dev/dsk/c44t0d0</code>. These paths are used as primary and secondary (alternate) paths for the remainder of this procedure example. <pre># sanlun lun show -p boothost:/vol/vol1/bootlun (LUN 0) VG: /dev/vg00 18g (19327352832) lun state: GOOD Filer_CF_State: Cluster Enabled Multipath_Policy: A/PG Multipath-provider: HP PV Links</pre> <table><tr><th>host</th><th>filer</th><th></th><th>primary</th><th>partner</th><th>PVLinks</th></tr><tr><th>path</th><th>path</th><th>/dev/dsk host</th><th>filer</th><th>filer</th><th>path failover</th></tr><tr><th>state</th><th>type</th><th>filename HBA</th><th>port</th><th>port</th><th>priority</th></tr><tr><td>up</td><td>primary</td><td>/dev/dsk/c24t0d0 td0</td><td>4a</td><td></td><td>0</td></tr><tr><td>up</td><td>primary</td><td>/dev/dsk/c46t0d0 td1</td><td>5a</td><td></td><td>1</td></tr><tr><td>up</td><td>secondary</td><td>/dev/dsk/c44t0d0 td1</td><td></td><td>5b</td><td>2</td></tr><tr><td>up</td><td>secondary</td><td>/dev/dsk/c26t0d0 td0</td><td></td><td>4b</td><td>3</td></tr></table>	host	filer		primary	partner	PVLinks	path	path	/dev/dsk host	filer	filer	path failover	state	type	filename HBA	port	port	priority	up	primary	/dev/dsk/c24t0d0 td0	4a		0	up	primary	/dev/dsk/c46t0d0 td1	5a		1	up	secondary	/dev/dsk/c44t0d0 td1		5b	2	up	secondary	/dev/dsk/c26t0d0 td0		4b	3
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2	Enter the following command to determine which hardware paths correspond to the primary and secondary paths to the boot LUN, which you displayed in Step 1. <pre>ioscan -funC disk</pre> Example: In this example, the hardware path for the primary path to the boot LUN is 0/4/0/0.1.4.0.0.0.0. Use this hardware path for the host's primary boot path. The hardware path for the secondary path to the boot LUN is 0/6/2/0.1.7.0.0.0.0. Use this hardware path for the host's alternate boot path. <pre># ioscan -funC disk</pre> <table><tr><th>Class</th><th>I</th><th>H/W Path</th><th>Driver</th><th>S/W State</th><th>H/W Type</th><th>Description</th></tr><tr><td colspan="7">=====</td></tr><tr><td>disk</td><td>0</td><td>0/0/1/1.15.0</td><td>sdisk</td><td>CLAIMED</td><td>DEVICE</td><td>HP 18.2GMAN3184MC</td></tr><tr><td></td><td></td><td></td><td>/dev/dsk/c1t15d0</td><td></td><td>/dev/rdsk/c1t15d0</td><td></td></tr><tr><td>disk</td><td>14</td><td>0/4/0/0.1.4.0.0.0.0</td><td>sdisk</td><td>CLAIMED</td><td>DEVICE</td><td>NETAPP LUN</td></tr><tr><td></td><td></td><td></td><td>/dev/dsk/c24t0d0</td><td></td><td>/dev/rdsk/c24t0d0</td><td></td></tr><tr><td>disk</td><td>28</td><td>0/4/0/0.1.7.0.0.0.0</td><td>sdisk</td><td>CLAIMED</td><td>DEVICE</td><td>NETAPP LUN</td></tr><tr><td></td><td></td><td></td><td>/dev/dsk/c26t0d0</td><td></td><td>/dev/rdsk/c26t0d0</td><td></td></tr><tr><td>disk</td><td>37</td><td>0/6/2/0.1.4.0.0.0.0</td><td>sdisk</td><td>CLAIMED</td><td>DEVICE</td><td>NETAPP LUN</td></tr><tr><td></td><td></td><td></td><td>/dev/dsk/c46t0d0</td><td></td><td>/dev/rdsk/c46t0d0</td><td></td></tr><tr><td>disk</td><td>46</td><td>0/6/2/0.1.7.0.0.0.0</td><td>sdisk</td><td>CLAIMED</td><td>DEVICE</td><td>NETAPP LUN</td></tr><tr><td></td><td></td><td></td><td>/dev/dsk/c44t0d0</td><td></td><td>/dev/rdsk/c44t0d0</td><td></td></tr></table>	Class	I	H/W Path	Driver	S/W State	H/W Type	Description	=====							disk	0	0/0/1/1.15.0	sdisk	CLAIMED	DEVICE	HP 18.2GMAN3184MC				/dev/dsk/c1t15d0		/dev/rdsk/c1t15d0		disk	14	0/4/0/0.1.4.0.0.0.0	sdisk	CLAIMED	DEVICE	NETAPP LUN				/dev/dsk/c24t0d0		/dev/rdsk/c24t0d0		disk	28	0/4/0/0.1.7.0.0.0.0	sdisk	CLAIMED	DEVICE	NETAPP LUN				/dev/dsk/c26t0d0		/dev/rdsk/c26t0d0		disk	37	0/6/2/0.1.4.0.0.0.0	sdisk	CLAIMED	DEVICE	NETAPP LUN				/dev/dsk/c46t0d0		/dev/rdsk/c46t0d0		disk	46	0/6/2/0.1.7.0.0.0.0	sdisk	CLAIMED	DEVICE	NETAPP LUN				/dev/dsk/c44t0d0		/dev/rdsk/c44t0d0	
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3	Record the primary and secondary hardware and device paths. During installation, you use a primary path to the LUN to define the root disk (vg00). After you install the OS, you use a secondary path to define the host's alternate boot path.																																																																																				

Installing the OS on the boot LUN To install the OS on the boot LUN, complete the following steps.

1	If...	Then...
	You are installing from a CD	Follow the HP instructions to boot from the CD.
	You are installing from an Ignite Server	1. Shutdown the host by entering the following command: <pre>shutdown -r -y 0</pre> Note _____ If Autoboot is enabled (set to ON), you have to interrupt the boot process to get to the Boot Control Handler (BCH) menu. If Autoboot is disabled (set to OFF), the system comes up and displays the BCH menu. 2. When the system is back up, enter the following command at the BCH Main Menu prompt: <pre>bo lan.<server_IP></pre> <i>server_IP</i> is the IP address of the Ignite Server. Example: <pre>Main Menu: Enter command or menu > bo lan.10.105.36.44 Interact with IPL (Y, N, or Cancel)?> n</pre>
2	In the HP-UX installation, configure system parameters, such as network services, file-system characteristics, and other configuration details. Make sure that you define the Root Disk as the primary path to the boot LUN. This is the path you obtained in Step 1 of “Identifying paths to the boot LUN” on page 82. In the Ignite-UX Interface, you define the Root Disk in the Basic tab. When you define the primary path to the boot LUN as the Root Disk, the installation script does the following: ◆ Configures the root volume group (vg00) and adds remaining path to the LUN to the root volume group. ◆ Uses the <code>setboot -p</code> command to define the primary path to the boot LUN as the host’s primary boot path. Note _____ For details about configuring other system parameters, consult the HP documentation for your OS.	

3	After you complete the HP-UX installation, install the FCP HP-UX Attach Kit 1.1 software on the boot LUN. For detailed installation instructions, see the <i>Installation and Setup Guide</i> for the attach kit.	
4	Add the remaining paths to the LUN to the root volume group by using NetApp's <code>ntap_config_paths</code> command, which is in the <code>/optNetApp/santools/bin</code> directory. <code>ntap_config_paths vg00</code>	
5	Set the host's alternate boot path by entering the following command: <code>setboot -a sec_hw_path_to_lun</code> <code>sec_hw_path_to_lun</code> is the secondary hardware path to the boot LUN from the host, which you obtained in Step 2 of “ Identifying paths to the boot LUN ” on page 82. Example: <code>setboot -a 0/6/2/0.1,7.0.0.0.0</code>	
6	Test the primary boot path by shutting down and rebooting the system. Note _____ If Autoboot is disabled (set to OFF) for your system, you will have to boot the system manually. _____ <code>shutdown -r -y 0</code>	
7	If...	Then...
	You cannot reboot the system.	Proceed to “ Troubleshooting sanboot configurations with PA-RISC systems ” on page 87
	You can reboot the system	Proceed to “ Testing the alternate boot path for PA-RISC systems ” on page 86.

Testing the alternate boot path for PA-RISC systems

Testing the alternate boot path

NetApp recommends that you test the alternate boot path before you put a SAN-booted configuration into a production environment. To test the alternate boot path, complete the following steps.

Step	Action
1	Shutdown the host by entering the following command: <code>shutdown -r -y 0</code>
2	At the Main Menu prompt of the Boot Console Handler (BCH), boot from the alternate boot path by entering the following command: <code>bo alt</code>
3	Shutdown the host again: <code>shutdown -r -y 0</code>
4	At the Main Menu prompt of Boot Console Handler (BCH), boot from the alternate boot path by entering the following command: <code>bo pri</code>

Troubleshooting sanboot configurations with PA-RISC systems

If you cannot boot from the primary or alternate path

If the system does not boot from the primary or alternate path, check the following configuration components:

- ◆ Connectivity—Check physical connectivity and cabling between the HBA, the switches, and the NetApp cluster.
- ◆ Boot path settings—If your system fails to boot from either the primary or alternate path, boot from the internal system disk, and then check your boot path settings.

Checking boot path settings: To boot from the system disk and check your boot path settings, complete the following steps:

Step	Action
1	If the system does not return to the Boot Control Handler (BCH) menu, reset the system to return to the BCH prompt.
2	Boot from the internal system disk by entering the following command: <pre>bo path</pre> <i>path</i> is the hardware path to the internal disk that the system formerly booted from. Example: The following example uses the hardware path to the internal system disk. <pre>bo 0/0/1/1.15.0</pre>
3	Verify that you correctly translated the primary and secondary device paths to the boot LUN to the correct hardware paths by using the following commands: ◆ <code>sanlun lun show -p</code>—Shows the primary and secondary device paths to the boot LUN. ◆ <code>ioscan -funC disk</code>—Shows the hardware paths to the device files.

Step	Action
4	Make sure that all paths to the boot LUN are in the root volume group by entering the following command: <pre>vgdisplay -v vg00</pre> Result: Paths to the LUN are listed under the <code>Physical volumes</code> section of the output. Example: In the following example, all paths to the boot LUN are in the root volume group. <pre>--- Physical volumes --- PV Name /dev/dsk/c24t0d0 PV Name /dev/dsk/c26t0d0 Alternate Link PV Name /dev/dsk/c46t0d0 Alternate Link PV Name /dev/dsk/c44t0d0 Alternate Link PV Status available Total PE 4606 Free PE 1577 Autoswitch On</pre>
5	If all paths to the boot LUN are not in the root volume group, add the remaining paths by using the <code>ntap_config_paths</code> utility, which is in the <code>/opt/NetApp/santools/bin</code> directory. <pre>ntap_config_paths vg00</pre>

About this chapter This chapter describes how to troubleshoot software installation problems and HBA and LUN management problems.

Topics covered in this chapter This chapter discusses the following topics:

- ◆ “[Troubleshooting checklists](#)” on page 90
- ◆ “[Correcting volume group multipathing with `ntap\_config\_paths`](#)” on page 93
- ◆ “[Handling a takeover and giveback](#)” on page 95
- ◆ “[Recovering from a host reboot during a takeover.](#)” on page 96
- ◆ “[Enabling the host to identify more than eight LUNs per target HBA](#)” on page 101
- ◆ “[Commands you can use to troubleshoot problems](#)” on page 106
- ◆ “[NetApp’s diagnostic utilities](#)” on page 111
- ◆ “[General troubleshooting](#)” on page 116

Troubleshooting checklists

Connectivity problems

On HP-UX systems, applications don't generally produce I/O errors. Instead, I/O retries continue uninterrupted if connectivity is lost. If you have a situation where I/O retries appear to be continuing without succeeding, check the following areas for connectivity problems:

- ◆ NetApp system setup
- ◆ Connectivity between the NetApp system and the Fibre Channel switch
- ◆ Fibre Channel switch setup
- ◆ Fibre Channel connectivity to the host
- ◆ Host setup

NetApp system setup checklist

You should make sure that the following situations are true:

- ◆ If you have a cluster, make sure the FCP cfmode setting is correct and supported by your configuration. For example, standby mode is not supported for any HP-UX hosts.
- ◆ FCP is running and all the target ports are in a good state.

Note

Keep in mind that if an HP-UX FCP driver is not in use, it logs off the target port. For this reason, the `fcv show initiators` command might not display all the host drivers as connected even though they are.

- ◆ The igroups have the following values for the attributes:
 - ❖ The `ostype` attribute must be `hpux`
 - ❖ The `vsa` attribute must be set to `yes`

Note

This attribute only appears in the output displays if it is incorrectly set. When it is correctly set, no references to it appear.

- ◆ For the LUNs, the following is true:
 - ❖ They are mapped to host igroups.
 - ❖ They are in a good state (that is, when you execute the `sanlun lun show -p` command, it lists the LUN state as “good”)

Host setup checklist

The following is a checklist of items that pertain to the host setup. You should check to see that the following is true:

- ◆ The HBAs are working.
Check the output from the `sanluns fcp show adapter` command.
- ◆ The host is seeing all of the LUNs it should.
- ◆ The software states reported by the `ioscan` command for the LUNs are “CLAIMED” (that is, in a good state).
- ◆ The `sanlun lun show -p` command is not reporting problems such as the following:
 - ❖ Downed paths
 - ❖ Missing paths
 - ❖ Out of order paths
 - ❖ The NetApp cluster is in a takeover state
- ◆ There are no suspicious messages in the `/usr/adm/syslog/syslog.log` file, including messages about the following:
 - ❖ I/O timeouts
 - ❖ Reported disk or SCSI errors
 - ❖ EMS event notifications

Note

A suspicious message might simply say that there is a loss of connectivity without explaining what the problem is.

- ◆ There are no other volume group configuration problems reported.
Use the `vgdisplay -v` command to display information about volume group configurations.

Situations affecting volume groups and disk devices

If certain events or changes occur, you must reconfigure the volume groups on the HP-UX host and disk devices the host sees from the NetApp storage. These situations include the following:

- ◆ If the host reboots while a NetApp cluster is in a degraded or takeover state (see [“Recovering from a host reboot during a takeover.”](#) on page 96)
- ◆ If you change any of the following settings on the storage appliance:
 - ❖ FCP cfmodes (do not do this unless directed to do so by NetApp)
 - ❖ igroup VSA setting

Fixing problems with the volume groups online

You can resolve problems with a volume group while it is online as long as you have at least one active path to each physical volume in the volume group. For example, if there is a missing path, you can locate it without taking the volume group offline.

Fixing problems with the volume groups offline

If all the paths to a physical volume go down and new paths appear, you must perform a host volume group reconfiguration. The following situations require a host volume group reconfiguration:

- ◆ The `cfmode` needs to change. (Do not change the `cfmode` unless directed to do so by NetApp.)
- ◆ The `vsa` attribute for the igroup is not enabled. This would happen if you created an igroup without specifying `hpux` as the operating system type. By default, this value is set correctly when you create an HP-UX igroup. (For information about setting the `vsa` attribute, see [“Changing the vsa value”](#) on page 101.)

Correcting volume group multipathing with ntap_config_paths

Using the utility ntap_config_paths

When you’re using HP LVM with PVlinks multipathing, you can use the `ntap_config_paths` utility that NetApp provides to perform the following tasks:

- ◆ Set up alternate paths to a volume group after you create the volume group with one primary path.
- ◆ Correct problems with path order within a volume group.

Example: The following example shows how `ntap_config_paths` works to correct paths to volume groups in a multipathing environment. The `sanlun lun show -p` command output includes the comment “not in VG,” which means that the LUN is a member of a volume group, but some of the paths to it are missing.

Note

To make this example easier to read, the `ntap_config_paths` output was removed.

```
# sanlun lun show -p all

filer1:/vol/vol1/hp-lv-lun1 (LUN 1) VG: /dev/hp-lv01
      2g (2147483648)          lun state: GOOD
Filer_CF_State: Cluster Enabled  Multipath_Policy: A/P
Multipath-provider: HP PVlinks
-----
host      filer              primary partner PVlinks
path      path              /dev/dsk      host filer  filer  failover
state     type              filename      HBA  port   port   priority
-----
up        primary          /dev/dsk/c34t0d5  td0 4a              0
up        primary          /dev/dsk/c35t0d5  td1 5a              not in VG
up        secondary        /dev/dsk/c30t0d5  td1              5b  not in VG
up        secondary        /dev/dsk/c31t0d5  td0              4b  not in VG

# ntap_config_paths

Getting information from sanlun...

Adding missing path with:
    vgextend /dev/vg_ntap01 /dev/dsk/c30t0d5
(output removed)
Moving VG path to the end of the alternate paths with:
    vgreduce /dev/vg_ntap01 /dev/dsk/c34t0d5
```

```
vgextend /dev/vg_ntap01 /dev/dsk/c34t0d5  
(output removed)  
Moving VG path to the end of the alternate paths with:  
vgreduce /dev/vg_ntap01 /dev/dsk/c31t0d5  
vgextend /dev/vg_ntap01 /dev/dsk/c31t0d5  
(output removed)
```

Handling a takeover and giveback

Handling a takeover and giveback

If a storage appliance fails, a takeover occurs. The storage appliance starts using the secondary paths during the takeover. When the giveback occurs, the storage appliance starts using the primary paths again.

Note

If the host reboots during the takeover, the storage appliance loses the primary paths. See “[Recognizing a host reboot during a takeover](#)” on page 96 for information about how to determine whether the host rebooted during a takeover. If the reboot occurred, the section “[Recovering from a host reboot during a takeover](#)” on page 98 tells you which steps you must perform to get the storage to rediscover the primary paths.

What happens during a takeover

Several things happen during a takeover:

- ◆ All the primary paths become unresponsive. If you execute the `ioscan` command, it displays a SW State of `NO_HW`, which means unresponsive paths.
- ◆ Applications do not see I/O errors from the system.
- ◆ It might take PVLinks up to $(P * T)$ seconds to resume I/O on the secondary paths during a takeover, where
 - ❖ P is the number of primary paths.
 - ❖ T is the I/O timeout on the physical volume. To see the value, enter `pvdisplay -v`; to change this value, enter `pvchange`.
- ◆ There might be timeout messages in the host’s syslog file.

What happens during a giveback

After the giveback occurs, the primary paths come back up. When the host notices that these paths are back, it takes approximately 15 to 30 seconds to transfer I/O back to the path that was active before the takeover.

Recovering from a host reboot during a takeover.

Events that occur if a host reboots during a takeover

If a host reboots while the storage appliance is in a takeover state, the following events occur:

1. The primary paths to the LUNs on the downed storage appliance disappear. Secondary paths might disappear as well.
2. The volume groups deactivate those primary paths.
3. The volume groups remain active, but are aware of the secondary paths only.
4. When the giveback occurs, the host is only aware of the secondary paths; it uses the proxy paths, not the primary paths.

When a reboot occurs, you need to perform steps so that the host rediscovers the primary paths to the volume groups.

If no host reboot occurs during the takeover, the host automatically notices when the primary paths come back up and transfers information back to them without any user intervention. See “[Handling a takeover and giveback](#)” on page 95 for more information.

Recognizing a host reboot during a takeover

When a host reboots while the cluster is in a takeover state, information about the primary and sometimes the secondary paths disappears. You can determine whether a host reboot occurred during a takeover by executing commands such as `sanlun lun show`, `-p, ioscan -fnC disk`, and `vgdisplay -v` after the giveback occurs. These commands display current information about the configuration information.

sanlun command output: The output of the `sanlun lun show -p` command does not show all paths to the LUN after the giveback occurs. The output depends on which storage appliance in the cluster owns the LUNs. The following output example shows information about the secondary paths only because LUN is on the primary filer.

```
# sanlun lun show -p all
```

```
filer1:/vol/vol1/hp-lv-lun1 (LUN 1) VG: /dev/hp-lv01
      2g (2147483648)          lun state: GOOD
Filer_CF_State: Cluster Enabled Multipath_Policy: A/P
Multipath-provider: HP PVlinks
```

host	filer	primary	partner	PVlinks
path	path	/dev/dsk	host filer	filer
state	type	filename	HBA	port
up	secondary	/dev/dsk/c44t0d0	td1	5b
up	secondary	/dev/dsk/c26t0d0	td0	4b

ioscan command output: The `ioscan -fnC disk` command does not display some of the devices the host accessed before the takeover.

```
# ioscan -funC disk
```

Class	I	H/W Path	Driver	S/W State	H/W Type	Description
disk	0	0/0/1/1.15.0	sdisk	CLAIMED	DEVICE	HP 18.2GMAN3184MC
		/dev/dsk/c1t15d0			/dev/rdisk/c1t15d0	
disk	28	0/4/0/0.1.7.0.0.0.0	sdisk	CLAIMED	DEVICE	NETAPP LUN
		/dev/dsk/c26t0d0			/dev/rdisk/c26t0d0	
disk	46	0/6/2/0.1.7.0.0.0.0	sdisk	CLAIMED	DEVICE	NETAPP LUN
		/dev/dsk/c44t0d0			/dev/rdisk/c44t0d0	

vgdisplay command output: If you enter the `vgdisplay -v` command, the output shows warnings similar to the following:

```
vgdisplay: Warning: couldn't query physical volume "<volume_name>":
The specified path does not correspond to physical volume attached
to this volume group
```

Recovering from a host reboot during a takeover

If the host reboot occurs while the cluster is in a takeover state, it does not automatically rediscover the paths to the LUNs after giveback. After the giveback occurs, perform the following steps for each volume group hosted on the storage appliance.

Step	Action
1	Repair the problem that caused the filer to fail, and then reboot the storage appliance.
2	On the NetApp console, perform the giveback by entering the following command. cf giveback
3	On the host, enter the <code>ioscan</code> command to detect the primary paths. Example: The following is an example of the output from the <code>ioscan</code> command that shows all paths to the LUN. <pre># ioscan -funC disk Class I H/W Path Driver S/W State H/W Type Description ===== disk 0 0/0/1/1.15.0 sdisk CLAIMED DEVICE HP 18.2GMAN3184MC /dev/dsk/c1t15d0 /dev/rdisk/c1t15d0 disk 14 0/4/0/0.1.4.0.0.0.0.0 sdisk CLAIMED DEVICE NETAPP LUN /dev/dsk/c24t0d0 /dev/rdisk/c24t0d0 disk 28 0/4/0/0.1.7.0.0.0.0.0 sdisk CLAIMED DEVICE NETAPP LUN /dev/dsk/c26t0d0 /dev/rdisk/c26t0d0 disk 37 0/6/2/0.1.4.0.0.0.0.0 sdisk CLAIMED DEVICE NETAPP LUN /dev/dsk/c46t0d0 /dev/rdisk/c46t0d0 disk 46 0/6/2/0.1.7.0.0.0.0.0 sdisk CLAIMED DEVICE NETAPP LUN /dev/dsk/c44t0d0 /dev/rdisk/c44t0d0</pre>

Step	Action																																																						
4	On the host, enter the following command to confirm that the host detects all paths to the LUNs. <pre>sanlun lun show -p all</pre> Result: The <code>sanlun</code> command shows all recovered paths, but the paths are not shown in the correct multipathing order. Example: The following shows partial <code>sanlun</code> command output after you have used the <code>ioscan</code> command to detect the recovered paths. Note that the PVlinks priority is not correct—a secondary path is listed as the first path in the PVlinks order. <pre># sanlun lun show -p filer1:/vol/vol1/hp-lv-lun1 (LUN 1) VG: /dev/hp-lv01 2g (2147483648)) lun state: GOOD Filer_CF_State: Cluster Enabled Array_Policy: A/P Multipath-provider: HP PVlinks</pre> <table><tr><td>host</td><td>filer</td><td></td><td>primary</td><td>partner</td><td>PVlinks</td></tr><tr><td>path</td><td>path</td><td>/dev/dsk</td><td>host</td><td>filer</td><td>filer</td></tr><tr><td>state</td><td>type</td><td>filename</td><td>HBA</td><td>port</td><td>port</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>failover</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>priority</td></tr><tr><td>up</td><td>secondary</td><td>/dev/dsk/c44t0d0</td><td>td1</td><td></td><td>5b</td></tr><tr><td>up</td><td>primary</td><td>/dev/dsk/c24t0d0</td><td>td0</td><td>4a</td><td></td></tr><tr><td>up</td><td>primary</td><td>/dev/dsk/c46t0d0</td><td>td1</td><td>5a</td><td></td></tr><tr><td>up</td><td>secondary</td><td>/dev/dsk/c26t0d0</td><td>td0</td><td></td><td>4b</td></tr></table>	host	filer		primary	partner	PVlinks	path	path	/dev/dsk	host	filer	filer	state	type	filename	HBA	port	port						failover						priority	up	secondary	/dev/dsk/c44t0d0	td1		5b	up	primary	/dev/dsk/c24t0d0	td0	4a		up	primary	/dev/dsk/c46t0d0	td1	5a		up	secondary	/dev/dsk/c26t0d0	td0		4b
host	filer		primary	partner	PVlinks																																																		
path	path	/dev/dsk	host	filer	filer																																																		
state	type	filename	HBA	port	port																																																		
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up	secondary	/dev/dsk/c44t0d0	td1		5b																																																		
up	primary	/dev/dsk/c24t0d0	td0	4a																																																			
up	primary	/dev/dsk/c46t0d0	td1	5a																																																			
up	secondary	/dev/dsk/c26t0d0	td0		4b																																																		
5	Enter the following command to reconfigure the PVlinks path order. <pre>ntap_config_paths</pre>																																																						
6	Enter the <code>ntap_config_paths</code> command a second time. You must run this command again because in this situation it does not set the correct path order when you enter it the first time. <pre>ntap_config_paths</pre>																																																						

Step	Action
7	Enter the <code>sanlun</code> command to verify that the paths are configured in the correct order. <pre>sanlun lun show -p all</pre> Example: The following partial output shows the correct order of the paths to the LUN. For example, the primary paths to the LUN are the first two paths listed. <pre># sanlun lun show -p all filer1:/vol/vol1/hp-lv-lun1 (LUN 1) VG: /dev/hp-lv01 2g (2147483648)) lun state: GOOD Filer_CF_State: Cluster Enabled Multipath_Policy: A/P Multipath-provider: HP PVlinks ----- host filer primary partner PVlinks path path /dev/dsk host filer filer path failover state type filename HBA port port priority ----- up primary /dev/dsk/c24t0d0 td0 4a 0 up primary /dev/dsk/c46t0d0 td1 5a 1 up secondary /dev/dsk/c44t0d0 td1 5b 2 up secondary /dev/dsk/c26t0d0 td0 4b 3</pre>

Enabling the host to identify more than eight LUNs per target HBA

Changing the vsa value

The igroup vsa attribute enables the HP-UX host to identify more than eight LUNs per target HBA.

By default, this attribute is set when you create an igroup that specifies hpux as the operating system type. You must manually set this attribute if you change an existing igroup to an HP-UX igroup by modifying the ostype attribute.

Note—
You should never turn this attribute off.

To manually set the vsa attribute to on, complete the following steps.

Step	Action
1	On the host, make a backup of all the volume groups that contain LUNs. These backups must contain up-to-date information for both the data within the volume group and the volume group configuration. You should record the LUN volume group membership. To find all the LUNs and volume groups that contain LUNs from a specific pair of NetApp storage appliances, run the sanlun lun show -p command for each filer: <pre>sanlun lun show -p <filer1 name> sanlun lun show -p <filer2 name></pre>
2	Close the logical volumes. If a logical volume contains a file system, unmount the file system.
3	Deactivate each volume group by entering the following command: <pre>vgchange -a n <vg_name>/dev/vol_group_name</pre> vg_name is the path to the volume group. Example: The following command deactivates the volume group /dev/ntap01: <pre># vgchange -a n /dev/ntap01</pre>

Step	Action
4	Remove the volume group entry from the /etc/lvmtab and associated device files by using the <code>vgexport</code> command: <pre>vgexport /dev/ntap01</pre>
5	Go into diagnostic mode by entering the following command: <pre>priv set diag</pre> Example: When you start diagnostic mode, a warning appears. <pre># priv set diag Warning: These diagnostic commands are for use by Network Appliance personnel only.</pre>
6	Enter the following command: <pre>igroup set <igroup> vsa <value></pre> <igroup> is the name of the igroup for which you want to change the setting. <value> is either <i>on</i> or <i>off</i>. For HP-UX systems, you must always set this value to <i>on</i>. Result: The igroup you specify in this command. Note_____ Although this command lets you change the <i>vsa</i> value of a specific igroup and all igroups you create in the future, it does not change the value of any other existing igroups. You must perform this command on each existing igroup to change its attribute value. Example: Here is an example showing the output you might see when you change the igroup <i>hostA</i> on <i>filerX</i> to <i>on</i>: <pre>filerX> igroup set -f netapp vsa on Wed Sep 3 21:13:59 GMT [filerX: scsitarget.notice:notice]: VSA setting changed on initiator group "hostA" to "on"</pre>

Step	Action
7	Confirm that the <code>vsa</code> value for that <code>igroup</code> is now correct by using the <code>igroup show -v</code> command. ◆ If the attribute is not set correctly for an HP-UX system, the line “Volume Set Addressing: No” appears in the output. ◆ If the attribute is correctly set, there is no reference to volume set addressing or <code>vsa</code> in the output. Example: This example checks the settings for the <code>igroup</code> <code>hostA</code> and corrects the value for <code>vsa</code>. <pre>filerX> igroup show -v hostA hostA (FCP): OS Type: hpux Volume Set Addressing: No Member: 50:06:0b:00:00:10:a7:00 Member: 50:06:0b:00:00:10:a6:06</pre> <pre>filerX> priv set diag Warning: These diagnostic commands are for use by Network Appliance personnel only.</pre> <pre>filerX> igroup set hostA vsa on Wed Sep 3 21:13:59 GMT [filerX: scsitarget.notice:notice]: VSA setting changed on initiator group "hostA" to "on" filerX> igroup show -v hostA hostA (FCP) (ostype: hpux): OS Type: hpux Member: 50:06:0b:00:00:10:a7:00 Member: 50:06:0b:00:00:10:a6:06 filerX> priv set</pre>

Step	Action
8	Return to the host and execute the <code>ioscan -fnC disk</code> command and the <code>ioinit -i</code> command to have the host discover the disks and create device nodes for them. <pre># ioscan -fnC disk # ioinit -i</pre> Note_____ If the <code>ioinit -i</code> command does not create the devices, use the <code>insf -e</code> command. _____ Result: The old disk devices then show up as NO_HW in the <code>ioscan</code> output.
9	Either manually remove the old device paths or reboot the host. Doing this removes the old disk devices and causes the host to discover the new ones. Make sure that the only device nodes that are removed are those that disappeared as a result of the <code>igroup</code> attribute change.
10	Run the <code>vgscan -v</code> command and the <code>sanlun lun show -p</code> command to view the new locations: <pre># vgscan -v # sanlun lun show -p</pre> Correlate the new <code>sanlun</code> output with the <code>sanlun</code> information from Step 1 to determine which devices go with which volume group.

Step	Action
11	Re-add the volume group entries to /etc/lvmtab and the associated device files to the system. For each volume group, perform the following tasks: 1. Create a new directory with the <code>mkdir</code> command: <pre># mkdir /dev/<vg_name></pre> 2. Create a group file in the preceding directory with the <code>mknod</code> command: <pre># mknod /dev/<vg_name>/group c 64 <vg minor dev num></pre> 3. Issue the <code>vgimport</code> command with a device that represents a primary path (as indicated by the <code>sanlun lun show -p</code> command) for the volume group: <pre># vgimport /dev/<vg_name> <dev_name_primary_path></pre>
12	For each volume group you exported before changing the <code>vsa</code> attribute, activate the newly imported volume group: <pre># vgchange -a y /dev/vol_group_name</pre>
13	Run the <code>ntap_config_paths</code> utility to configure multipathing for the newly imported volume groups: <pre># ntap_config_paths</pre>
14	Verify that the paths are now set up correctly: <pre># sanlun lun show all -p</pre>
15	Repeat these steps for each filer in the cluster.

Commands you can use to troubleshoot problems

Commands you can use to check for problems

There are several commands you can use to check your system and look for problems. The following two commands are especially useful in tracking down problems:

- ◆ The HP-UX command `ioscan`
- ◆ The NetApp `sanlun` utility

Using HP-UX's `ioscan` command

The HP-UX `ioscan` command displays information about the state of the LUNs and whether the host recognizes them.

Example of `ioscan` output

The following example shows the type of output from the `ioscan` command that you would see after a takeover occurs. From this example, you can determine the following information:

- ◆ The storage appliance is in `cfmode mixed` because there are multiple paths to the filer LUN.
- ◆ There are no device entries for the NetApp LUNs yet.
- ◆ The state `CLAIMED` on four paths to the LUN means that these paths are visible to the host and ready to use.
- ◆ The state `NO_HW` on four paths to the LUN means that these paths are not visible to the host, so they cannot be used. These four paths would have been the primary paths, which were lost during the takeover.

# ioscan -fnC disk							
Class	I	H/W Path	Driver	S/W State	H/W Type	Description	
=====							
disk	0	0/0/1/1.15.0	sdisk	CLAIMED	DEVICE	HP 18.2GMAN3184MC	
			/dev/dsk/clt15d0		/dev/rdisk/clt15d0		
disk	1	0/4/0/0.1.5.0.26.0.5	sdisk	CLAIMED	DEVICE	NETAPP	LUN
			/dev/dsk/c31t0d5		/dev/rdisk/c31t0d5		
disk	3	0/4/0/0.1.6.0.26.0.5	sdisk	NO_HW	DEVICE	NETAPP	LUN
			/dev/dsk/c34t0d5		/dev/rdisk/c34t0d5		
disk	2	0/6/2/0.1.13.0.26.0.5	sdisk	CLAIMED	DEVICE	NETAPP	LUN
			/dev/dsk/c30t0d5		/dev/rdisk/c30t0d5		
disk	4	0/6/2/0.1.14.0.26.0.5	sdisk	NO_HW	DEVICE	NETAPP	LUN
			/dev/dsk/c35t0d5		/dev/rdisk/c35t0d5		

Using NetApp's sanlun utility

You can use NetApp's sanlun utility to perform the following tasks:

- ◆ Check the status of the
 - ❖ HBA
 - ❖ LUN
 - ❖ PVLlinks path
- ◆ Determine the /dev/dsk device node association with the filer LUN
- ◆ Discover whether a path is up or down

With the `-p` option, you can also use the sanlun utility to

- ◆ Determine whether the path to the filer is primary or secondary.
- ◆ Report missing paths from the volume group. (You can use the `ntap_config_paths` utility to easily correct any missing paths.)
- ◆ Report the PVLlinks path ordering.
- ◆ Get information about a takeover.

**Using sanlun to
check device nodes**

Using the `-pvv` option with `sanlun` increases the amount of information you get about a system. The following example illustrates how you can use `sanlun` with this option to determine which device notes are not responding to which commands:

```
# sanlun lun show -pvv

[open_device_filename] /dev/rdisk/c31t0d5
OK [/dev/rdisk/c31t0d5]
[open_device_filename] /dev/rdisk/c34t0d5
OK [/dev/rdisk/c34t0d5]
[open_device_filename] /dev/rdisk/c30t0d5
OK [/dev/rdisk/c30t0d5]
[open_device_filename] /dev/rdisk/c35t0d5
OK [/dev/rdisk/c35t0d5]

filer1:/vol/vol1/hp-lv-lun1 (LUN 1) VG: /dev/hp-lv01
      2g (2147483648))          lun state: GOOD
Filer_CF_State: Cluster Enabled  Multipath_Policy: A/P
Multipath-provider: HP PVlinks
-----
host      filer                                primary partner PVlinks
path      path          /dev/dsk          host filer    filer    path failover
state     type          filename        HBA  port     port     priority
-----
up        primary      /dev/dsk/c35t0d5 td1  5a                0
up        primary      /dev/dsk/c34t0d5 td0  4a                1
up        secondary    /dev/dsk/c30t0d5 td1                5b                2
up        secondary    /dev/dsk/c31t0d5 td0                4b                3
```

**Using sanlun to
check multipathing**

The order of the paths you use when you set up the LUNs can affect performance. In general, secondary paths are slower than primary paths.

To get the best performance, you must set up your paths with the primary paths first, followed by the secondary paths. You can use `sanlun` with the `-p` option to check your paths. If the paths are not in the correct order, `sanlun` puts the word (wrong) next to them.

Example: The following example shows where the secondary paths were entered before the primary path. Also, in this example, the primary path is visible, but is not in the volume group.

```
# sanlun lun show -p

filer1:/vol/vol1/hp-lv-lun1 (LUN 1) VG: /dev/hp-lv01
      2g (2147483648))          lun state: GOOD
Filer_CF_State: Cluster Enabled  Multipath_Policy: A/P
Multipath-provider: HP PVLlinks
-----
host      filer              primary partner PVLlinks
path      path              /dev/dsk      host filer  filer  path failover
state     type              filename      HBA  port   port   priority
-----
up        primary          /dev/dsk/c35t0d5 td1  5a           0
up        secondary        /dev/dsk/c30t0d5 td1           5b         1 (Wrong)
up        secondary        /dev/dsk/c31t0d5 td0           4b         2 (Wrong)
up        primary          /dev/dsk/c34t0d5 td0  4a           not in VG

#
```

You can repair the ordering of the paths by running the `ntap_config_paths` utility. You must manually add the primary path to the volume group.

Example of sanlun output after filer takeover

The following example shows the type of output the `sanlun` utility displays after a takeover occurs. From this example, you can determine

- ◆ The four primary paths to the LUN are down.
- ◆ The four secondary paths are taking over. The takeover paths start with the active path that has the lowest priority.

```
# sanlun lun show -p

filer1:/vol/vol1/hp-lv-lun1 (LUN 1) VG: /dev/hp-lv01
      2g (2147483648))          lun state: GOOD
Filer_CF_State: Cluster Enabled  Multipath_Policy: A/P
Multipath-provider: HP PVlinks

-----
host      filer                primary partner PVlinks
path      path                /dev/dsk      host filer  filer  path failover
state     type                filename      HBA  port   port   priority
-----
DOWN      /dev/dsk/c35t0d5              0
DOWN      /dev/dsk/c34t0d5              1
takeover secondary /dev/dsk/c30t0d5 td1          5b    2
takeover secondary /dev/dsk/c31t0d5 td0          4b    3
```

NetApp's diagnostic utilities

NetApp's diagnostic utilities

NetApp provides several scripts that provide diagnostic information you can use for troubleshooting.

When you run these utilities, they gather configuration information about different aspects of your system. They automatically create a gzipped .tar file and place the information in it. You can then send this information to NetApp.

Normally, you only use these utilities when requested to do so by NetApp's Customer Support. The utilities are

- ◆ filer_info. See “[Collecting filer information](#)” on page 111 for more information.
- ◆ hpux_info. See “[Using the HP-UX data-collection tool](#)” on page 113.
- ◆ <switch>_info, where <switch> is the name of the switch you are using (for example, brocade_info). See “[Collecting switch information](#)” on page 113.

General steps for executing the programs

Although some of the scripts have arguments that you might want to use, the general steps for executing these scripts are the same.

Step	Action
1	Go to the directory /opt/NetApp/santools/bin: <code>cd /opt/NetApp/santools/bin</code>
2	Enter the utility name. If the utility you are using includes arguments, you can enter them as well. Result: The configuration information that the utility gathers is placed in a gzipped .tar file.

Collecting filer information

If you are having a problem, NetApp Customer Support might ask you to run filer_info to collect filer configuration information. You should run this utility only when requested to do so by NetApp. To execute filer_info, complete the following steps.

Note

This utility runs in command-line mode only. Double-clicking the utility name to run it does not work.

Step	Action
1	Go to the directory /opt/NetApp/santools/bin: <code>cd /opt/netapp/santools/bin</code>
2	At the host command prompt, enter the following command: <pre>filer_info [-d <path_and_file_name>] [-l <user>] -n <filer_name></pre> The -d option enables you to specify a different path in which to place the resulting output. The default path is /tmp/netapp/ntap_filer_<filer_name>. The -l <user> option allows the choice of a user name and password on the switch. If this option is not specified, the Brocade default settings of admin:password are used. The target of the command is specified by “-n <filer_name>”, where <i>filer_name</i> is the name of IP address of the filer to be interrogated. Result The output of various status commands are placed in the output directory named netapp_filer_<filer_name>, where <i>filer_name</i> is replaced by the filer name or IP address. The contents of this directory are placed in a tarred and gzipped file named filer_filer_<filer_name>.tar.gz. Example: The following command line checks filer1, logging on to it as the user root. <pre>host1> filer_info -d /opt/netapp/santools -l root -n filer1</pre> The information from filer1 is placed in a gzipped file with the following directory path: /tmp/netapp/filer_filer1.tar.gz
3	Send the resulting gzipped file to NetApp for analysis.

Using the HP-UX
data-collection tool

If you are having a problem, NetApp Customer Support might ask you to run `hpux_info` to collect configuration information on your HP-UX system. You should run this utility only when requested to do so by NetApp.

To execute `hpux_info`, complete the following steps.

Step	Action
1	Change to the <code>/opt/netapp/santools/bin</code> directory: <code>cd /opt/netapp/santools/bin</code>
2	At the command prompt, enter the following command: <code>hpux_info [-d <directory>] [-n <file_name>]</code> <code>-d <directory></code> specifies the location for the gzipped file that <code>hpux_info</code> creates. The default location is <code>/tmp/netapp</code> . <code>-n <name></code> specifies the name for the output file and directory names. The default path name is <code>/tmp/netapp/ntap_hpux_info.tar.gz</code> . Result: When you run <code>hpux_info</code> , the utility gathers information about your HP-UX configuration and places it in a gzipped file. It also creates a directory and populates it with files containing output from numerous commands and copies of files, such as <code>/var/adm/syslog/syslog.log</code> file. Example: Depending on the options you specify, you see output similar to the following when you run this utility: <pre># hpux_info HP-UX system info is in directory /tmp/netapp/ntap_hpux_info Compressed file is /tmp/netapp/ntap_hpux_info.tar.gz Please send this file to Network Appliance for analysis</pre>
3	Send the resulting gzipped file to NetApp for analysis.

Collecting switch
information

If you are having a problem, NetApp Customer Support might ask you to run the switch utility NetApp supplies when you install the host attach kit software. NetApp provides a utility for each switch it supports for this host attach kit. The utility name is `<switch>_info`, where `switch` is the name of the switch (for example, `brocade_info` or `mcddata_info`). This utility collects switch configuration information. You should run this utility only when requested to do so by NetApp.

To execute the utility, complete the following steps.

Note

This utility runs in command-line mode only. Double-clicking the utility name to run it does not work.

Step	Action
1	Go to the directory /opt/netapp/santools/bin: <code>cd /opt/netapp/santools/bin</code>

Step	Action
2	At the host command prompt, enter the following command: <pre><switch_brand>_info [-d <path_and_file_name>] [-l <user:password>] -n <switchname></pre> <switch_brand> is the name of the switch you are using; for example, brocade or mcddata. The -d <path_and_file_name> option enables you to specify a different path in which to place the resulting output. The default path is /tmp/netapp/<switch_brand>_switch_<switch_name>. The -l <user:password> option allows the choice of a user name and password on the switch. If this option is not specified, the Brocade default settings of admin:password are used. The target of the command is specified by -n <switchname>, where switchname is the name or IP address of the switch to be interrogated. Result: The output of various status commands on the switch are placed in a directory named <switch_brand>_switch_switchname, where switch_brand is the brand of the switch, such as Brocade, and switchname is replaced by the switch name or IP address. The contents of this directory are placed in a tarred and gzipped file named <switch_brand>_switch_switchname.tar.gz. Example: This example uses the brocade_info file. The switch brcd1 is connected with the user "john", who has the password "smith". <pre>host1> brocade_info -d /opt/netapp/santools -l john:smith -n brcd1</pre> The information from filer1 is placed in a tarred, gzipped file that has the pathname /tmp/netapp/brocade_switch_brcd1.tar.gz .
3	Send the resulting gzipped file to NetApp for analysis.

General troubleshooting

Basic operations take a long time

Problem: There are no errors and everything appears to be correctly connected, but basic operations are taking exceptionally long times; in some cases, hours instead of minutes.

Explanation: If there are no other problems, this could mean that one of the connectors is not firmly attached. This can be the case even when it has a link and is reporting information such as the correct speed.

What to do: Disconnect the connector and reconnect it.

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