

FCP AIX® Host Utilities 4.2 for Veritas **Installation and Setup Guide**

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Preface

About this guide

This guide describes how to integrate an AIX® host with a Network Appliance® storage system with Data ONTAP® software and the Fibre Channel Protocol (FCP) for SCSI.

See either the NetApp Interoperability Matrix Tool, available on the NetApp on the Web™ (NOW) site <http://now.netapp.com/matrix/mtx/login.do> or the *Compatibility and Configuration Guide for NetApp FCP and iSCSI Products*, available at <http://now.netapp.com/NOW/knowledge/docs/docs.shtml>, for current information about the system requirements.

This document applies only to host environments running Veritas Storage Foundation™. If you are using Multiple Path I/O (MPIO) as your multipathing solution, see the *FCP AIX Host Utilities for Native OS Installation and Setup Guide*.

Audience

This guide is for system installers and administrators who:

- ◆ Are familiar with the AIX operating system
- ◆ Are familiar with Veritas
- ◆ Understand how to configure and administer a storage system
- ◆ Understand how to use FCP to store and retrieve data on a storage system.

Terminology

This guide uses the following terms:

- ◆ NetApp® storage products (filers, FAS appliances, and NearStore systems) are all storage systems and are also sometimes called filers or storage appliances.
- ◆ *igroup* refers to a collection of unique identifiers, either FCP WWPNs in a SCSI network or iSCSI node names of initiators (hosts) in an IP network, that are given access to LUNs when they are mapped to those LUNs.
- ◆ *LUN* (Logical Unit Number) refers to a logical unit of storage identified by a number.
- ◆ *LUN ID* refers to the numerical identifier for a LUN.
- ◆ *Initiator* refers to the system component that originates an I/O command over an I/O bus or network.
- ◆ *Target* refers to the storage system that receives an FCP I/O request and serves the data requested by the initiator.

Command conventions

You can enter storage system commands on either the system console or from any host system that can access the system through a Telnet session.

Formatting conventions

The following table lists different character formats used in this guide to set off special information.

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 requires you to enter the <code>fctest <i>adapternam</i></code> command, you enter the characters “fctest” followed by the actual name of the adapter. ◆ Book titles 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 your program is case-sensitive and uppercase letters are necessary for it to work properly.

Keyboard conventions

This guide uses capitalization and some abbreviations to refer to the keys on the keyboard. The keys on your keyboard might not be labeled exactly as they are in this guide.

What is in this guide...	What it means...
hyphen (-)	Used to separate individual keys. For example, Ctrl-D means holding down the Ctrl key while pressing the D key.

What is in this guide...	What it means...
<i>Enter, enter</i>	Used to refer to the key that generates a carriage return; the key is named Return on some keyboards. Also used to mean pressing one or more keys and then pressing the Enter key.
<i>type</i>	Used to mean pressing one or more keys on the keyboard.

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.

How to send your comments

Your feedback is important in helping us to provide the most accurate and high-quality information. If you have comments or suggestions for improving this publication, you can send us comments electronically to doccomments@netapp.com. To help us direct the comments to the correct division, please put FCP AIX in the subject line.

About this chapter

This chapter provides a brief overview of the FCP AIX Host Utilities for Veritas.

In addition, this chapter provides a high-level overview of the tasks you need to perform to install the Host Utilities and set up your system. It also includes pointers to other documentation that might be helpful in working with your Host Utilities setup.

Topics covered in this chapter

This chapter includes the following topics:

- ◆ [“Host Utilities overview”](#) on page 2
- ◆ [“FCP AIX Host Utilities installation overview”](#) on page 5
- ◆ [“Where to go for more information”](#) on page 8

Host Utilities overview

Important information about Host Utilities and Attach Kits

Previously NetApp provided FCP AIX Attach Kits to enable users to connect AIX hosts to NetApp storage systems. Going forward, NetApp is using Host Utilities to provide this support.

Host Utilities both simplify the products and provide more options for the host stacks. A single FCP AIX Host Utilities can contain software tools and documentation packages to support different host configurations.

Because the Host Utilities are the umbrella for the different kits, component version numbers are not tied to the Host Utilities version number. It is possible for each component to have a different version number. For example, at the time this document was produced, it supported the FCP Host Utilities 4.2 using version 3.2 of the SAN Toolkit.

If you are concerned about the version numbers, you can confirm that you have the most current components by checking the Host Utilities version number in the *NetApp Interoperability Matrix Tool* at <http://now.netapp.com/matrix/mtx/login.do> or the *Compatibility and Configuration Guide for NetApp's FCP and iSCSI Products* at <http://now.netapp.com/NOW/knowledge/docs/docs.shtml>.

Overview of the FCP AIX Host Utilities

The Host Utilities provide the tools and information necessary to enable an AIX host to connect to your storage systems. The FCP AIX Host Utilities for Veritas use Veritas Dynamic Multipathing (DMP) as the multipathing solution. In addition, the Host Utilities consist of:

- ◆ The SAN Toolkit, which contains:
 - ❖ The `san lun` utility that helps you manage LUNs and the host HBA.
 - ❖ Diagnostic scripts that provide diagnostic information about components in your configuration. Customer Support may ask for output from these scripts.
- ◆ Documentation that describes how to configure the AIX host. It includes this setup guide, *Release Notes*, and a quick command reference guide.

NetApp adds new components on an ongoing basis. For information on where to find the most current information on the supported FCP AIX Host Utilities stack, see “[Where to go for more information](#)” on page 8.

Software tools provided by the Host Utilities

The FCP AIX Host Utilities bundle the tools into a SAN Toolkit. The toolkit contains the following components:

- ◆ `aix_info` script. This script collects configuration information about your host.

Note

You use this script on AIX hosts that are not running Virtual Input/Output (VIO) environments. Not all FCP AIX Host Utilities stacks support VIO environments.

- ◆ `dotpaths` utility. This utility lets you set path priorities. (This utility applies only to systems using MPIO, which is supported by the Host Utilities for Native OS.)
- ◆ `filer_info` script. This script collects information about the storage system.
- ◆ (VIO server/client environment only) `ontap_collect`. This is snap extension that collects configuration information about your host just as the `aix_info` script does. You use `ontap_collect` in VIO server/client environments. VIO servers require you to run as the prime administrator (`padmin`) instead of `root`. You can execute `ontap_collect` when running as `padmin`.
- ◆ `san_version` command. This command displays the version of the SAN Toolkit that you are running.
- ◆ `sanlun` utility. You can use this utility to display information about LUNs on the storage system that are available to this host. In a VIO environment, you can only run the `sanlun` utility on the server; you cannot run it on a VIO client.
- ◆ Additional diagnostic scripts. The following scripts can also be used to collect troubleshooting information:
 - ❖ `brocade_info` collects information about Brocade switches installed in the network.
 - ❖ `cisco_info` collects information about Cisco switches installed in the network.
 - ❖ `mcddata_info` collects information about McData switches installed in the network.
 - ❖ `qllogic_info` collects information about QLogic switches installed in the network.
- ◆ The man pages for `sanlun` and the diagnostic scripts.

About the HBAs

Do not use different HBA brands on a single host. The supported HBAs should be installed before you install the Host Utilities.

Multipathing

The FCP AIX Host Utilities for Veritas use Veritas DMP to provide multipathing. By using Veritas DMP, you can configure multiple network paths between the host and storage system. If one path fails, FCP traffic continues on the remaining paths. DMP is required if the host has multiple paths to a LUN.

The SAN Toolkit `sanlun` command will show you all NetApp consolidated devices to which the host has access.

Dynamic LPAR is available

Dynamic Logical Partitioning (DLPAR) is an AIX 5.2 and 5.3 feature on IBM's pSeries servers. With DLPAR, you can move hardware resources such as processors, memory, and I/O slots from one logical partition to another without disruption. Refer to AIX documentation for details about DLPAR.

Remove previous versions before installing Host Utilities

The FCP AIX Host Utilities for Veritas use a different stack from previous versions of the Host Utilities. You should not have both products installed on the same host.

If you have an earlier version installed, you must remove it before you install this version. For more information, see “[Uninstalling the software packages](#)” on page 30.

FCP AIX Host Utilities installation overview

Overview of Installing the Host Utilities and setting up your system

Installing the FCP AIX Host Utilities and setting up your system involves a number of steps that are performed on both the storage system and the host. The following sections provide information about the tasks you need to perform.

Note

Occasionally there are known problems that can affect your system setup. Please check the FCP AIX Host Utilities Release Notes to make sure there are no issues affecting your system setup.

Pre-requisites

Before you install the Host Utilities, you must perform the following tasks:

1. Set up your system:

- ❖ Host OS, technology levels, and appropriate updates
- ❖ HBAs
- ❖ Drivers
- ❖ Storage system and Data ONTAP
- ❖ Switches (if used)

For information about the system requirements, see “[Where to go for more information](#)” on page 8.

2. Verify that your storage system is:

- ❖ Licensed correctly
- ❖ Using the correct cfmode
- ❖ Running the FCP service
- ❖ Configured to work with the target HBAs
- ❖ Set up to work with the AIX host and the initiator HBAs
- ❖ Set up with working volumes and qtrees (if desired)

Note

It is recommended that you create volumes and LUNs with space reservations enabled.

3. If you're using a fabric connection, verify that the switch is:

- ❖ Set up correctly

- ❖ Zoned (if your system uses switches)
 - ❖ Cabled according to the instructions that came with the switch
4. Verify that:
- ❖ The power to the switches, disk shelves, storage systems, and hosts is turned on in the correct order
 - ❖ The host and the storage system can communicate

Installation overview

Installing the Host Utilities involves the following tasks:

1. Get a copy of the Host Utilities software packages.
 - ❖ Get the compressed file containing the host settings software. This file contains the Object Data Manager (ODM) fileset, for NetApp LUNs.
 - ❖ Get the compressed file containing the SAN Toolkit software. This file contains scripts that you can run to collect information about your configuration.

You can download these files or copy them from the CD.

- ❖ Extract the software packages from the compressed files.

Note

If your configuration requires multipathing (DMP), you must also install Veritas Storage Foundation, the Array Support Library (ASL) for NetApp storage controllers. If you are using Storage Foundation 5.0, you must also install an Array Policy Module (APM) for NetApp storage controllers. You must install the Veritas Volume Manager (VxVM) before you install the ASL and APM software.

These components are available from the Symantec web site.

2. Install the software packages:
 - ❖ Login as root.
 - ❖ Go to the directory containing the extracted software package.
 - ❖ Use either the AIX System Management Interface Tool (SMIT) or the `installp` command to install the host settings software and the toolkit software.
3. Verify that the HBA initiator queue depth is appropriate for your system.
 - ❖ Use the `lsattr -El` command to check the queue depth.
4. (Recommended) Check your cluster failover mode (cfmode).

- ❖ If you have a storage cluster, migrate your `cfmode` setting to single image mode.
 - ❖ If you have a direct-attached storage, verify that the media type is correct.
5. Configure the LUNs by performing the following tasks:
- ❖ Create at least one igroup and at least one LUN.
One way to create igroups and LUNs is to use the `lun setup` command to create igroups and LUNs. Specify `aix` as the value for the `ostype` attribute.
 - ❖ Map the LUNs to the igroup.
 - ❖ Configure the host to discover the LUNs.
 - ❖ Get the host to discover the new LUNs by using the `cfgmgr` command.
 - ❖ Display information about the LUNs and HBA.
On an AIX host, you can use the `sanlun` command.

Where to go for more information

Host and storage system information

The documents listed below contain information about host and storage system requirements, supported configurations, best practices, installation procedures and troubleshooting.

If you need information about...	See the following product documentation...
Known issues, system requirements, and last minute updates	The <i>Release Notes</i> , which are available at http://now.netapp.com/NOW/knowledge/docs/san/
A summary of some of the commands you might use with the Host Utilities	The <i>Quick Reference</i> for the FCP AIX Host Utilities, which is available from the NOW site
The latest supported configurations	◆ <i>NetApp Interoperability Matrix Tool</i> at http://now.netapp.com/matrix/mtx/login.do ◆ <i>Compatibility and Configuration Guide for NetApp's FCP and iSCSI Products</i> at http://now.netapp.com/NOW/knowledge/docs/docs.shtml ◆ <i>System Configuration Guide</i> at http://now.netapp.com/NOW/knowledge/docs/docs.shtml
Supported Fibre Channel SAN topologies	<i>FCP Configuration Guide</i> at http://now.netapp.com/NOW/knowledge/docs/san/fcp_iscsi_config/
Configuring the storage system	◆ <i>Best Practices for Reliability: New System Installation</i> at http://now.netapp.com/NOW/knowledge/docs/other/best_practices/index.shtml ◆ <i>Data ONTAP® Software Setup Guide</i> at http://now.netapp.com/NOW/knowledge/docs/ontap/ontap_index.shtml ◆ <i>Data ONTAP® Block Access Management Guide</i> at http://now.netapp.com/NOW/knowledge/docs/ontap/ontap_index.shtml

If you need information about...	See the following product documentation...
Managing SAN storage on the storage system	◆ <i>Data ONTAP® Block Access Management Guide for FCP</i> at http://now.netapp.com/NOW/knowledge/docs/ontap/ontap_index.shtml ◆ <i>Data ONTAP® Release Notes</i> at http://now.netapp.com/NOW/knowledge/docs/ontap/ontap_index.shtml ◆ <i>Command Reference</i> at http://now.netapp.com/NOW/knowledge/docs/ontap/ontap_index.shtml ◆ <i>FilerView® Online Help</i> - available from within the FilerView GUI ◆ <i>Best Practices for Reliability: Ongoing Maintenance</i> at http://now.netapp.com/NOW/knowledge/docs/other/best_practices/newsys/index.htm
Upgrading Data ONTAP	◆ <i>Data ONTAP® Upgrade Guide</i> at http://now.netapp.com/NOW/knowledge/docs/ontap/ontap_index.shtml
Verifying compatibility of storage system with environmental requirements	◆ <i>Site Requirements</i> at http://now.netapp.com/NOW/knowledge/docs/docs.shtml
Installing and configuring the HBA in your host	◆ Refer to your HBA vendor documentation.
Your host operating system	◆ Refer to your operating system documentation.

If you need information about...	See the following product documentation...
Working with Veritas	Refer to your Veritas documentation. The following documents in particular might be helpful: ◆ Veritas Storage Foundation Veritas 5.0 ❖ Veritas Storage Foundation and High Availability Solutions 5.0 - Getting Started Guide (AIX) ❖ Veritas Storage Foundation 5.0 - Installation Guide (AIX) ❖ Veritas Storage Foundation for Oracle RAC 5.0 - Installation and Configuration Guide (AIX) ◆ Veritas Storage Foundation 4.0 ❖ Veritas Storage Solutions 4.0 Getting Started Guide for AIX ❖ Veritas Storage Foundation 4.0 Installation Guide/AIX ❖ Veritas Storage Foundation 4.0 for Oracle RAC - Installation and Configuration Guide (AIX)

About this chapter This chapter describes procedures for installing the FCP AIX Host Utilities.

Topics in this chapter This chapter discusses the following topics:

- ◆ “[Obtaining the software packages](#)” on page 13
- ◆ “[Installing the software packages](#)” on page 17
- ◆ “[Uninstalling the software packages](#)” on page 30

Completing the pre-installation tasks

Before you begin

The FCP AIX Host Utilities for Veritas require Veritas Storage Foundation. You must have Veritas Storage Foundation installed and set up before you install the Host Utilities. In addition, you should configure VxVM and, if you want to use multipathing, DMP.

Before you install the Host Utilities software:

- ◆ Verify that your host system meets the system requirements. See “[Where to go for more information](#)” on page 8.
- ◆ If you have an earlier version of the FCP AIX Host Utilities or FCP AIX Attach Kit installed, you must remove it. See “[Uninstalling the software packages](#)” on page 30 or “[Uninstalling the software packages](#)” on page 30.

Once your host is set up, you must install the host settings software package and the SAN Toolkit software package.

For more information on planning your installation, see “[Confirming that your system is correctly set up](#)” on page 98.

Obtaining the software packages

Software packages

The FCP AIX Host Utilities include:

- ◆ The host settings file. This is the software package for the FCP AIX Host Utilities for Veritas that contains NetApp's FCP device definitions, which are required for FCP AIX configurations. This is an Object Data Manager (ODM) stanza LPP package.
- ◆ The NetApp SAN Toolkit file. This software package contains the `sanlun` utility and diagnostic scripts. The `sanlun` utility displays configuration information about LUNs and HBAs. The diagnostic scripts collect information about your system if a problem occurs. Customer support may ask you to run the `sanlun` utility or a diagnostic script if a problem occurs.

You must download both the host settings software package and the SAN Toolkit software package. If you are getting your files from a CD-ROM, you must get both files.

Note

This document uses names for these files in its examples to make the examples easier to read and provide information about the type of output displayed when working with the files. The final names for these files may differ from those used in examples. Do not be concerned if the names of the files you actually have are different. The names used on the NOW site are the correct names.

Configurations that include multipathing require DMP, ASL, and APM, which you obtain from Symantec.

Ways to obtain the software packages

You can obtain the software packages in two ways:

- ◆ Download them from the NOW site. The FCP AIX Host Utilities on the NOW site provides the host settings software package and the SAN Toolkit software package. You must download both packages. For information about downloading these files, see [“Downloading the software”](#) on page 14.
- ◆ Get them from the FCP AIX Host Utilities CD-ROM. Information on getting the software packages from the CD-ROM is detailed in the section [“Installing the software packages”](#) on page 17.

Once you have the files, you must uncompress them to get the software packages. To install the software, make sure the software packages are in a working directory on your AIX host.

Getting the files from the CD-ROM

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

Step	Action
1	Insert the CD-ROM into the CD-ROM drive.
2	Change to the root directory of the CD-ROM: # cd <CDROM_mountpoint>
3	Copy the host settings software file and the SAN Toolkit package from the CD-ROM's root directory to a temporary location on the host. Example: If you mount the CD-ROM on /mnt and want to place the SAN Toolkit file in the /tmp directory, you might enter commands similar to the following: # mount -v cdrfs -o ro /dev/cd0 /mnt # cp /mnt/santoolkit_aix_3.2.tar.Z /tmp # cd /tmp

Downloading the software

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 Download Software. 3. Click the Login button.
2	On the Download Software page, go to the SAN Host Utilities (FCP) product row of the table and select AIX from the Select Platform drop-down list.

Step	Action
3	Click Go!
4	Follow the prompts to reach the Software Download page.
5	Download the NetApp host settings software file and the SAN Toolkit software file to a local directory on your host. You must download both files. Note_____ If you download the files to a machine other than the AIX host, you must move them to the host. _____

Uncompressing the software files

To uncompress the software files, complete the following steps.

Step	Action
1	Change to the directory where you saved the downloaded software and enter the following commands to uncompress the FCP AIX host settings package and the SAN Toolkit package. Note The name of the file you download or get from the CD-ROM may be different from the filename shown in these examples. <pre># zcat netapp_aix_SAN_kit_4.2.tar.Z tar -xvf - # zcat santoolkit_aix_v3.2.tar.Z tar xvf -</pre> Result: The extracted software is placed in the directory where you downloaded the software. Example: Executing the <code>zcat</code> and <code>tar</code> commands with the host settings file and the SAN Toolkit file produces output similar to the following. <pre>HostA# zcat netapp_aix_SAN_kit_4.2.tar.Z tar xvf - x ./netapp_aix_SAN_kit_4.2/netapp_aix_SAN_kit.fcp_attach_kit, 22528 bytes, 44 media blocks. x ./netapp_aix_SAN_kit_4.2/netapp.fcp_toolkit, 1005568 bytes, 1964 media blocks. x ./netapp_aix_SAN_kit_4.2/install, 37326 bytes, 73 media blocks. x ./netapp_aix_SAN_kit_4.2/uninstall, 17844 bytes, 35 media blocks. HostA# zcat santoolkit_aix_v3.2.tar.Z tar xvf - x ./netapp.SAN_toolkit, 1146880 bytes, 2240 media blocks. HostA#</pre>
2	Go to “Installing the software packages” on page 17.

Installing the software packages

Methods for installing the software

You can install the host settings software and the SAN Toolkit software using either the AIX System Management Interface Tool (SMIT) or the `installp` command.

Note

This section uses SMIT as its installation example.

Upgrading from an earlier attach kit

If you have an FCP AIX Host Attach Kit or a previous version of the Host Utilities installed, you should remove it before you install a new version of the Host Utilities. See “[Uninstalling the software packages](#)” on page 30.

In addition, if you have SANpath installed, you must remove it. You cannot use both Veritas and SANpath.

Note

Previous versions of the Host Utilities were called Attach Kits.

Using SMIT to
install the software

You must install both the host setting software and the SAN Toolkit software. To do this, complete the following steps.

Note_____

This installation example install the host settings software first. You then repeat the steps to install the SAN Toolkit.

Step	Action
1	Make sure you are logged in as root.
2	Start SMIT by entering the following command: # smit install
3	At the screen that appears, select the option titled “Install and Update Software.” Example: When you start SMIT, it displays the following screen. On this screen, the “Install and Update Software” option is the first menu option. <pre># smitty install +-----+ Software Installation and Maintenance Move cursor to desired item and press Enter. Install and Update Software List Software and Related Information Software Maintenance and Utilities Software Service Management Network Installation Management EZ NIM (Easy NIM Tool) System Backup Manager Alternate Disk Installation EFIX Management F1=Help F2=Refresh F3=Cancel Esc+8=Image Esc+9=Shell Esc+0=Exit Enter=Do +-----+</pre>

Step	Action
4	At the next screen, select the Install Software menu option. Example: The following is an example of the Install and Update Software screen. <pre> +-----+ Install and Update Software Move cursor to desired item and press Enter. Install Software Update Installed Software to Latest Level (Update All) Install Software Bundle Update Software by Fix (APAR) Install and Update from ALL Available Software F1=Help F2=Refresh F3=Cancel Esc+8=Image Esc+9=Shell Esc+0=Exit Enter=Do +-----+</pre>

Step	Action
5	At the Install Software screen, specify the location of the software in one of the following ways: ◆ Manually enter the location by providing the following information. ❖ If you're installing from the CD-ROM, enter the CD-ROM drive. ❖ If you're installing from the host machine, enter the path to the software package (for example, /var/tmp/ntap_aix_fcp_4.2/netapp.fcp_attach_kit). ◆ Press F4 to display a list of options. If you want to use the F4 method, complete the following steps: 1. Press F4. 2. At the prompt for software to install, enter netapp.fcp_attach_kit. 3. At the prompt asking whether you want to continue or cancel, press Enter to complete the installation. Example 1: The following is an example of entering the path to the software package when you're at the Install Software screen. <pre> +-----+ Install Software Type or select a value for the entry field. Press Enter AFTER making all desired changes. [Entry Fields] * INPUT device / directory for software [/var/tmp/netapp_aix_SAN_kit_4.2/netapp.fcp_attach_kit]+ F1=Help F2=Refresh F3=Cancel F4=List Esc+5=Reset Esc+6=Command Esc+7=Edit Esc+8=Image Esc+9=Shell Esc+0=Exit Enter=Do +-----+ </pre>

Step	Action
	Example 2: After you enter path to the software package, SMIT displays the following screen. This is the screen where you enter name of the software package, <code>netapp.fcp_attach_kit</code>, and press Enter. <pre> +-----+ Install Software Type or select values in entry fields. Press Enter AFTER making all desired changes. [Entry Fields] * INPUT device / directory for software [/var/tmp/netapp_aix_SAN_kit_4.2/netapp_aix_SAN_kit.fcp_attach_kit] + * SOFTWARE to install [NetApp.fcp_attach_kit]+ PREVIEW only? (install operation will NOT occur) no + COMMIT software updates? yes + SAVE replaced files? no + AUTOMATICALLY install requisite software? yes + EXTEND file systems if space needed? yes + OVERWRITE same or newer versions? no + VERIFY install and check file sizes? no + Include corresponding LANGUAGE filesets? yes + DETAILED output? no + Process multiple volumes? yes + ACCEPT new license agreements? no + Preview new LICENSE agreements? no + F1=Help F2=Refresh F3=Cancel F4=List Esc+5=Reset Esc+6=Command Esc+7=Edit Esc+8=Image Esc+9=Shell Esc+0=Exit Enter=Do +-----+ </pre>

Step	Action
6	SMIT displays a warning, asking you to confirm that you want to install the software. Press Enter to continue. Example 1: The following is an example of entering the path to the software package when you're at the Install Software screen. <pre>x*****x x ARE YOU SURE? x x x x Continuing may delete information you may want x x to keep. This is your last chance to stop x x before continuing. x x Press Enter to continue. x x Press Cancel to return to the application. x x x x Flx F1=Help F2=Refresh F3=Cancel x x Esx Esc+8=Image Esc+0=Exit Enter=Do x x*****x</pre>

Step	Action
7	SMIT displays information about the installation. Note_____ By default, the host settings software installs the filesets for both FCP and iSCSI. This is not a problem. If you are using only FCP, ignore the iSCSI fileset. _____ Example of a successful installation: The following is an example of output you might see when an installation successfully completes. <pre> COMMAND STATUS Command: running stdout: yes stderr: no Before command completion, additional instructions may appear below. netapp_aix_SAN_kit_4.2.fcp_attach_kit.iscsi 4.2.0.0 netapp_aix_SAN_kit_4.2.fcp_attach_kit.fcp 4.2.0.0 netapp_aix_SAN_kit_4.2.fcp_attach_kit.config 4.2.0.0 << Copyright notice for NetApp.fcp_attach_kit >> (C) Copyright Network Appliance, Inc. 2003-2007. All rights reserved. << End of copyright notice for NetApp.fcp_attach_kit >>. . . . Finished processing all filesets. (Total time: 5 secs). 0503-409 installp: bosboot verification starting... installp: bosboot verification completed. 0503-408 installp: bosboot process starting... bosboot: Boot image is 23825 512 byte blocks. 0503-292 This update will not fully take effect until after a system reboot. * * * A T T E N T I O N * * * System boot image has been updated. You should reboot the system as soon as possible to properly integrate the changes and to avoid disruption of current functionality.</pre>

Step	Action
	<pre> installp: bosboot process completed. +-----+ Summaries: +-----+ Installation Summary ----- Name Level Part Event Result ----- netapp.fcp_attach_kit.iscsi 4.2.0.0 USR APPLY SUCCESS NetApp.fcp_attach_kit.fcp 4.2.0.0 USR APPLY SUCCESS NetApp.fcp_attach_kit.conf 4.2.0.0 USR APPLY SUCCESS COMMAND STATUS Command: OK stdout: yes stderr: no Before command completion, additional instructions may appear below. netapp.fcp_attach_kit.config 4.2.0.0 << Copyright notice for NetApp.fcp_attach_kit >> (C) Copyright Network Appliance, Inc. 2003-2007. All rights reserved. << End of copyright notice for NetApp.fcp_attach_kit >>. . . . Finished processing all filesets. (Total time: 5 secs). 0503-409 installp: bosboot verification starting... installp: bosboot verification completed. 0503-408 installp: bosboot process starting... bosboot: Boot image is 23825 512 byte blocks. 0503-292 This update will not fully take effect until after a system reboot. installp: bosboot process completed. +-----+ Summaries: +-----+ Installation Summary ----- </pre>

Example 1: The following an example of installing the SAN Toolkit using the command line:

```
[5300-06-03-0732] root@p505-aix01 /tmp/netapp -> zcat netapp_aix_SAN_kit_4.2RC1.tar.Z | tar
tar xvf -
x ./netapp_aix_SAN_kit_4.2RC1/NetApp.fcp_attach_kit, 25600 bytes, 50 media blocks.
x ./netapp_aix_SAN_kit_4.2RC1/NetApp.iscsi_support_kit, 20480 bytes, 40 media blocks.

[5300-06-03-0732] root@p505-aix01 /tmp/netapp -> zcat santoolkit_aix_3.2RC3.tar.Z | tar
tar xvf -
x ./NetApp.SAN_toolkit, 1232896 bytes, 2408 media blocks.

[5300-06-03-0732] root@p505-aix01 /tmp/netapp/netapp_aix_SAN_kit_4.2RC1 -> installp -
aXd $(pwd) NetApp.fcp_attach_kit

-----+
Pre-installation Verification...
-----+
Verifying selections...done
Verifying requisites...done
Results...

SUCSESSES
-----

Filesets listed in this section passed pre-installation verification
and will be installed.

Selected Filesets
-----

NetApp.fcp_attach_kit.LUN.msg.en_US 4.2.0.0 # Network Appliance FCP Attach...
NetApp.fcp_attach_kit.ODM_stanzas 4.2.0.0 # Network Appliance FCP Attach...

<< End of Success Section >>
```

FILESET STATISTICS

```
-----
      2  Selected to be installed, of which:
        2  Passed pre-installation verification
-----
```

```
      2  Total to be installed
```

0503-409 installp: bosboot verification starting...

installp: bosboot verification completed.

```
+-----+
                        Installing Software...
+-----+
```

installp: APPLYING software for:

NetApp.fcp_attach_kit.ODM_stanzas 4.2.0.0

NetApp.fcp_attach_kit.LUN.msg.en_US 4.2.0.0

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. << End of copyright notice for NetApp.SAN_toolkit >>.

Finished processing all filesets. (Total time: 2 secs).

```
+-----+
                        Summaries:
+-----+
```

Installation Summary

Name	Level	Part	Event	Result
NetApp.SAN_toolkit.scripts	3.2.0.0	USR	APPLY	SUCCESS
NetApp.SAN_toolkit.sanlun	3.2.0.0	USR	APPLY	SUCCESS

Example 2: The following an example of installing the SAN Toolkit using the command line:

```
# installp -aXd netapp.SAN_toolkit netapp.SAN_toolkit
+-----+
+               Pre-installation Verification...
+-----+
Verifying selections...done
Verifying requisites...done
Results...

SUCCESES
-----
Filesets listed in this section passed pre-installation verification
and will be installed.

Selected Filesets
-----
netapp.SAN_toolkit.sanlun 3.2.0.0           # Network Appliance SAN Toolki...
netapp.SAN_toolkit.scripts 3.2.0.0        # Network Appliance SAN Toolki...

<< End of Success Section >>

FILESET STATISTICS
-----
    2  Selected to be installed, of which:
        2  Passed pre-installation verification
----
    2  Total to be installed

+-----+
+               Installing Software...
+-----+

installp:  APPLYING software for:
          netapp.SAN_toolkit.scripts 3.2.0.0
          netapp.SAN_toolkit.sanlun 3.2.0.0

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Finished processing all filesets.  (Total time:  2 secs).
```

+-----+ Summaries: +-----+				
Installation Summary -----				
Name	Level	Part	Event	Result

netapp.SAN_toolkit.scripts	3.2.0.0	USR	APPLY	SUCCESS
netapp.SAN_toolkit.sanlun	3.2.0.0	USR	APPLY	SUCCESS
#				

Verifying the HBA initiator queue depth

It’s a good practice to verify the value of the HBA initiator queue depth. To check the queue depth, perform the following step.

Step	Action
1	Check the HBA queue depth by using the <code>lsattr -El</code> command. Example: For HBA <code>fcs0</code>, you would enter the following command: <pre># lsattr -El fcs0</pre> Note_____ The default value for the HBA queue depth is 200. This is shown in the <code>num_cmd_elems</code> parameter. _____

Uninstalling the software packages

Before you uninstall previous versions of software

- Before you uninstall a previous version of the software, make sure you do the following;
- ◆ Unmount the file systems that contain the volume groups mapped to storage system LUNs.
 - ◆ Quiesce and export the volume groups.
 - ◆ Stop multipathing software.
 - ◆ Remove the existing NetApp LUN handles.
- These procedures disconnect NetApp LUNs from the host before you uninstall the software.

Uninstalling the software from an AIX host

You can use SMIT to uninstall the Host Utilities software.

Note_____

You should always uninstall the current Host Utilities software before installing a new version.

Uninstalling the software using SMIT

To uninstall the software using SMIT, complete the following steps.

Step	Action
1	Ensure that you are logged in as root.
2	Start SMIT by entering the following command: # smit

Step	Action
3	Select the “Software Installation and Maintenance” menu option. Example: When you start SMIT, it displays the following screen. <pre>+-----+ root> # smit System Management Move cursor to desired item and press Enter. Software Installation and Maintenance Software License Management Devices System Storage Management (Physical & Logical Storage) Security & Users Communications Applications and Services Print Spooling Problem Determination Performance & Resource Scheduling System Environments Processes & Subsystems Applications Cluster System Management Using SMIT (information only) F1=Help F2=Refresh F3=Cancel Esc+8=Image Esc+9=Shell Esc+0=Exit Enter=Do +-----+</pre>

Step	Action
4	At the screen that appears, select the Software Maintenance and Utilities menu option. Example: The following is an example of the Software Installation and Maintenance screen. <pre> +-----+ Software Installation and Maintenance Move cursor to desired item and press Enter. Install and Update Software List Software and Related Information Software Maintenance and Utilities Network Installation Management System Backup Manager F1=Help F2=Refresh F3=Cancel Esc+8=Image Esc+9=Shell Esc+0=Exit Enter=Do +-----+</pre>

Step	Action
5	At the next screen, select the Remove Installed Software menu option. Example: The following is an example of the Software Maintenance and Utilities screen. <pre> +-----+ Software Maintenance and Utilities Move cursor to desired item and press Enter. Commit Applied Software Updates (Remove Saved Files) Reject Applied Software Updates (Use Previous Version) Remove Installed Software Copy Software to Hard Disk for Future Installation Check Software File Sizes After Installation Verify Software Installation and Requisites Clean Up After Failed or Interrupted Installation F1=Help F2=Refresh F3=Cancel Esc+8=Image Esc+9=Shell Esc+0=Exit Enter=Do +-----+</pre>

Step	Action
6	Remove the software in one of the following ways: ◆ Enter the package name (netapp.fcp_attach_kit). (Make sure that the “Preview only” option is set to no.) ◆ Press F4 to display a list of names. If you use F4, complete the following steps: 1. Press F4. 2. Scroll down the list of names until you reach netapp.fcp_attach_kit. 3. Select netapp.fcp_attach_kit and press Enter. 4. At the prompt asking whether you want to continue or cancel, press Enter to complete the uninstall. Example 1: The following is an example of the Remove Installed Software screen. Note_____ By default PREVIEW only? is set to yes. You must change it to no if you want to uninstall. _____ <pre>+-----+ Remove Installed Software Type or select values in entry fields. Press Enter AFTER making all desired changes. [Entry Fields] * SOFTWARE name [netapp.fcp_attach_kit.config netapp.fcp_attach_kit.fcp netapp.fcp_attach_netapp.fcp_attach_kit> + PREVIEW only? (remove operation will NOT occur) no + REMOVE dependent software? no + EXTEND file systems if space needed? no + DETAILED output? no + F1=Help F2=Refresh F3=Cancel F4=List Esc+5=Reset Esc+6=Command Esc+7=Edit Esc+8=Image Esc+9=Shell Esc+0=Exit Enter=Do +-----+</pre>


```
# installp -u NetApp*
```

```
# installp -u netapp.SAN_toolkit*
```

```
[5300-06-03-0732] root@p505-aix01 /tmp/netapp -> installp -u NetApp*
+-----+
+-----+
Pre-deinstall Verification...
+-----+
Verifying selections...done
Verifying requisites...done
Results...

SUCCESES
-----
Filesets listed in this section passed pre-deinstall verification
and will be removed.

Selected Filesets
-----
NetApp.SAN_toolkit.sanlun 3.2.0.0          # Network Appliance SAN Toolki...
NetApp.SAN_toolkit.scripts 3.2.0.0        # Network Appliance SAN Toolki...
NetApp.fcp_attach_kit.LUN.msg.en_US 4.2.0.0 # Network Appliance FCP Attach...
NetApp.fcp_attach_kit.ODM_stanzas 4.2.0.0 # Network Appliance FCP Attach...

<< End of Success Section >>

FILESET STATISTICS
-----
    4 Selected to be deinstalled, of which:
      4 Passed pre-deinstall verification
-----
    4 Total to be deinstalled

0503-049 installp: bosboot verification starting...
installp: bosboot verification completed.
```

```

+-----+
                        Deinstalling Software...
+-----+

installp:  DEINSTALLING software for:
           NetApp.SAN_toolkit.sanlun 3.2.0.0
           NetApp.SAN_toolkit.scripts 3.2.0.0

Filesets processed:  2 of 4   (Total time:  5 secs).

installp:  DEINSTALLING software for:
           NetApp.fcp_attach_kit.LUN.msg.en_US 4.2.0.0
           NetApp.fcp_attach_kit.ODM_stanzas 4.2.0.0
Finished processing all filesets.  (Total time:  6 secs).0503-409 installp:  bosboot
verification starting...
installp:  bosboot verification completed.
0503-408 installp:  bosboot process starting...

bosboot: Boot image is 33032 512 byte blocks.
0503-292 This update will not fully take effect until after a
        system reboot.

    * * *   A T T E N T I O N   * * *
    System boot image has been updated. You should reboot the
    system as soon as possible to properly integrate the changes
    and to avoid disruption of current functionality.

installp:  bosboot process completed.
+-----+
                        Summaries:
+-----+

Installation Summary
-----

```

Name	Level	Part	Event	Result
NetApp.SAN_toolkit.sanlun	3.2.0.0	USR	DEINSTALL	SUCCESS
NetApp.SAN_toolkit.scripts	3.2.0.0	USR	DEINSTALL	SUCCESS
NetApp.fcp_attach_kit.LUN.m	4.2.0.0	USR	DEINSTALL	SUCCESS
NetApp.fcp_attach_kit.ODM_s	4.2.0.0	USR	DEINSTALL	SUCCESS
#				

About this chapter

If you are using Veritas Storage Foundation for multipathing, you must install and configure the Symantec Array Support Library (ASL) and Array Policy Module (APM). This chapter describes how to install and configure the ASL and APM and how these components affect multipathing and failover.

Note

With the Veritas Storage Foundation 4.0, the APM is distributed as a point patch to Volume Manager 4.0.3.3 (Point-Patch_3), so you do not have to perform a separate installation.

With Veritas Storage Foundation 5.0, you must install both the ASL and the APM.

Topics in this chapter

This chapter discusses the following topics:

- ◆ [“Overview of the Array Support Library and Array Policy Module”](#) on page 40
- ◆ [“Installing the ASL and APM”](#) on page 42
- ◆ [“Removing the ASL”](#) on page 47
- ◆ [“Obtaining multipathing information”](#) on page 53
- ◆ [“Optimizing the Veritas DMP Restore Daemon”](#) on page 58
- ◆ [“Understanding ASL error message types”](#) on page 60

Overview of the Array Support Library and Array Policy Module

What the Array Support Library is

The Array Support Library (ASL) is an NetApp-qualified library that provides information about storage array attributes configuration to the Device Discovery Layer (DDL).

The DDL is a component of VxVM that discovers available enclosure information for disks and disk arrays that are connected to a host system. The DDL calls ASL functions during the storage discovery process on the host. The ASL in turn “claims” a device based on vendor and product identifiers. The claim associates the storage array model and product identifiers with the device.

You can add or remove ASLs from a running VxVM system. You do not need to reboot the host.

Note

In a Storage Foundation RAC cluster, you must stop clustering on a node before you remove the ASL.

Using storage with the ASL

You cannot use storage systems simultaneously as JBODs and vendor arrays. If you install the ASL, storage systems cannot be configured in VxVM as JBODs. They are reported as storage arrays unless you explicitly exclude them by using the `vxddladm excludearray` command.

By using the ASL, you obtain the following information about the LUNs:

- ◆ Enclosure name—VxVM's enclosure-based naming feature creates disk names based on the name of its enclosure, or disk array, and not a raw device name.
- ◆ Multipathing policy—Whether the NetApp storage is accessed as an Active/Active (A/A) disk array or an Active/Passive Group Concurrent (A/PG-C) disk array. The ASL also provides information about primary and secondary paths to NetApp storage.

What the ASL provides

The ASL provides enclosure-based naming information about SAN-attached storage systems. With enclosure-based naming, the name of the disk is based on the logical name of its enclosure, or disk array, and not a raw device name. The ASL provides specific information to VxVM about SAN-attached storage systems, instead of referring to them as JBOD devices or raw devices.

What the Array Policy Module is

The Array Policy Module (APM) is a kernel module that defines I/O error handling, failover path selection, and other failover behavior for a specific array. The NetApp APM is customized to optimize I/O error handling and failover path selection for the NetApp environment. When the ASL detects the NetApp storage array, it sets the array type to A/A-NETAPP. This instructs Veritas software to use the NetApp APM to handle I/O and path failures for the NetApp storage array.

Installing the ASL and APM

Installation overview

Installing the ASL involves the following tasks:

- ◆ Verifying that your configuration meets system requirements. To locate information on system requirements, see “[Where to go for more information](#)” on page 8.
- ◆ Determining the ASL version if it is currently installed.
- ◆ Obtaining the ASL and the APM.
- ◆ Installing the ASL and APM.

Determining the ASL version

If you currently have the ASL installed, use the Veritas `vxddladm listversion` command to determine its version.

Example: The following shows output from the `vxddladm listversion` command.

```
# vxddladm listversion
LIB_NAME                               ASL_VERSION           Min. VXVM version
=====
libvxshark.so                          vm-5.0-rev-1          5.0
libvxcscovrts.so                       vm-5.0-rev-1          5.0
libvxhitachi.so                        vm-5.0-rev-1          5.0
libvxibmds6k.so                        vm-5.0-rev-1          5.0
libvxvpath.so                          vm-5.0-rev-1          5.0
libvxvp256.so                          vm-5.0-rev-1          5.0
libvxibmds4k.so                        vm-5.0-rev-2          5.0
libvxemc.so                            vm-5.0-rev-2          5.0
libvxCLARiiON.so                      vm-5.0-rev-1          5.0
libvxhds.so                            vm-5.0-rev-1          5.0
libvxhdsalua.so                       vm-5.0-rev-1          5.0
libvxhds9980.so                       vm-5.0-rev-1          5.0
libvxibmds8k.so                       vm-5.0-rev-1          5.0
libvxpurple.so                        vm-5.0-rev-1          5.0
libvxhdsusp.so                        vm-5.0-rev-2          5.0
libvxhpalua.so                        vm-5.0-rev-1          5.0
libvxibmsvc.so                        vm-5.0-rev-1          5.0
libvxvscsi.so                         vm-4.0-rev-1          5.0
libvxnetapp.so                        vm-5.0-rev-1          5.0
#
```

Obtaining the ASL and APM

The ASL and APM are not distributed with the Host Utilities. You obtain the ASL and APM from the Symantec web site. The APM is distributed as a point patch to Volume Manager 4.0.3.3 (Point-Patch_3) so you only need to install the ASL software once you have VxVM installed. For Storage Foundation 5.0, the ASL download file contains the software packages for both the ASL and the APM. You must extract these software packages and then install each one separately.

For information on getting these software packages, see the *NetApp Interoperability Matrix Tool* at <http://now.netapp.com/matrix/mtx/login.do>.

Note

Before you begin, make sure you obtain the ASL TechNote, which you can review at the Symantec Web site. The TechNote contains Symantec's instructions for installing the ASL

Installing the ASL and APM

To install the ASL and APM, complete the following steps.

Step	Action
1	Make sure you are logged into the host as the root user.
2	If you have VxVM installed, stop all applications using VxVM volumes. Make sure that there are no VxVM volumes open, mounted, or in use. Note_____ Check the <i>NetApp Interoperability Matrix Tool</i> to make sure you have the supported maintenance packages. You should install the correct VxVM and maintenance packages before you install the ASL and APM. _____
3	For each host HBA (<i>fscsiX</i>), enable the AIX FastFail feature. Enabling the FastFail feature improves I/O failover handling in the NetApp environment. Sample input: <pre>chdev -l fscsi0 -a fc_err_recov=fast_fail -P chdev -l fscsi1 -a fc_err_recov=fast_fail -P</pre>

Step	Action
4	For each host HBA (<i>fscsiX</i>), enable Dynamic Tracking. Sample input: <pre>chdev -l fscsi0 -a dyntrk=yes -P chdev -l fscsi1 -a dyntrk=yes -P</pre>
5	Install the ASL according to the directions provided in the ASL TechNote on the Symantec Web site.
6	If you have Storage Foundation 4.0, install the Volume Manager point patch that contains the APM. Use the procedures documented in the README file that ships with the point patch. If you have Storage Foundation 5.0, you can skip this step.
7	Reboot the host.
8	Verify that FastFail and Dynamic Tracking are enabled by entering the following command for each HBA. <pre>lsattr -El fscsiX</pre> <i>X</i> is the controller/HBA ID. Output Example: The following output indicates that Dynamic Tracking is on (<i>dyntrk</i> value=<i>yes</i>) and the FastFail feature is enabled (<i>fc_err_recov=fast_fail</i>). <pre>attach switch How this adapter is CONNECTED False dyntrk yes Dynamic Tracking of FC Devices True fc_err_recov fast_fail FC Fabric Event Error RECOVERY Policy True scsi_id 0x10400 Adapter SCSI ID False sw_fc_class 3 FC Class for Fabric True</pre>

Step	Action
9	Verify that the ASL is installed by entering the following command. vxddladm listsupport Result: The libvxnetapp.so library is listed in the command output. See the example below: <pre># vxddladm listsupport LIBNAME VID ===== libvxshark.so IBM libvxcscovrts.so CSCOVRTS libvxhitachi.so HITACHI libvxibmds6k.so IBM libvxvpath.so IBM libvxxp256.so HP libvxibmds4k.so IBM libvxemc.so EMC libvxhdsusp.so HITACHI libvxhds.so HITACHI libvxhdsalua.so HITACHI libvxhds9980.so HITACHI libvxibmds8k.so IBM libvxpurple.so SUN libvxCLARiion.so DGC libvxhpalua.so HP, COMPAQ libvxibmsvc.so IBM libvxvscsi.so AIX libvxnetapp.so NETAPP</pre>

Step	Action																																																																	
10	Enter the <code>vxddmpadm listapm all</code> command to verify that the APM is installed. Result: The output displays the Array Type as A/A-NETAPP. If the storage controller disks have not yet been detected by the host, the state of the APM is Not-Active. See the output example below. <table><tr><th>Module Name</th><th>APM Name</th><th>APM Version</th><th>Array Types</th><th>State</th></tr><tr><td>=====</td><td>=====</td><td>=====</td><td>=====</td><td>=====</td></tr><tr><td>dmpaa</td><td>dmpaa</td><td>1</td><td>A/A</td><td>Active</td></tr><tr><td>dmpap</td><td>dmpap</td><td>1</td><td>A/P</td><td>Active</td></tr><tr><td>dmpap</td><td>dmpap</td><td>1</td><td>A/P-C</td><td>Active</td></tr><tr><td>dmpapf</td><td>dmpapf</td><td>1</td><td>A/PF-VERITAS</td><td>Not-Active</td></tr><tr><td>dmpapf</td><td>dmpapf</td><td>1</td><td>A/PF-T3PLUS</td><td>Not-Active</td></tr><tr><td>dmpapg</td><td>dmpapg</td><td>1</td><td>A/PG</td><td>Not-Active</td></tr><tr><td>dmpapg</td><td>dmpapg</td><td>1</td><td>A/PG-C</td><td>Not-Active</td></tr><tr><td>dmpjbod</td><td>dmpjbod</td><td>1</td><td>Disk</td><td>Active</td></tr><tr><td>dmpjbod</td><td>dmpjbod</td><td>1</td><td>APdisk</td><td>Active</td></tr><tr><td>dmpnetapp</td><td>dmpnetapp</td><td>1</td><td>A/A-NETAPP</td><td>Not-Active</td></tr><tr><td>dmpsvc</td><td>dmpsvc</td><td>1</td><td>A/A-IBMSVC</td><td>Not-Active</td></tr></table>	Module Name	APM Name	APM Version	Array Types	State	=====	=====	=====	=====	=====	dmpaa	dmpaa	1	A/A	Active	dmpap	dmpap	1	A/P	Active	dmpap	dmpap	1	A/P-C	Active	dmpapf	dmpapf	1	A/PF-VERITAS	Not-Active	dmpapf	dmpapf	1	A/PF-T3PLUS	Not-Active	dmpapg	dmpapg	1	A/PG	Not-Active	dmpapg	dmpapg	1	A/PG-C	Not-Active	dmpjbod	dmpjbod	1	Disk	Active	dmpjbod	dmpjbod	1	APdisk	Active	dmpnetapp	dmpnetapp	1	A/A-NETAPP	Not-Active	dmpsvc	dmpsvc	1	A/A-IBMSVC	Not-Active
Module Name	APM Name	APM Version	Array Types	State																																																														
=====	=====	=====	=====	=====																																																														
dmpaa	dmpaa	1	A/A	Active																																																														
dmpap	dmpap	1	A/P	Active																																																														
dmpap	dmpap	1	A/P-C	Active																																																														
dmpapf	dmpapf	1	A/PF-VERITAS	Not-Active																																																														
dmpapf	dmpapf	1	A/PF-T3PLUS	Not-Active																																																														
dmpapg	dmpapg	1	A/PG	Not-Active																																																														
dmpapg	dmpapg	1	A/PG-C	Not-Active																																																														
dmpjbod	dmpjbod	1	Disk	Active																																																														
dmpjbod	dmpjbod	1	APdisk	Active																																																														
dmpnetapp	dmpnetapp	1	A/A-NETAPP	Not-Active																																																														
dmpsvc	dmpsvc	1	A/A-IBMSVC	Not-Active																																																														

Next steps

After you install the ASL and APM, complete the following procedures:

- ◆ If you have Data ONTAP 7.1 or higher, it is recommended to change the `cfmode` setting of your clustered systems to single image and then reconfigure your host to discover the new paths to the disk. See [“Migrating a Storage Cluster to Single Image Mode”](#) on page 61.
- ◆ On the storage system, create LUNs and map them to igroups containing the WWPNs of the host HBAs. See [“Creating and mapping igroups and LUNs”](#) on page 78.
- ◆ On the host, discover the new LUNs and configure them to be managed by VxVM. See [“Configuring LUNs with Veritas software \(multipathing\)”](#) on page 80.

Removing the ASL

Before you begin You do not need to stop any volumes created on unaffected disk arrays, such as disk arrays from other vendors, before removing ASL support. This is also true for arrays or disks in the OTHER_DISKS category. OTHER_DISKS are local non-FCP-attached disks. Volumes created on these arrays remain accessible because they are not multipathed.

Only one version of an ASL that supports Data ONTAP storage system can be installed on the host at any given time.

Removing the ASL To remove the ASL, complete the following steps.

Step	Action
1	Ensure that you are logged in as root.
2	Stop all I/O to NetApp LUNs. Note _____ In a Storage Foundation RAC cluster, you must also stop clustering on a node before you remove the ASL. _____
3	Use either SMIT or the command line to remove the ASL package. For more information on removing the ASL, see the Veritas documentation.

Example of uninstalling and installing the ASL and APM

Upgrading to a new ASL and APM when running Storage Foundation 5.0

If you are using Veritas Storage Foundation 5.0, you need to install the ASL and the APM. If you already have these installed, you must first remove them.

This section contains examples that show how you remove the ASL and APM and then how you install the new version of these components. The examples assume you have already gotten the software packages from Symantec.

Uninstalling the ASL and the APM

The following is a sample uninstall of the ASL and the APM. If you were actually doing this, your output would vary slightly based on your system setup.

```
[5300-06-03-0732] root@p505-aix01 / -> lslpp -i *asl *apm
Vendor
Fileset      Code      Product Id  Feature Id  Package Name
-----
Path: /usr/lib/objrepos
NTAPasl 1.0.0.0
VRTSNetApp_apm 1.0.0.0
VRTSNetApp_apm
Path: /etc/objrepos
NTAPasl 1.0.0.0
VRTSNetApp_apm 1.0.0.0
VRTSNetApp_apm
[5300-06-03-0732] root@p505-aix01 / -> installp -u NTAPasl VRTSNetApp_apm
+-----+
Pre-deinstall Verification...
+-----+
Verifying selections...done
Verifying requisites...done
Results...
SUCSESSES
-----
Filesets listed in this section passed pre-deinstall verification
and will be removed.
```


Installing the ASL and the APM

The following is a sample installation of the ASL and the APM when you have Veritas Storage Foundation 5.0. If you were actually doing this, your output would vary slightly based on your system setup.

```
[5300-06-03-0732] root@p505-aix01 /tmp/VRTS_AS_L_APM -> installp -ld $(pwd)
Fileset Name                      Level                      I/U Q Content
=====
NTAPas1                          1.0.0.0                  I  N usr,root
#  VERITAS Array Support Library (1.0)

VRTSNetApp_apm                   1.0.0.0                  I  N usr,root
#  VERITAS Array Policy Module for NetApp(1.0)

[5300-06-03-0732] root@p505-aix01 /tmp/VRTS_AS_L_APM -> installp -aXd $(pwd) NTAPas1
VRTSNetApp_apm
+-----+
+-----+
Pre-installation Verification...
+-----+
Verifying selections...done
Verifying requisites...done
Results...

SUCSESSES
-----
Filesets listed in this section passed pre-installation verification
and will be installed.

Selected Filesets
-----
NTAPas1 1.0.0.0                  # VERITAS Array Support Librar...
VRTSNetApp_apm 1.0.0.0          # VERITAS Array Policy Module ...

<< End of Success Section >>

FILESET STATISTICS
-----
2  Selected to be installed, of which:
2  Passed pre-installation verification
----
2  Total to be installed
```

```

+-----+
                Installing Software...
+-----+

installp:  APPLYING software for:
           VRTSNetApp_apm 1.0.0.0

. . . . . << Copyright notice for VRTSNetApp_apm >> . . . . .

Copyright 1990-2004 VERITAS Software Corporation. All rights reserved.
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product names and slogans are trademarks or registered
trademarks of VERITAS Software Corporation in the USA and/or other
countries. Other product names and/or slogans mentioned herein may
be trademarks or registered trademarks of their respective companies.

. . . . . << End of copyright notice for VRTSNetApp_apm >>. . . .

Filesets processed:  1 of 2  (Total time:  1 secs).

installp:  APPLYING software for:
           NTAPasl 1.0.0.0

. . . . . << Copyright notice for NTAPasl >> . . . . .
Copyright ? 1990-2006 Symantec Corporation. All rights reserved.

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Symantec Corporation or its affiliates in the U.S. and other countries. Other
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software" and "commercial computer software documentation" as defined in FAR
Sections 12.212 and DFARS Section 227.7202.

. . . . . << End of copyright notice for NTAPasl >>. . . .

mv libvxnetapp.so.2 libvxnetapp.so.3
ln -s /etc/vx/lib/discovery.d/libvxnetapp.so.3 /etc/vx/lib/discovery.d/libvxnetapp.so
mv libvxnetapp.key.2 libvxnetapp.key.3
ln -s /etc/vx/aslkey.d/libvxnetapp.key.3 /etc/vx/aslkey.d/libvxnetapp.key
Loading The Library
Adding the entry in supported arrays
Finished processing all filesets.  (Total time:  3 secs).

+

```

-----+				
Summaries:				
+-----+				
Installation Summary				

Name	Level	Part	Event	Result
VRTSNetApp_apm	1.0.0.0	USR	APPLY	SUCCESS
VRTSNetApp_apm	1.0.0.0	ROOT	APPLY	SUCCESS
NTAPasl	1.0.0.0	USR	APPLY	SUCCESS
NTAPasl	1.0.0.0	ROOT	APPLY	SUCCESS

Obtaining multipathing information

What an ASL array type is

The ASL reports information about the multipathing configuration to the DDL as one of the following disk array types:

- ◆ Active/Active (A/A)—There are multiple active paths to storage and simultaneous I/O is supported on all paths. If a path fails, I/O is distributed across the remaining paths.
- ◆ Active/Passive Group Concurrent (A/PG-C) - An A/PG-C array is a variant of the A/PG array type that supports concurrent I/O and load balancing by having multiple primary paths to LUNs. Failover to the secondary (passive) path occurs only if all the active primary paths fail.

For additional information, see the following documents:

- ◆ *Veritas Array Support Library Developer's Guide* - for details about load balancing.
- ◆ *Veritas Volume Manager Administrator's Guide* - for details about system management

How the storage system's FCP failover mode corresponds to array types

The ASL also supports direct attached, non-clustered configurations, including NearStore models. These configurations have no cfmode settings. ASL reports these configurations as Active/Active (A/A) array types. For more details about array types, see the *Veritas Array Support Library Developer's Guide*.

How sanlun displays the array type

The Host Utilities SAN Toolkit includes the sanlun utility in the /opt/NetApp/santools/bin directory. You use the sanlun utility to display information about paths to LUNs on the storage system. When the ASL is installed and the LUN is controlled by VxVM, the output of the sanlun command displays the Multipath_Policy as A/A-NetApp.

Using VxVM to display available paths

To obtain information about available paths to a LUN using VxVM, complete the following steps

Step	Action
1	Enter the following command to view all devices: <code>vxdisk list</code> Result: The VxVM management interface displays the vxdisk device, type, disk, group and status. It also shows which disks are managed by VxVM. Example: The following is an example of the type of output you see with the vxdisk list command. <pre># vxdisk list DEVICE TYPE DISK GROUP STATUS FAS9600_0 auto:cdsdisk FAS9600_1 VRTS_CFS online shared FAS9600_1 auto:cdsdisk FAS9600_7 VRTS_CFS online shared FAS9600_2 auto:cdsdisk FAS9600_4 VRTS_CFS online shared FAS9600_3 auto:cdsdisk FAS9600_3 VRTS_CFS online shared FAS9600_4 auto:cdsdisk FAS9600_5 VRTS_CFS online shared FAS9600_5 auto:cdsdisk FAS9600_6 VRTS_CFS online shared FAS9600_6 auto:cdsdisk FAS9600_8 VRTS_CFS online shared FAS9600_7 auto:cdsdisk FAS9600_10 VRTS_CFS online shared FAS9600_8 auto:cdsdisk FAS9600_11 VRTS_CFS online shared FAS9600_9 auto:cdsdisk FAS9600_2 VRTS_CFS online shared</pre> (The output has been truncated to make the document easier to read.)

Step	Action																																																																																																																														
2	On the host console, enter the following command to display path information for the device you want: <pre>vxdmpadm getsubpaths dmpnodename=<device></pre> where <device> is the name listed under the output of the <code>vxdisk list</code> command. Example: The following is the type of output you should see. <pre># vxdmpadm getsubpaths dmpnodename=FAS30200_29</pre> <table><tr><th>NAME</th><th>STATE[A]</th><th>PATH-TYPE[M]</th><th>CTLR-NAME</th><th>ENCLR-TYPE</th><th>ENCLR-NAME</th><th>ATTRS</th></tr><tr><td>=====</td><td>=====</td><td>=====</td><td>=====</td><td>=====</td><td>=====</td><td>=====</td></tr><tr><td>hdisk3</td><td>ENABLED(A)</td><td>-</td><td>fscsi0</td><td>FAS3020</td><td>FAS30200</td><td>-</td></tr><tr><td>hdisk33</td><td>ENABLED(A)</td><td>-</td><td>fscsi0</td><td>FAS3020</td><td>FAS30200</td><td>STANDBY</td></tr><tr><td>hdisk183</td><td>ENABLED(A)</td><td>-</td><td>fscsi1</td><td>FAS3020</td><td>FAS30200</td><td>-</td></tr><tr><td>hdisk213</td><td>ENABLED(A)</td><td>-</td><td>fscsi1</td><td>FAS3020</td><td>FAS30200</td><td>STANDBY</td></tr><tr><td>hdisk363</td><td>ENABLED(A)</td><td>-</td><td>fscsi2</td><td>FAS3020</td><td>FAS30200</td><td>-</td></tr><tr><td>hdisk393</td><td>ENABLED(A)</td><td>-</td><td>fscsi2</td><td>FAS3020</td><td>FAS30200</td><td>STANDBY</td></tr><tr><td>hdisk543</td><td>ENABLED(A)</td><td>-</td><td>fscsi3</td><td>FAS3020</td><td>FAS30200</td><td>-</td></tr><tr><td>hdisk573</td><td>ENABLED(A)</td><td>-</td><td>fscsi3</td><td>FAS3020</td><td>FAS30200</td><td>STANDBY</td></tr><tr><td>hdisk753</td><td>ENABLED(A)</td><td>-</td><td>fscsi0</td><td>FAS3020</td><td>FAS30200</td><td>-</td></tr><tr><td>hdisk783</td><td>ENABLED(A)</td><td>-</td><td>fscsi0</td><td>FAS3020</td><td>FAS30200</td><td>STANDBY</td></tr><tr><td>hdisk1085</td><td>ENABLED(A)</td><td>-</td><td>fscsi1</td><td>FAS3020</td><td>FAS30200</td><td>-</td></tr><tr><td>hdisk1115</td><td>ENABLED(A)</td><td>-</td><td>fscsi1</td><td>FAS3020</td><td>FAS30200</td><td>STANDBY</td></tr><tr><td>hdisk1415</td><td>ENABLED(A)</td><td>-</td><td>fscsi2</td><td>FAS3020</td><td>FAS30200</td><td>-</td></tr><tr><td>hdisk1445</td><td>ENABLED(A)</td><td>-</td><td>fscsi2</td><td>FAS3020</td><td>FAS30200</td><td>STANDBY</td></tr><tr><td>hdisk1745</td><td>ENABLED(A)</td><td>-</td><td>fscsi3</td><td>FAS3020</td><td>FAS30200</td><td>-</td></tr><tr><td>hdisk1775</td><td>ENABLED(A)</td><td>-</td><td>fscsi3</td><td>FAS3020</td><td>FAS30200</td><td>STANDBY</td></tr></table> <pre>#</pre>	NAME	STATE[A]	PATH-TYPE[M]	CTLR-NAME	ENCLR-TYPE	ENCLR-NAME	ATTRS	=====	=====	=====	=====	=====	=====	=====	hdisk3	ENABLED(A)	-	fscsi0	FAS3020	FAS30200	-	hdisk33	ENABLED(A)	-	fscsi0	FAS3020	FAS30200	STANDBY	hdisk183	ENABLED(A)	-	fscsi1	FAS3020	FAS30200	-	hdisk213	ENABLED(A)	-	fscsi1	FAS3020	FAS30200	STANDBY	hdisk363	ENABLED(A)	-	fscsi2	FAS3020	FAS30200	-	hdisk393	ENABLED(A)	-	fscsi2	FAS3020	FAS30200	STANDBY	hdisk543	ENABLED(A)	-	fscsi3	FAS3020	FAS30200	-	hdisk573	ENABLED(A)	-	fscsi3	FAS3020	FAS30200	STANDBY	hdisk753	ENABLED(A)	-	fscsi0	FAS3020	FAS30200	-	hdisk783	ENABLED(A)	-	fscsi0	FAS3020	FAS30200	STANDBY	hdisk1085	ENABLED(A)	-	fscsi1	FAS3020	FAS30200	-	hdisk1115	ENABLED(A)	-	fscsi1	FAS3020	FAS30200	STANDBY	hdisk1415	ENABLED(A)	-	fscsi2	FAS3020	FAS30200	-	hdisk1445	ENABLED(A)	-	fscsi2	FAS3020	FAS30200	STANDBY	hdisk1745	ENABLED(A)	-	fscsi3	FAS3020	FAS30200	-	hdisk1775	ENABLED(A)	-	fscsi3	FAS3020	FAS30200	STANDBY
NAME	STATE[A]	PATH-TYPE[M]	CTLR-NAME	ENCLR-TYPE	ENCLR-NAME	ATTRS																																																																																																																									
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hdisk183	ENABLED(A)	-	fscsi1	FAS3020	FAS30200	-																																																																																																																									
hdisk213	ENABLED(A)	-	fscsi1	FAS3020	FAS30200	STANDBY																																																																																																																									
hdisk363	ENABLED(A)	-	fscsi2	FAS3020	FAS30200	-																																																																																																																									
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Step	Action																																																																																				
3	Enter the following command to obtain path information for a host HBA: <pre>vxdmpadm getsubpaths ctlr=<controller_name></pre> controller_name is the controller displayed under “CTRL - NAME” in the output of the vxdmpadm getsubpaths dmpnodename command you entered in Step 2. Result: The output displays information about the paths to the storage system (whether the path is a primary or secondary path). The output also lists the storage system that the device is mapped to. Example: The following is the type of output you should see. <pre># vxdmpadm getsubpaths ctlr=fscsi0</pre> <table><tr><th>NAME</th><th>STATE[A]</th><th>PATH-TYPE[M]</th><th>DMPNODENAME</th><th>ENCLR-TYPE</th><th>ENCLR-NAME</th><th>ATTRS</th></tr><tr><td>=====</td><td>=====</td><td>=====</td><td>=====</td><td>=====</td><td>=====</td><td>=====</td></tr><tr><td>hdisk9</td><td>ENABLED(A)</td><td>-</td><td>FAS30200_86</td><td>FAS3020</td><td>FAS30200</td><td>STANDBY</td></tr><tr><td>hdisk55</td><td>ENABLED(A)</td><td>-</td><td>FAS30200_86</td><td>FAS3020</td><td>FAS30200</td><td>STANDBY</td></tr><tr><td>hdisk101</td><td>ENABLED(A)</td><td>-</td><td>FAS30200_86</td><td>FAS3020</td><td>FAS30200</td><td>-</td></tr><tr><td>hdisk147</td><td>ENABLED(A)</td><td>-</td><td>FAS30200_86</td><td>FAS3020</td><td>FAS30200</td><td>-</td></tr></table> <pre># vxdmpadm getsubpaths ctlr=fscsi1</pre> <table><tr><th>NAME</th><th>STATE[A]</th><th>PATH-TYPE[M]</th><th>DMPNODENAME</th><th>ENCLR-TYPE</th><th>ENCLR-NAME</th><th>ATTRS</th></tr><tr><td>=====</td><td>=====</td><td>=====</td><td>=====</td><td>=====</td><td>=====</td><td>=====</td></tr><tr><td>hdisk193</td><td>ENABLED(A)</td><td>-</td><td>FAS30200_86</td><td>FAS3020</td><td>FAS30200</td><td>STANDBY</td></tr><tr><td>hdisk239</td><td>ENABLED(A)</td><td>-</td><td>FAS30200_86</td><td>FAS3020</td><td>FAS30200</td><td>STANDBY</td></tr><tr><td>hdisk285</td><td>ENABLED(A)</td><td>-</td><td>FAS30200_86</td><td>FAS3020</td><td>FAS30200</td><td>-</td></tr><tr><td>hdisk331</td><td>ENABLED(A)</td><td>-</td><td>FAS30200_86</td><td>FAS3020</td><td>FAS30200</td><td>-</td></tr></table>	NAME	STATE[A]	PATH-TYPE[M]	DMPNODENAME	ENCLR-TYPE	ENCLR-NAME	ATTRS	=====	=====	=====	=====	=====	=====	=====	hdisk9	ENABLED(A)	-	FAS30200_86	FAS3020	FAS30200	STANDBY	hdisk55	ENABLED(A)	-	FAS30200_86	FAS3020	FAS30200	STANDBY	hdisk101	ENABLED(A)	-	FAS30200_86	FAS3020	FAS30200	-	hdisk147	ENABLED(A)	-	FAS30200_86	FAS3020	FAS30200	-	NAME	STATE[A]	PATH-TYPE[M]	DMPNODENAME	ENCLR-TYPE	ENCLR-NAME	ATTRS	=====	=====	=====	=====	=====	=====	=====	hdisk193	ENABLED(A)	-	FAS30200_86	FAS3020	FAS30200	STANDBY	hdisk239	ENABLED(A)	-	FAS30200_86	FAS3020	FAS30200	STANDBY	hdisk285	ENABLED(A)	-	FAS30200_86	FAS3020	FAS30200	-	hdisk331	ENABLED(A)	-	FAS30200_86	FAS3020	FAS30200	-
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Using sanlun to obtain multipathing information

To obtain multipathing information by using the `san lun` command, complete the following step.

Step	Action																																																																																																																																				
1	On the host command line, enter the following command: <pre>sanlun lun show -p all</pre> Result: sanlun displays path information for each LUN. For LUNs managed by VxVM, the output displays the Veritas multipathing policy (A/A or A/PG-C array types) and the path I/O policy. Example: The following partial output shows eight paths to one LUN managed by VxVM. <pre># sanlun lun show -p all fas3020-aix08:/vol/VRTS_3_Node_14/VRTS_3_Node_LUN_269 (LUN 29) DMP_NODE: FAS30200_1 5g (5368709120) lun state: GOOD Filer_CF_State: Cluster Enabled Multipath_Policy: A/A-NETAPP Multipath-provider: VERITAS DMP</pre> <table><tr><th>host</th><th>filer</th><th></th><th>primary</th><th>partner</th><th>Veritas</th></tr><tr><th>path</th><th>path</th><th>device</th><th>host</th><th>filer</th><th>filer</th><th>path I/O</th></tr><tr><th>state</th><th>type</th><th>filename</th><th>HBA</th><th>port</th><th>port</th><th>policy</th></tr><tr><td>up</td><td>primary</td><td>hdisk809</td><td>fcs0</td><td>1b</td><td></td><td>Balanced</td></tr><tr><td>up</td><td>secondary</td><td>hdisk779</td><td>fcs0</td><td></td><td>1b</td><td>Balanced</td></tr><tr><td>up</td><td>primary</td><td>hdisk599</td><td>fcs3</td><td>1a</td><td></td><td>Balanced</td></tr><tr><td>up</td><td>secondary</td><td>hdisk569</td><td>fcs3</td><td></td><td>1a</td><td>Balanced</td></tr><tr><td>up</td><td>primary</td><td>hdisk59</td><td>fcs0</td><td>1a</td><td></td><td>Balanced</td></tr><tr><td>up</td><td>primary</td><td>hdisk419</td><td>fcs2</td><td>1a</td><td></td><td>Balanced</td></tr><tr><td>up</td><td>secondary</td><td>hdisk389</td><td>fcs2</td><td></td><td>1a</td><td>Balanced</td></tr><tr><td>up</td><td>secondary</td><td>hdisk29</td><td>fcs0</td><td></td><td>1a</td><td>Balanced</td></tr><tr><td>up</td><td>primary</td><td>hdisk239</td><td>fcs1</td><td>1a</td><td></td><td>Balanced</td></tr><tr><td>up</td><td>secondary</td><td>hdisk209</td><td>fcs1</td><td></td><td>1a</td><td>Balanced</td></tr><tr><td>up</td><td>primary</td><td>hdisk1801</td><td>fcs3</td><td>1b</td><td></td><td>Balanced</td></tr><tr><td>up</td><td>secondary</td><td>hdisk1771</td><td>fcs3</td><td></td><td>1b</td><td>Balanced</td></tr><tr><td>up</td><td>primary</td><td>hdisk1471</td><td>fcs2</td><td>1b</td><td></td><td>Balanced</td></tr><tr><td>up</td><td>secondary</td><td>hdisk1441</td><td>fcs2</td><td></td><td>1b</td><td>Balanced</td></tr><tr><td>up</td><td>primary</td><td>hdisk1141</td><td>fcs1</td><td>1b</td><td></td><td>Balanced</td></tr><tr><td>up</td><td>secondary</td><td>hdisk1111</td><td>fcs1</td><td></td><td>1b</td><td>Balanced#</td></tr></table>	host	filer		primary	partner	Veritas	path	path	device	host	filer	filer	path I/O	state	type	filename	HBA	port	port	policy	up	primary	hdisk809	fcs0	1b		Balanced	up	secondary	hdisk779	fcs0		1b	Balanced	up	primary	hdisk599	fcs3	1a		Balanced	up	secondary	hdisk569	fcs3		1a	Balanced	up	primary	hdisk59	fcs0	1a		Balanced	up	primary	hdisk419	fcs2	1a		Balanced	up	secondary	hdisk389	fcs2		1a	Balanced	up	secondary	hdisk29	fcs0		1a	Balanced	up	primary	hdisk239	fcs1	1a		Balanced	up	secondary	hdisk209	fcs1		1a	Balanced	up	primary	hdisk1801	fcs3	1b		Balanced	up	secondary	hdisk1771	fcs3		1b	Balanced	up	primary	hdisk1471	fcs2	1b		Balanced	up	secondary	hdisk1441	fcs2		1b	Balanced	up	primary	hdisk1141	fcs1	1b		Balanced	up	secondary	hdisk1111	fcs1		1b	Balanced#
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Optimizing the Veritas DMP Restore Daemon

The Veritas DMP restore daemon requirements

You should set the restore policy of the Veritas DMP restore daemon and specify a polling interval based on the recommended values. These settings determine the frequency that the Veritas daemon checks paths between the host and the storage system. By default, the restore daemon checks disabled paths every 300 seconds.

For the most up-to-date recommendations on the recommended values, see the General Operational Considerations page of the FCP AIX Host Utilities Release Notes. The Release Notes are online in the SAN/iSAN Information Library at <http://now.netapp.com/NOW/knowledge/docs/san/>.

Setting the restore daemon interval

At the time this document was prepared, NetApp recommended you set the restore daemon interval value to 60 seconds to improve I/O failover handling.

To set the `vxrestore` daemon, complete the following steps.

Step	Action
1	Stop the restore daemon. <code>/usr/sbin/vxdmpadm stop restore</code>
2	Change the restore daemon setting to 60. <code>/usr/sbin/vxdmpadm start restore policy=check_disabled interval=60</code> Note _____ This step reconfigures and restarts the restore daemon without the need for an immediate reboot. _____

Step	Action
3	Edit the /etc/init.d/vxvm-sysboot file to make the new restore daemon interval persistent across reboots. By default, the restore daemon options are: <pre>restore_daemon_opts="interval=300 policy=check_disabled"</pre> Edit the restore daemon options so that the interval is 60 seconds: <pre>restore_daemon_opts="interval=60 policy=check_disabled"</pre>
4	Save and exit the /etc/init.d/vxvm-sysboot file.
5	Verify the changes. <pre>/usr/sbin/vxdmpadm stat restored</pre> Result: The command output shows the status of the vxrestore daemon, as shown by the output example below. <pre>The number of daemons running : 1 The interval of daemon: 60 The policy of daemon: check_disabled</pre>

Understanding ASL error message types

Understanding error message severity The ASL works silently and seamlessly with the VxVM DDL. If an error, misconfiguration, or malfunction occurs, messages from the library are logged to the console using the host’s logging facility. The following table lists the importance and severity of these messages.

Message severity	Definition	Action required
Error	Indicates that an ERROR status is being returned from the ASL to the VxVM DDL that prevents the device (LUN) from being used. The device might still appear in vxdisk list, but it is not usable.	Call Symantec Technical Support for help.
Warning	Indicates that an UNCLAIMED status is being returned. Unless claimed by a subsequent ASL, dynamic multipathing is disabled. No error is being returned but the device (LUN) might not function as expected.	
Info	Indicates that a CLAIMED status is being returned. The device functions fully, with DMP enabled, but the results seen by the user might be other than what is expected. For example, the enclosure name might change.	

About this chapter

If you have a storage cluster, it is recommended that you migrate the `cfmode` setting of both systems in the cluster to single image mode. This chapter describes how to decide if you should migrate, as well as how to change the `cfmode` setting and reconfigure the host to discover new paths to its disks.

Topics covered in this chapter

This chapter includes the following topics:

- ◆ [“Deciding whether to migrate to single image mode”](#) on page 62
- ◆ [“Understanding `cfmode`”](#) on page 63
- ◆ [“Tasks to complete before you begin”](#) on page 67
- ◆ [“Upgrading to single image mode”](#) on page 68

Deciding whether to migrate to single image mode

When to migrate to single image mode

If you upgraded to Data ONTAP 7.1 or higher, it is recommended to change your storage systems' cfmodes setting to single image.

When you upgrade to Data ONTAP 7.1 from a previous release, your cfmodes settings are preserved. Your cfmodes setting is one of the following:

- ◆ FAS2xx models: dual-fabric mode
- ◆ All other storage systems and backup storage: partner or mixed.

To display the current cfmodes settings, enter the following command on each system in the cluster:

```
fc> show cfmodes
```

The single image setting provides many advantages:

- ◆ It supports all storage systems and switches.
- ◆ It increases the number of available paths in your configuration.

For details, see “[Reasons for using single image mode](#)” on page 63.

Migrating to single image mode also requires planning downtime in your configuration, possible modifications to zoning, and reconfiguring your host to detect new paths to LUNs.

- ◆ If you want to migrate your cluster to single image mode, use the procedures in this chapter to change the cfmodes settings on your cluster and reconfigure your host.
- ◆ If you want to keep the current cfmodes setting for your cluster, proceed to Chapter 5, “[Creating, Configuring, and Managing LUNs](#),” on page 75.

Understanding cfmode

What is single image mode?

In single image mode, both systems in the cluster share the same World Wide Node Name (WWNN).

Single image mode provides the following advantages:

The host can access all LUNs through any target port on the cluster.

- ◆ Single image mode is supported on all storage systems and by all supported FCP hosts.
- ◆ There are no switch limitations. You can connect a storage system in single image mode to any supported FCP switch.

Reasons for using single image mode

You might want to migrate your configuration to single image mode for the following reasons:

- ◆ To increase the number of paths to the cluster
You can increase the number of available paths in your configuration because all ports on each storage system are available to the host.
- ◆ To support heterogeneous configurations
For example, you upgraded an existing SAN configuration with Solaris hosts and you want to add HP-UX or AIX hosts to the configuration.

HP-UX and AIX hosts do not support failover when the systems in a cluster are in standby mode. If you want to add these hosts to an existing homogenous configuration that has Solaris-only hosts, you have to change the cfmode setting on the cluster to either single image or partner.

Resolving LUN mapping conflicts

Single image mode does not allow the following mapping conflicts:

- ◆ Two LUNs, each one on a different node in the cluster, that have the same LUN ID and are mapped to the same igroup.
- ◆ Initiators that are members of more igroups with a different OS Type (for example, an initiator that is a member of a Solaris igroup on the local system and a member of an AIX igroup on the partner)

When you change the cfmode and restart the FCP service, one WWNN is automatically assigned to both systems in the cluster. This means you might have LUN mapping conflicts between the systems in the cluster.

Before you switch to the single image cfmode setting, you use the `lun config_check -S` command to check for any LUN mapping and ostype conflicts between the nodes in the cluster.

Impact of changing the cfmode setting

Changing the cfmode setting of a cluster impacts the following components of your configuration:

- ◆ Access to LUNs

When you change the cfmode setting, you change the available paths between the host and the storage cluster. Some previously available paths are no longer available and some new paths become available. You must reconfigure every host that is connected to the cluster to discover the new paths. The LUNs might be accessible but must not be used until you reconfigure the host.

- ◆ Multipathing policy

If you have multipathing software in your configuration, changing the cfmode setting might also affect the multipathing policy because there are more paths between the host and the cluster.

- ◆ Zoning

Updating the system to single image cfmode changes the WWNN of the cluster and the World Wide Port Names (WWPNs) of the target ports on each storage system. If the cluster connects to a switch by using soft zoning (zoning by WWPN), you must check the zoning setup and make the required updates to your switch. Systems that connect to switches using hard (physical port) zoning are not impacted.

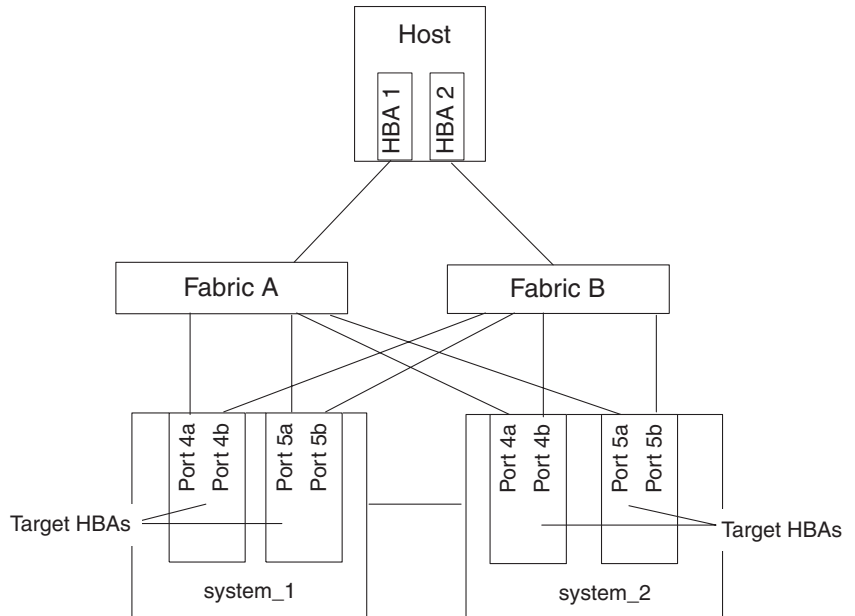
- ◆ Switch configuration and cabling

In mixed and dual fabric modes, the target ports log into the fabric in loop mode. In single image mode, the target ports log into the fabric using point-to-point (PTP) mode. This means you might need to update your switch configuration when you migrate to single image mode so that the target connects to the fabric as point-to-point device.

Single image mode works with all currently supported cabling configurations. This means that if you have a supported configuration, it will continue to work after you migrate to single image mode. You might want to change the cabling of the cluster to the fabric to optimize high availability and performance.

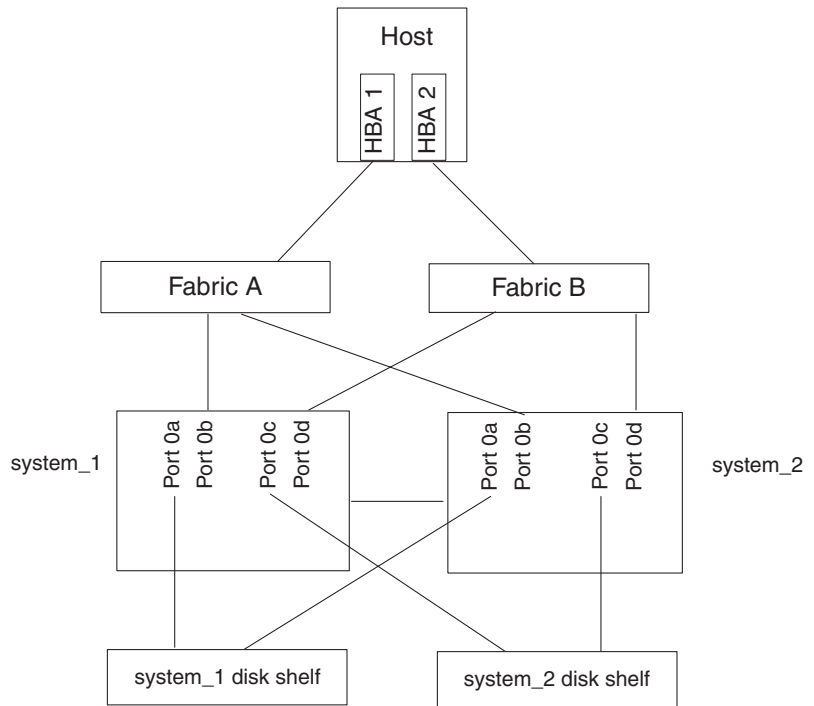
The following figures show examples of how to cable a cluster in single image mode to optimize high availability and performance. The first figure is one example of cabling on a system with target HBAs that is using single image mode.

Example cabling for single image mode
for systems with target HBAs



The FAS3000 storage systems have onboard Fibre Channel ports, which can be configured to operate in either target or initiator mode. In the following figure, ports 0b and 0d connect to the fabric and are configured in target mode. Ports 0a and 0c connect to the disk shelves and are configured in initiator mode. For information about configuring Fibre Channel ports on systems with onboard ports, see the *Data ONTAP Block Access Management Guide for FCP and iSCSI*.

Example cabling for single image mode
for systems with onboard FCP ports



For detailed information about the cabling configurations supported and recommended examples for systems with onboard FCP ports, see the *FCP Configuration Guide* at http://now.netapp.com/NOW/knowledge/docs/san/fcp_iscsi_config/.

Tasks to complete before you begin

Prerequisite tasks Complete the following tasks before you change your cfmode:

Task	Description	What to do
Save configuration information.	Enter commands that display information about the current configuration and save the output to the local disk. 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.	Perform a complete backup of the system's data. Save output from the following commands: ◆ <code>sanlun lun show</code> displays LUNs visible to the host. ◆ <code>sanlun lun show -p</code> displays LUNs and paths visible to the host If your LUNs are under VxVM disk management, then save the output from the following commands. ◆ <code>vxdisk list</code> displays disks under VxVM control ◆ <code>vxdisk path</code> displays disks and paths under VxVM control ◆ <code>vxprint -htg diskgroup_name</code> displays VxVM volumes and status
Identify affected hosts and initiators.	You must reconfigure and reboot any hosts and initiators that access LUNs on the systems you are upgrading.	Enter the following command: <pre>igroup show</pre>
Schedule downtime for the storage cluster.	Hosts cannot access LUNs while you change cfmode. You must allow sufficient downtime to change the cfmode setting and reconfigure and reboot the host.	Enter commands that quiesce host I/O and take host applications off-line.

Upgrading to single image mode

Procedure Overview

To migrate the host and storage cluster to single image mode you must complete the following tasks:

1. Prepare the host
Quiesce I/O and protect the configuration by unmounting file systems and disconnecting LUNs attached to the host. For example if you are using VxVM software, deport the VxVM disk groups.
2. Upgrade the storage cluster to single image mode
Resolve LUN mapping or OS-type conflicts, and change the cfmode setting.
3. Validate zoning and cabling
Check zoning and resolve zone mapping issues on configurations that use soft zoning.
4. Reconfigure the host
Reconfigure the host to detect the new devices and new paths to the devices.

Preparing the host

To prepare the AIX host for to migrate to single image mode, complete the following steps.

Step	Action
1	Open a session to the AIX host.
2	Find all the LUNs and volume groups that contain LUNs from the cluster by entering the following command: sanlun lun show -p
3	Record the LUN volume group membership.
4	Unmount the file systems that contain the volume groups mapped to storage system LUNs. umount /filesystem_path
5	Quiesce the disk groups by entering the following command: vxvg deport disk_group_name
6	Remove all Veritas disk names by entering the following command: vxdisk rm disk_name Note _____ You get use the <code>vxdisk list</code> command to get a list of the disk names. _____
7	Enter the following command to list local devices: lsdev -Cc disk
8	Remove the existing NetApp LUN handles for the devices by entering the following command for each device: rmdev -dl device_name Example: <code>rmdev -dl hdisk2</code>

Step	Action
9	Verify that the device handles are removed by entering the following command: <pre>lsdev -Cc disk</pre> Example: The following example output shows that the devices handles were successfully removed because devices that were mapped to the LUNs are not listed. In this case, only internal devices are listed. <pre>hdisk0 Available 1S-08-00-8,0 16 Bit LVD SCSI Disk Drive hdisk1 Available 1S-08-00-9,0 16 Bit LVD SCSI Disk Drive</pre>
10	Proceed to “Migrating the cluster to single image mode” below.

Migrating the cluster to single image mode

To migrate the cluster to single image mode, complete the following steps.

Step	Action
1	Open a window to the console of each storage system you want to update.
2	Login at the console of the system(s) you are upgrading, and enter the following command to identify and resolve LUN and igroup mapping conflicts. <pre>lun config_check -S</pre> Result: Mappings that are displayed using the “*” character indicate an error, and also provide LUN and igroup information that you can use to resolve conflicts. Use the <code>lun map</code> command to re-map LUNS to a new ID that is unique to each node in the cluster. You use the <code>igroup</code> command to change igroup otypes, if required.
3	Switch to advanced privileges by entering the following command: <pre>priv set advanced</pre>
4	Stop the FCP service on both systems. On each system, enter: <pre>fcv stop</pre>

Step	Action
5	Set the cfmode to single_image. On each system console, enter: <pre>fcv set cfmode single_image</pre> If you see messages indicating mapping conflicts, then return to Step 2 to resolve the mapping conflicts.
6	Start the FCP service on each system in the cluster. On each system, enter the following command: <pre>fcv start</pre>
7	After you switch to the single image setting, both nodes in the cluster use the same WWNN. Obtain the WWNN of the cluster by entering the following command on the console of each system: <pre>fcv nodename</pre>
8	If you are using soft zoning, you need the WWPNNs of the target ports to reconfigure zones on your switch. To obtain the WWPNNs, enter the following command on each system in the cluster. <pre>fcv config</pre> For more information about zoning, see “Validating zoning and connectivity” on page 71.
9	Return to administrative privileges. On each storage system, enter: <pre>priv set admin</pre>

Validating zoning and connectivity

Changes to WWNNs and WWPNNs: After you change the cfmode setting to single image both systems in the cluster share a single WWNN. One node in the cluster takes the WWNN of its partner. This means that the WWNN of one of the systems in the cluster has changed. The WWPNNs of the target ports also change. You might have to update your zoning configuration depending on the type of zoning you use. Soft zoning uses the WWPNN. Port zoning uses the physical location (switch port) in the zone. If you use soft zoning you must update your zones to use the new WWPNNs. Configurations that use hard zoning are not impacted.

Cabling and zoning: If you did not change your cabling, migrating to single image mode also changes the number of available paths to the LUNs. Some additional paths to the target become available because more target ports are

visible to the host. You can use zoning or Data ONTAP portsets to reduce the number of paths in your configuration to comply with the number of paths supported by your multipathing software.

For details about validating and modifying switch zones see the documentation provided by your switch manufacturer.

For details about portsets, see the *Data ONTAP Block Access Management Guide*.

You might also want to change your cabling if you have more paths between the host and the cluster and want to reduce the number of paths. It is recommended that after you change the `cfmode` setting, make sure each HBA has one primary and at least one secondary path to each LUN. For additional information, see the FCP Configuration Guide at http://now.netapp.com/NOW/knowledge/docs/san/fcp_iscsi_config/.

Reconfiguring AIX hosts

To reconfigure AIX hosts to detect new paths to the storage, complete the following steps.

Step	Action
1	Connect to the AIX host console.
2	On the host console, enter the following command: cfgmgr The host scans the bus for new devices. If you created volume groups with the <code>autovaryon</code> flag, then the volume groups are reimported.
3	Get Veritas to rescan the bus for new devices. vxdctl enable
4	Verify the new paths by entering the following command. sanlun lun show -p
5	Import the existing disk groups by entering the following command: vxdg import disk_group_name
6	Enter the following command to verify the paths to the LUNs. sanlun lun show -p

Step	Action
7	Verify that the volume groups are active by entering the following command. vxdg list
8	If you created file systems on the devices, mount the file systems.

About this chapter

This chapter describes how to prepare the storage system for LUN configuration, and also how to create and configure LUNs.

Topics in this chapter

This chapter discusses the following topics:

- ◆ [“Overview of completing the configuration”](#) on page 76
- ◆ [“Preparing the storage system”](#) on page 77
- ◆ [“Creating and mapping igroups and LUNs”](#) on page 78
- ◆ [“LUN configuration overview”](#) on page 80
- ◆ [“Configuring LUNs with VxVM and DMP multipathing software”](#) on page 82
- ◆ [“Displaying LUN and HBA information”](#) on page 87
- ◆ [“Using sanlun to display host LUN information”](#) on page 88
- ◆ [“Displaying host HBA information”](#) on page 93

Overview of completing the configuration

Task overview

Completing the configuration involves the following tasks.

Task	Discussion	Additional information
1. Create and map igroups and LUNs	An igroup is a collection of WWPNs on the storage system that map to one or more host HBAs. After you create the igroup, you must create LUNs on the storage system, and map the LUNs to the igroup.	For complete information, refer to your version of the <i>Data ONTAP® Block Access Management Guide for FCP</i> at http://now.netapp.com/NOW/knowledge/docs/ontap/ontap_index.shtml .
2. Discover and configure LUNs	You can discover LUNs using the <code>cfgmgr</code> command followed by the <code>vxctl enable</code> command.	Refer to “ LUN configuration overview ” on page 80 for an overview of these tasks. For more information, see “ Configuring LUNs with VxVM and DMP multipathing software ” on page 82.
3. Display information about the LUNs and the HBAs	You can use the <code>sanlun</code> utility to display information about the LUNs and the HBAs.	Refer to “ Using sanlun to display host LUN information ” on page 88 and “ Displaying host HBA information ” on page 93 for additional information.

Preparing the storage system

Correct media type for direct-attached storage system

If you use a direct-attached configuration you must set the target HBA media type to loop. Use the `fcp config` command to set the media type.

Note_____

If you are using a cluster, the media type setting is disabled.

You must also make sure that you do not have clustering licensed or the Interconnect Card installed. Remove both if they exist on your storage system.

Setting the media type: To set the media type to loop, perform the following steps:

Step	Action
1	Stop each adapter used in the direct attach configuration by entering the following command: <code>fcp config <adapter> down</code> <i>adapter</i> is the name of the Fibre Channel target adapter.
2	Set the media type to loop by entering the following command for each adapter: <code>fcp config <adapter> mediatype loop</code>
3	Restart the adapter by entering the following command: <code>fcp config <adapter> up</code>
4	Reboot the storage system and the host.
5	Verify the adapter ports are online by entering the following command: <code>fcp show adapter</code>
6	Verify that the media type is now correctly set on each adapter port by entering the following command; <code>fcp config</code>

Creating and mapping igroups and LUNs

Tasks needed to create and map LUNs

Before you can complete the configuration, you must perform the following tasks:

- ◆ Create an igroup. An igroup is a collection of host WWPNs.

Note

If you have a cluster, you must create a separate igroup on each system in the cluster.

- ◆ Create one or more LUNs and map the LUNs to an igroup.

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. (Multiple applications may be using the same initiators.)
- ◆ Do not put LUNs in /vol/vol0 (the root volume).
- ◆ Ensure that the LUNs are at the root of a qtree in a volume.
- ◆ Enable space reservations.
- ◆ If you have a clustered pair, use different LUN IDs on each system in the cluster.
- ◆ Disable scheduled auto snapshots.

Methods for creating igroups and LUNs

You can create igroups and LUNs on the storage system by:

- ◆ Entering the `lun setup` command
This method prompts you through the process of creating a LUN, creating an igroup, and mapping the LUN to the igroup.
- ◆ Entering a series of individual commands (such as `lun create`, `igroup create` and `lun map`).

Use this method to create one or more LUNs and igroups in any order.

For complete information about creating igroups and LUNs, refer to *Data ONTAP™ Block Access Management Guide for FCP* at

http://now.netapp.com/NOW/knowledge/docs/ontap/ontap_index.shtml.

Increasing the size of a LUN

If you are using Storage Foundation 5.0, you can use Dynamic LUN Expansion (DLE) to increase the size of the LUN. You can use the `vxdisk resize` command to automatically update the disk information.

On the storage system, you must run the `lun resize` command.

The only requirement for the DLE operation is that the disk group have at least two disks. This is because the DLE operation temporarily removes the disk from the disk group. It is not possible to remove the last disk from the disk group so the operation fails if there is only one disk group.

For more information on DLE, see the Veritas documentation. For information on working with LUNs, see the *Block Access Management Guide* for your version of Data ONTAP.

Next Steps

The next configuration task you must complete involves configuring the LUNs. For more information, refer to “[Configuring LUNs with VxVM and DMP multipathing software](#)” on page 82.

For detailed information about creating and managing LUNs, see the *Block Access Management Guide* for your version of Data ONTAP.

LUN configuration overview

Types of configurations and software

The software you use to configure LUNs on the host depends on your multipathing requirements. Systems that require multipathing can use VxVM and DMP.

Note

Before you configure LUNs to be managed by VxVM, make sure you installed the ASL and APM according to the procedures in Chapter 3, “[Installing the ASL and APM](#),” on page 39.

Configuring LUNs with Veritas software (multipathing)

To configure LUNs using VxVM and DMP:

1. Use `cfgmgr` to get the host to discover the new LUNs.
2. Use `vxctl enable` to allow VxVM to recognize AIX hdisks.
3. Use VxVM tools (VEA, `vxdiskadm`, CLI) or `smit` to add disks to the VxVM disk group and initialize them for use by VxVM.
4. Use VxVM tools (VEA, CLI) or `smit` to create a volume
5. Use VxVM tools (VEA, CLI) or `smit` to configure data access (raw or file system)

Refer to “[Configuring LUNs with VxVM and DMP multipathing software](#)” on page 82 for additional information.

Utility for displaying information

The `sanlun` utility is a SAN Toolkit tool that aids in collecting and reporting information about paths to your devices and how they map to LUNs on the storage system. You can also use this command to display information about the host HBAs.

For more information, see:

- ◆ “[Using sanlun to display host LUN information](#)” on page 88
- ◆ “[Displaying host HBA information](#)” on page 93

Additional tasks

Once you've set up your LUNs, you may want to configure the new storage. For example, you can create a new volume group, add the hdisk to an existing volume group, create logical volume groups, or create file systems.

Configuring the LUNs

Configuring LUNs with VxVM and DMP multipathing software

Discovering the new LUNs

To get the host and VxVM to discover the new LUNs, complete the following steps.

Note_____

You do not need to reboot the host to discover the LUNs.

Step	Action
1	Log in as root on the host.
2	Execute the <code>cfgmgr</code> command on the AIX host to discover the newly created LUNs: <pre># cfgmgr</pre> Result: The <code>cfgmgr</code> command causes initiators to log into the fabric, the system to check for new devices, and the system to create new device entries.
3	Enter <code>lsdev -Cc disk</code> to verify that the host has discovered the LUNs. Example: This example shows the hdisks discovered by the AIX host. <pre># lsdev -Cc disk hdisk0 Available 06-08-02 NetApp LUN hdisk1 Available 06-08-02 NetApp LUN hdisk2 Available 06-08-02 NetApp LUN hdisk3 Available 06-08-02 NetApp LUN hdisk4 Available 06-08-02 NetApp LUN hdisk5 Available 06-08-02 NetApp LUN hdisk6 Available 06-08-02 NetApp LUN hdisk7 Available 06-08-02 NetApp LUN hdisk8 Available 06-08-02 NetApp LUN hdisk9 Available 06-08-02 NetApp LUN hdisk10 Available 06-08-02 NetApp LUN hdisk11 Available 06-08-02 NetApp LUN hdisk12 Available 06-08-02 NetApp LUN #</pre>

Step	Action																																																																	
4	Enter <code>vxctl enable</code> to enable VxVM to recognize each known hdisk. Result: The <code>vxctl</code> utility recognizes and assigns names to LUNs on the storage system. The following shows the results of <code>vxctl enable</code>. Example: The following <pre>vxdisk list</pre> <table><tr><th>DEVICE</th><th>TYPE</th><th>DISK</th><th>GROUP</th><th>STATUS</th></tr><tr><td>Disk_0</td><td>auto:LVM</td><td>-</td><td>-</td><td>LVM</td></tr><tr><td>Disk_1</td><td>auto:LVM</td><td>-</td><td>-</td><td>LVM</td></tr><tr><td>Netapp1_0</td><td>auto:none</td><td>-</td><td>-</td><td>online:invalid</td></tr><tr><td>Netapp1_0</td><td>auto:none</td><td>-</td><td>-</td><td>online:invalid</td></tr></table>	DEVICE	TYPE	DISK	GROUP	STATUS	Disk_0	auto:LVM	-	-	LVM	Disk_1	auto:LVM	-	-	LVM	Netapp1_0	auto:none	-	-	online:invalid	Netapp1_0	auto:none	-	-	online:invalid																																								
DEVICE	TYPE	DISK	GROUP	STATUS																																																														
Disk_0	auto:LVM	-	-	LVM																																																														
Disk_1	auto:LVM	-	-	LVM																																																														
Netapp1_0	auto:none	-	-	online:invalid																																																														
Netapp1_0	auto:none	-	-	online:invalid																																																														
5	Verify that the ASL is has detected the new devices by entering the <code>vxddm listenclosure all</code> command. In the output, verify that the model names of your storage systems are listed as the <code>ENCLR_NAME</code> and <code>ENCLR_TYPE</code>. Verify that the <code>ARRAY_TYPE</code> is <code>A/A-NETAPP</code>. <pre>vxddm listenclosure all</pre> <table><tr><th>ENCLR_NAME</th><th>ENCLR_TYPE</th><th>ENCLR_SNO</th><th>STATUS</th><th>ARRAY_TYPE</th></tr><tr><td colspan="5">=====</td></tr><tr><td>Disk</td><td>Disk</td><td>DISKS</td><td>CONNECTED</td><td>Disk</td></tr><tr><td>F9600</td><td>FAS960</td><td>1024916</td><td>CONNECTED</td><td>A/A-NETAPP</td></tr><tr><td>F9601</td><td>FAS960</td><td>1024915</td><td>CONNECTED</td><td>A/A-NETAPP</td></tr></table>	ENCLR_NAME	ENCLR_TYPE	ENCLR_SNO	STATUS	ARRAY_TYPE	=====					Disk	Disk	DISKS	CONNECTED	Disk	F9600	FAS960	1024916	CONNECTED	A/A-NETAPP	F9601	FAS960	1024915	CONNECTED	A/A-NETAPP																																								
ENCLR_NAME	ENCLR_TYPE	ENCLR_SNO	STATUS	ARRAY_TYPE																																																														
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Disk	Disk	DISKS	CONNECTED	Disk																																																														
F9600	FAS960	1024916	CONNECTED	A/A-NETAPP																																																														
F9601	FAS960	1024915	CONNECTED	A/A-NETAPP																																																														
6	Enter the <code>vxddm listapm all</code> command to verify that the APM is active. Output example: The following output example shows that the NetApp APM is active. <table><tr><th>Module Name</th><th>APM Name</th><th>APM Version</th><th>Array Types</th><th>State</th></tr><tr><td colspan="5">=====</td></tr><tr><td>dmpaa</td><td>dmpaa</td><td>1</td><td>A/A</td><td>Active</td></tr><tr><td>dmpap</td><td>dmpap</td><td>1</td><td>A/P</td><td>Active</td></tr><tr><td>dmpap</td><td>dmpap</td><td>1</td><td>A/P-C</td><td>Active</td></tr><tr><td>dmpapf</td><td>dmpapf</td><td>1</td><td>A/PF-VERITAS</td><td>Not-Active</td></tr><tr><td>dmpapf</td><td>dmpapf</td><td>1</td><td>A/PF-T3PLUS</td><td>Not-Active</td></tr><tr><td>dmpapg</td><td>dmpapg</td><td>1</td><td>A/PG</td><td>Not-Active</td></tr><tr><td>dmpapg</td><td>dmpapg</td><td>1</td><td>A/PG-C</td><td>Not-Active</td></tr><tr><td>dmpjbod</td><td>dmpjbod</td><td>1</td><td>Disk</td><td>Active</td></tr><tr><td>dmpjbod</td><td>dmpjbod</td><td>1</td><td>APdisk</td><td>Active</td></tr><tr><td>dmpnetapp</td><td>dmpnetapp</td><td>1</td><td>A/A-NETAPP</td><td>Active</td></tr><tr><td>dmpsvc</td><td>dmpsvc</td><td>1</td><td>A/A-IBMSVC</td><td>Not-Active</td></tr></table>	Module Name	APM Name	APM Version	Array Types	State	=====					dmpaa	dmpaa	1	A/A	Active	dmpap	dmpap	1	A/P	Active	dmpap	dmpap	1	A/P-C	Active	dmpapf	dmpapf	1	A/PF-VERITAS	Not-Active	dmpapf	dmpapf	1	A/PF-T3PLUS	Not-Active	dmpapg	dmpapg	1	A/PG	Not-Active	dmpapg	dmpapg	1	A/PG-C	Not-Active	dmpjbod	dmpjbod	1	Disk	Active	dmpjbod	dmpjbod	1	APdisk	Active	dmpnetapp	dmpnetapp	1	A/A-NETAPP	Active	dmpsvc	dmpsvc	1	A/A-IBMSVC	Not-Active
Module Name	APM Name	APM Version	Array Types	State																																																														
=====																																																																		
dmpaa	dmpaa	1	A/A	Active																																																														
dmpap	dmpap	1	A/P	Active																																																														
dmpap	dmpap	1	A/P-C	Active																																																														
dmpapf	dmpapf	1	A/PF-VERITAS	Not-Active																																																														
dmpapf	dmpapf	1	A/PF-T3PLUS	Not-Active																																																														
dmpapg	dmpapg	1	A/PG	Not-Active																																																														
dmpapg	dmpapg	1	A/PG-C	Not-Active																																																														
dmpjbod	dmpjbod	1	Disk	Active																																																														
dmpjbod	dmpjbod	1	APdisk	Active																																																														
dmpnetapp	dmpnetapp	1	A/A-NETAPP	Active																																																														
dmpsvc	dmpsvc	1	A/A-IBMSVC	Not-Active																																																														

Adding the disk to a disk group

Adding a disk to a disk group makes the disk space available when you create a VxVM volume. Disks that you add must be uninitialized, or free. If the disk is uninitialized, you must initialize it before you add it to the group.

Adding a disk to a disk group involves specifying how you want the to configure the disks. You should understand the following before you begin:

- ◆ Are you adding single or multiple disks?
- ◆ Do you want to add disks associated with a specific controller or target?
- ◆ Which disks do you want to add?
- ◆ Do you want to add the disk to a free disk pool?
- ◆ To which disk group will you add the disk?

To add the disk to the group, complete the following step. Refer to Veritas documentation for additional information.

Step	Action
1	Select any of the following methods: VEA: 1. Select the disk to add or the disk group to expand. 2. Select Actions and Add Disk to Dynamic Disk Group. 3. Indicate the disk group that you want. 4. Indicate the disks you want to add. vxdiskadm: 1. Enter vxdiskadm to activate the vxdiskadm interface. 2. Select option 1 Add or initialize one or more disks and follow screen directions. CLI: ◆ To configure private and public regions on a VxVM disk, enter vxdisksetup. ◆ To add one or more disks to a disk group, enter vx dg add disk smit: 1. Enter smit vxvmdiskadmadd to add disks using smit.

Creating a volume

Veritas volumes span data across multiple disks. Creating a volume with VxVM involves selecting the disk group and disks, and also specifying the volume layout.

To create a Veritas volume, complete the following step. Refer to Veritas documentation for additional information.

Step	Action
1	Select any of the following methods: VEA: 1. Expand the disk group and select the disk group you want. 2. Select Actions and New Volume. 3. Specify the volume characteristics that meet your requirements. CLI: ◆ Enter the following: <code>vxassist -g <i>diskgroup</i> make <i>volume_name</i> <i>length attributes</i></code> ◆ To add one or more disks to a disk group, enter <code>vx dg addisk</code> smit: 1. Enter <code>smit vxvm.</code> 2. Select VxVM Volumes. 3. Select Add a VxVM Volume. 4. Select the layout that meets your requirements. 5. Select the volume characteristics.

Access storage on the Veritas volume

You can access storage on a Veritas Volume using a raw Veritas volume, or a Veritas File System (VxFS). You can not configure a volume for both raw and VxFS access.

To create a file system, follow the step below.

Step	Action
1	Select any of the following methods: VEA: 1. Select the volume that will contain the file system. 2. Specify Actions, File System, and New File System. 3. Specify the file system requirements. CLI: To create the file system, enter <pre>mkfs -V vxfs /dev/vx/rdisk/<i>diskgroup/volume</i></pre> To mount the file system, enter <pre>mount -V vxfs /dev/vx/dsk/<i>diskgroup/volume</i> mount_point</pre> smit: Enter smit crvxfslvstd

Displaying LUN and HBA information

Utility for displaying information

The `sanlun` utility is a SAN Toolkit tool that aids in collecting and reporting information about paths to your devices and how they map to LUNs on the storage system. You can also use this command to display information about the host HBAs.

For detailed information

For detailed information, see the following topics:

- ◆ [“Using sanlun to display host LUN information”](#) on page 88
- ◆ [“Displaying host HBA information”](#) on page 93

Using sanlun to display 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 and go to the /opt/NetApp/santools/bin directory.
2	At the host command line, use the <code>sanlun lun show</code> command to display LUN information: <pre>sanlun lun show [-v] [-d <i>host device filename</i> <i>all</i> <i>storagesystem name</i> <i>storagesystem name:storagesystem pathname</i>] -p</pre> <code>-v</code> produces verbose output (you cannot use the <code>-v</code> on the same command line as the <code>-d</code>). <code>-d</code> is the device option and can be one of the following: ◆ <i>host device filename</i> specifies the special device file on the host. ◆ <i>all</i> lists all LUNs attached to the host. ◆ <i>storagesystem name</i> is the host name of the storage system. ◆ <i>storagesystem pathname</i> is the path name of the LUN on the storage system. (Multipathing only) <code>-p</code> provides information about the primary and secondary paths. You cannot use the <code>-d</code> option if you use <code>-p</code>. Use the following format: <pre>sanlun lun show -p [<i>filer name:filer pathname</i> <i>filer name</i> <i>all</i>]</pre> 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
	So you might enter: ◆ <code>sanlun lun show -p</code> to display a listing of all the paths associated with the LUN. This information is useful if you need to set up path ordering or troubleshoot a problem with path ordering. ◆ <code>sanlun lun show -d /dev/hdisk<x></code> to display the summary listing of the LUN(s) associated with the host device <code>/dev/hdisk<x></code> (<i>x</i> is the number of the hdisk; for example, you might have <code>hdisk1</code> or <code>hdisk4</code>). ◆ <code>sanlun lun show -v all</code> to display verbose output for all the LUN(s) currently available on the host. ◆ <code>sanlun lun show toaster</code> to display a summary listing of all the LUNs available to the host served by the storage system called <code>toaster</code>. ◆ <code>sanlun lun show toaster:/vol/vol0/lun0</code> to display a summary listing of all the LUNs available to the host served by <code>lun0</code> on <code>toaster</code>. Note _____ When you specify either the <code>sanlun lun show <storage_system_name></code> or the <code>sanlun lun show <storage_system_name:storage_system_pathname></code> command, the utility displays only the LUNs that have been discovered by the host. LUNs that have not been discovered by the host are not displayed. _____

Step	Action																																																																																																																																																												
	Example: This example displays sanlun lun show -p output for a system with Veritas multipathing. <pre># sanlun lun show -p tester:/vol/norm_1_2/norm_vx-aix01_lun6 (LUN 8) DMP_NODE: FAS30200_80 10g (10737418240) lun state: GOOD Filer_CF_State: Cluster Enabled Multipath_Policy: A/A-NETAPP Multipath-provider: VERITAS DMP</pre> <table><tr><th>host</th><th>filer</th><th></th><th>primary</th><th>partner</th><th>Veritas</th></tr><tr><th>path</th><th>path</th><th>device</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 I/O</th></tr><tr><th></th><th></th><th></th><th></th><th></th><th>policy</th></tr><tr><td>up</td><td>primary</td><td>hdisk95</td><td>fcs0</td><td>0d</td><td></td></tr><tr><td>up</td><td>primary</td><td>hdisk9</td><td>fcs0</td><td>0c</td><td></td></tr><tr><td>up</td><td>secondary</td><td>hdisk611</td><td>fcs1</td><td></td><td>0b</td></tr><tr><td>up</td><td>secondary</td><td>hdisk525</td><td>fcs1</td><td></td><td>0a</td></tr><tr><td>up</td><td>secondary</td><td>hdisk439</td><td>fcs0</td><td></td><td>0d</td></tr><tr><td>up</td><td>secondary</td><td>hdisk353</td><td>fcs0</td><td></td><td>0c</td></tr><tr><td>up</td><td>primary</td><td>hdisk267</td><td>fcs1</td><td>0b</td><td></td></tr><tr><td>up</td><td>primary</td><td>hdisk181</td><td>fcs1</td><td>0a</td><td></td></tr></table> <pre>tester:/vol/nate_1_2/norm_vx-aix01_lun4 (LUN 7) DMP_NODE: FAS30200_79 10g (10737418240) lun state: GOOD Filer_CF_State: Cluster Enabled Multipath_Policy: A/A-NETAPP Multipath-provider: VERITAS DMP</pre> <table><tr><th>host</th><th>filer</th><th></th><th>primary</th><th>partner</th><th>Veritas</th></tr><tr><th>path</th><th>path</th><th>device</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 I/O</th></tr><tr><th></th><th></th><th></th><th></th><th></th><th>policy</th></tr><tr><td>up</td><td>primary</td><td>hdisk94</td><td>fcs0</td><td>0d</td><td></td></tr><tr><td>up</td><td>primary</td><td>hdisk8</td><td>fcs0</td><td>0c</td><td></td></tr><tr><td>up</td><td>secondary</td><td>hdisk610</td><td>fcs1</td><td></td><td>0b</td></tr><tr><td>up</td><td>secondary</td><td>hdisk524</td><td>fcs1</td><td></td><td>0a</td></tr><tr><td>up</td><td>secondary</td><td>hdisk438</td><td>fcs0</td><td></td><td>0d</td></tr><tr><td>up</td><td>secondary</td><td>hdisk352</td><td>fcs0</td><td></td><td>0c</td></tr><tr><td>up</td><td>primary</td><td>hdisk266</td><td>fcs1</td><td>0b</td><td></td></tr><tr><td>up</td><td>primary</td><td>hdisk180</td><td>fcs1</td><td>0a</td><td></td></tr></table>	host	filer		primary	partner	Veritas	path	path	device	host	filer	filer	state	type	filename	HBA	port	port						path I/O						policy	up	primary	hdisk95	fcs0	0d		up	primary	hdisk9	fcs0	0c		up	secondary	hdisk611	fcs1		0b	up	secondary	hdisk525	fcs1		0a	up	secondary	hdisk439	fcs0		0d	up	secondary	hdisk353	fcs0		0c	up	primary	hdisk267	fcs1	0b		up	primary	hdisk181	fcs1	0a		host	filer		primary	partner	Veritas	path	path	device	host	filer	filer	state	type	filename	HBA	port	port						path I/O						policy	up	primary	hdisk94	fcs0	0d		up	primary	hdisk8	fcs0	0c		up	secondary	hdisk610	fcs1		0b	up	secondary	hdisk524	fcs1		0a	up	secondary	hdisk438	fcs0		0d	up	secondary	hdisk352	fcs0		0c	up	primary	hdisk266	fcs1	0b		up	primary	hdisk180	fcs1	0a	
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Interpreting `sanlun lun show -p` output

The `sanlun lun show -p` command provides the following information:

- ◆ path state—Whether the path is enabled or disabled.
- ◆ path type—Whether the path to the LUN is primary, secondary, or standby.
 - ❖ Primary paths communicate directly using the adapter on the local storage system.
 - ❖ Secondary paths are proxied to the partner storage system over the cluster interconnect.
 - ❖ Standby occurs if the `cfmode` is either mixed or standby and the path is being serviced by a partner storage system in takeover mode. Note that this case occurs only when Veritas assumes the array policy is Active/Active. If the array policy is Active/Passive and the path is being served by the partner file in the takeover mode, that path state displays as secondary.
- ◆ device filename—The special device file name for the disk on Solaris that represents the LUN.
- ◆ host HBA—The name of the initiator HBA on the host.
- ◆ local storage system port—The port that provides direct access to a LUN. This port appears as the `Xa` for F8xx, gF8xx, FAS9xx, gFAS9xx, FAS3000, or FAS6000 storage systems and `X_C` for FAS270 storage systems, where `X` is the slot number of the HBA. This is always a primary path.
- ◆ partner storage system port—The port that provides passive path failover. This port appears as `Xb` for F8xx or FAS9xx storage systems and `X_C` for FAS270 on storage systems, where `X` is the slot number of the HBA. This is always a secondary path.

After the failover of a storage system cluster, the `sanlun lun show -p` command reports secondary paths as secondary but enabled, because these are now the active paths.

- ◆ multipathing policy—The multipathing policy is one of the following:
 - ❖ A/A (Active/Active)—DMP uses more than one path concurrently for traffic. The A/A policy indicates that the B ports on the storage system HBAs are in standby mode and become active only during a takeover. This means that there are two active paths to the cluster at any given time.
 - ❖ A/PG-C (Active/Passive Group Concurrent)—Groups of LUNs connected to a single controller failover as a single failover entity. Failover occurs at the controller level and not at the LUN level.
 - ❖ The primary and secondary controllers are each connected to a separate group of LUNs. If a single LUN in the primary controller's LUN group fails, all LUN's in that group fail over to the secondary controller's passive LUN group. This array type allows load balancing of I/O across

multiple primary paths. Refer to Veritas documentation for details about load balancing.

Displaying host HBA information

Displaying host HBA information

To manage 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: <pre>sanlun fcp show adapter [-c [-v] [adapter name all]]</pre> <code>-v</code> 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 . Example 1: The following example displays the type of output you see with the <code>sanlun fcp show adapter</code> command line. This example simply displays information on the adapters. The next one includes the <code>-v</code> option, which provides more information on the adapter. <pre># sanlun fcp show adapter fcs0 WWPN:10000000abcde123 fcs1 WWPN:10000000abcde456</pre>

Step	Action
	Example 2: This example adds the <code>-v</code> option to the <code>sanlun fcp show adapter</code> command line. The <code>-v</code> option provides more information on the adapter. <pre># sanlun fcp show adapter -v fcs0 WWPN:10000000abcde123 WWNN: 20000000c936268b driver name: /usr/lib/drivers/pci/efcdd model: df1000f9 model description: FC Adapter serial number: 1E32909972 hardware version: not available driver version: 5.1.0.50 firmware version: CD382A1 Number of ports: 1 port type: Fabric port state: Operational supported speed: 2 GBit/sec negotiated speed: 1 GBit/sec OS device name: fcs0 fcs1 WWPN:10000000c9362687 WWNN: 20000000c9362687 driver name: /usr/lib/drivers/pci/efcdd model: df1000f9 model description: FC Adapter serial number: 1E32909970 hardware version: not available driver version: 5.1.0.50 firmware version: CD382A1 Number of ports: 1 port type: Fabric port state: Operational supported speed: 2 GBit/sec negotiated speed: 1 GBit/sec OS device name: fcs1 #</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 96
- ◆ “[Installation fails because system does not meet requirements](#)” on page 103
- ◆ “[Commands you can use to troubleshoot problems](#)” on page 104
- ◆ “[SAN Toolkit diagnostic utilities](#)” on page 106
- ◆ “[Change the AIX HBA’s attributes](#)” on page 112
- ◆ “[Change the HBA queue depth with no LUNs mapped](#)” on page 117
- ◆ “[Change the value for the queue depths on the disk](#)” on page 118
- ◆ “[General troubleshooting](#)” on page 119

Troubleshooting checklists

Connectivity problems

Because applications on AIX systems do not typically handle I/O errors gracefully, read/write failures can cause applications to hang, crash, or fail to return requested information.

You can minimize I/O application error on AIX systems by using highly available, multipathing configurations that provide continuous I/O with no single point of failure. If you continue to experience I/O errors, check the following areas for connectivity problems:

- ◆ Storage system setup
- ◆ Storage system connectivity to the Fibre Channel switch
- ◆ Fibre Channel switch setup
- ◆ Fibre Channel connectivity to the host
- ◆ Host setup

Storage setup checklist

The following is a checklist of items that pertain to the setup. You should make sure that the following situations are true:

- ◆ The storage system FCP cfmodes is correctly set for your configuration. See Chapter 4, “[Migrating a Storage Cluster to Single Image Mode](#),” on page 61.
- ◆ FCP is running and all the target ports are in a good state.
- ◆ The igroups have the ostype set to AIX.
- ◆ The LUNs are
 - ❖ mapped to host igroups
 - ❖ in a good state as indicated by the output from the `sanlun lun show -p` command or the `lspath` command.
 - ❖ use AIX as their operating system type

Host setup checklist

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

- ◆ The system meets the FCP AIX Host Utilities requirements.
The installation fails if your system does not meet the requirements.
- ◆ The HBAs are working.
Check the output from the `sanlun fcp show adapter -v` command.

- ◆ The host is seeing all of the LUNs and LUN paths that it should.
You can confirm this by running the `lsdev` command or, if you have multipathing, `sanlun lun show -p`.
- ◆ Use Veritas commands to check your path state and device availability.

Confirming that your system is correctly set up

About the sections that follow

If you have any problems with the Host Utilities, you should make sure your system setup is correct.

The information in the sections that follow helps you check your system setup. As you go through it, keep the following in mind:

- ◆ As an experienced AIX user, you may already know these commands. This is just a quick refresher of some of the key areas to check to avoid having problems.
For more information on any of the AIX commands, see the man pages and operating system documentation.
For more information on the Data ONTAP commands, see the Data ONTAP documentation, in particular, the FCP and iSCSI Block Access Guide.
- ◆ You perform some of these checks from the host and others from the storage system. In some cases, you must have the Host Utilities SAN Toolkit installed before you perform the check. For example, the SAN Toolkit contains both the `dotpaths` utility and the `san lun` command.
- ◆ To make sure you have the current version of the system components, see the *NetApp Interoperability Matrix Tool* at <http://now.netapp.com/matrix/mtx/login.do> or the *Compatibility and Configuration Guide for NetApp's FCP and iSCSI Products* at <http://now.netapp.com/NOW/knowledge/docs/docs.shtml>. Support for new components is added on an on-going basis. This online information contains a complete list of supported HBAs, platforms, applications, and drivers. It is updated on a regular basis to ensure that they always have information on the most current components.

Note

The examples that follow were accurate at the time this document was produced. They are not intended to show all the options available.

Check your operating system version

If you're not sure you have a supported version of the operating system, enter the following command:

```
oslevel -s
```

Result: Information about your operating system and maintenance or technology level appears. This command gives you basic information about the operating system level, but it may not be complete. You may need additional filesets.

Example: This command displays information on your operating system level.

```
# oslevel
5.3.0.0
#
```

Check the version of the prerequisite filesets

Use the `lslpp` command to check the filesets. The command format is:

```
lslpp -L <fileset_name>
```

`-L` displays information about filesets installed on the host.

fileset_name displays information about that fileset on the host.

Result: The output from this command tells you which filesets are installed on the host or provides information about a fileset on the host.

Example: The following example displays information about the fileset `devices.pci.df1000f7.com`.

```
# lslpp -L devices.pci.df1000f7.com
  Fileset                                Level  State  Type  Description
(Uninstaller)
-----
devices.pci.df1000f7.com  5.2.0.40 C      F      Common PCI FC Adapter
Device Software
State codes:
A -- Applied.
B -- Broken.
C -- Committed.
E -- EFIIX Locked.
O -- Obsolete. (partially migrated to newer version)
? -- Inconsistent State...Run lppchk -v.
Type codes:
F -- Installp Fileset
P -- Product
C -- Component
T -- Feature
R -- RPM Package
```

Verifying the correct host HBA is installed

Supported HBAs should be installed before you install the software package. Complete the following steps to display information about HBAs on your system and, if necessary, to install an HBA.

Step	Action
1	To display HBA information, enter: <pre>lsdev -Cc adapter</pre> Example: The system displays information similar to the following. In this case, fcs0 and fcs1 are fibre channel adapters. <pre># lsdev -Cc adapter ent0 Available 03-08 2-Port 10/100/1000 Base-TX PCI-X Adapter (14108902) ent1 Available 03-09 2-Port 10/100/1000 Base-TX PCI-X Adapter (14108902) fcs0 Available 05-08 FC Adapter fcs1 Available 09-08 FC Adapter ide0 Available 07-08 ATA/IDE Controller Device sisscsia0 Defined 04-08 PCI-X Dual Channel Ultra320 SCSI Adapter sisscsia1 Available 08-08 PCI-X Dual Channel Ultra320 SCSI Adapter usbhc0 Available 02-08 USB Host Controller (33103500) usbhc1 Available 02-09 USB Host Controller (33103500) vsa0 Available LPAR Virtual Serial Adapter vsa1 Available LPAR Virtual Serial Adapter</pre>
2	If you need to install an HBA, refer to the documentation that came with your HBA.

Verifying that the storage system is configured

Before you configure initiator groups and LUNs on the storage system, make sure you have completed the following:

1. Set up the AIX host and the initiator HBAs.
2. Configured the storage system and target HBAs (if needed).
3. Cabled the storage to the fabric according to your configuration topology.
4. Licensed and enabled the FCP protocol on the storage system.
5. Created working volumes and qtrees (if desired) on the storage system.

Note

It is recommended that you create volumes and LUNs with space reservations enabled.

Refer to “*Where to go for more information*” on page 8 for a list of useful documents and web sites.

Verifying that the switch is installed and configured

If you have a fabric-attached configuration, check that the switch is set up and configured as outlined in the Installation and Setup instructions that shipped with your hardware. You should have completed the following tasks:

- ◆ Installed the switch in a system cabinet or rack.
- ◆ Checked that the switch firmware is one of the versions supported with the Host Utilities. See the *Fibre Channel Configuration Guide* at http://now.netapp.com/NOW/knowledge/docs/san/fcp_iscsi_config/QuickRef/FCPCConfigurationGuide.pdf.
- ◆ Turned on power to the switch.
- ◆ 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.

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

- ◆ Configuring the host is simplified.
- ◆ Information becomes more manageable. The output from host tools such as `iostat` and `lsdev` is easier to read because fewer paths are displayed.

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

It is recommended that your configuration have no more than eight paths per LUN. For more information about zoning, see the *Configuration Guide for NetApp FCP and iSCSI Products* at <http://now.netapp.com/NOW/knowledge/docs/docs.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 follow, this is the order you must use when powering on the equipment:

- ◆ Configured Fibre Channel switches
It can take several minutes for the switches to boot.
- ◆ Disk shelves
- ◆ Storage systems
- ◆ Host

Verifying the host and storage system can communicate

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

Step	Action
1	Issue a command from the host to the storage system. One way to do this is to use a remote login, such as <code>telnet</code>, to connect with the storage system. Once you have logged in, enter a command at the filer prompt.

Installation fails because system does not meet requirements

Installation checks for system requirements

The installation process requires certain minimum system requirements. If it finds a problem with your system requirements, the installation fails.

Reinstalling the software

If the installation fails because your system does not meet the system requirements, complete the following steps.

Step	Action
1	Check the installation logs to determine why the install failed. The most common problems include missing the required filesets, such as devices.common.IBM.fc.hba-api fileset.
2	Correct the problem described in the log.
3	Run SMIT to install the software. Note _____ Unstalling software is not necessary. _____

Commands you can use to troubleshoot problems

Tools you can use

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

- ◆ The SAN Toolkit `sanlun` utility
- ◆ The AIX `lsdev` command
- ◆ The Veritas commands `vxddm` and `vxdisk list`

Using `sanlun`

You can use the `sanlun` utility to perform the following tasks:

- ◆ Check the status of the
 - ❖ HBA
 - ❖ LUN
 - ❖ Paths to the LUN
- ◆ Discover whether a path is up or down

When you have a direct-attached configuration, use the `sanlun lun show` command to get information on your system.

With a multipathing configuration, use `sanlun lun show -p` command, which includes information on the paths to LUNs.

Examples of the `sanlun` commands are in the section “” on page 81.

Using the `lsdev` command

The `lsdev -C -c disk` command provides information about the devices and LUNs in your configuration. The following example shows the type of output displayed when you run this command. (This example has been shortened.)

```
# lsdev -Cc disk
hdisk0    Available 06-08-02    NetApp LUN
hdisk1    Available 06-08-02    NetApp LUN
hdisk2    Available 06-08-02    NetApp LUN
hdisk3    Available 06-08-02    NetApp LUN
hdisk4    Available 06-08-02    NetApp LUN
hdisk5    Available 06-08-02    NetApp LUN
hdisk6    Available 06-08-02    NetApp LUN
hdisk7    Available 06-08-02    NetApp LUN
```

hdisk8	Available	06-08-02	NetApp	LUN
hdisk9	Available	06-08-02	NetApp	LUN
hdisk10	Available	06-08-02	NetApp	LUN
hdisk11	Available	06-08-02	NetApp	LUN
hdisk12	Available	06-08-02	NetApp	LUN
#				

SAN Toolkit diagnostic utilities

Diagnostic utilities

The SAN Toolkit provides several utilities 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 collect information and place it in a directory. Then they create a gzipped .tar file of that directory. You can send this file to technical support.

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

- ◆ `filer_info`. See “[Collecting storage system information](#)” on page 107 for more information.
- ◆ `aix_info`. See “[Using the AIX data-collection tool](#)” on page 108.
- ◆ `<switch>_info`, where `<switch>` is the brand of switch you are using (for example, `brocade_info`). See “[Collecting switch information](#)” on page 109.

General steps for executing the programs

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

Step	Action
1	Go to the directory <code>/opt/NetApp/santools/bin</code> : <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 storage system information

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

Note_____

This utility runs in command-line mode only.

Step	Action
1	Go to the directory <code>/opt/NetApp/santools/bin</code> : <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 <code>-d</code> option enables you to specify a different path in which to place the resulting output. The default path is <code>/tmp/NetApp/ntap_filer_<filer_name></code>. The <code>-l</code> user option allows the choice of a user name and password on the switch. The target of the command is specified by <code>-n <filer_name></code>, where <code>filer_name</code> is the name of IP address of the storage system. Result: The output of various status commands are placed in the <code>e</code> output directory named <code>netapp_filer_<filer_name></code>, where <code>filer_name</code> is the storage system name or IP address. The contents of this directory are placed in a tarred and gzipped file named <code>filer_<filer_name>.tar.gz</code>. Example: The following command line checks <code>system_1</code>, logging on to it as the user <code>root</code>. <pre>host1> filer_info -d /opt/NetApp/santools -l root -n system_1</pre> The information from <code>system_1</code> is placed in a gzipped file with the directory path <code>/opt/NetApp/santools/filer_filer1.tar.gz</code> as its name.
3	Send the resulting gzipped file to Customer Support for analysis.

Using the AIX data-collection tool

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

To execute `aix_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>

Step	Action
2	At the command prompt, enter the following command: <pre>aix_info [-d <directory>] [-n <file_name>]</pre> -d <directory> specifies the location for the gzipped file that aix_info creates. The default location is /tmp/netapp. -n <file_name> specifies the name for the output file and directory names. The default pathname is /tmp/netapp/ntap_aix_info.tar.gz. Note Ensure that you have at least 64MB of free storage in the output directory Result: When you run aix_info, the utility gathers information about your AIX configuration and places it in a tarred, gzipped file. It also creates a directory and populates it with files containing output from numerous commands run on the AIX system and copies of logs such as the output of the errpt command. Example: Depending on the options you specify, you see output similar to the following when you run this utility: <pre># aix_info # aix_info Collecting aix_info.....(collecting AIX snap... may take several minutes)..... AIX system info is in directory /tmp/netapp/ntap_aix_info Compressed file is /tmp/NetApp/ntap_aix_info.tar.Z Please send this file to Network Appliance for analysis</pre>
3	Send the resulting gzipped file to Customer Support for analysis.

Collecting switch information

If you are having a problem, Customer Support might ask you to run the switch utility the SAN Toolkit supplies when you install the toolkit software. The SAN Toolkit provides a utility for each switch it supports for this Host Utilities. The

utility name is <switch>_info, where *switch* is the brand of the switch (for example, if you have a McDATA switch, the file name would be mcddata_info). This utility collects switch configuration information. You should only run this utility when requested to do so by Customer Support.

To execute the utility, complete the following steps.

Note

This utility runs in command-line mode only.

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 for a Brocade switch. 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 switch default login and password settings are used. The target of the command is specified by -n switchname, where switchname is the name or IP address of the switch. 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 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 Customer Support for analysis.

Change the AIX HBA’s attributes

Methods for changing the FCP HBA’s attributes

If you want to change information, such as the queue depth on the HBA, you must change the HBA’s attributes. If you have LUNs mapped to the host, there are two methods you can use to change these attributes. One method requires you to reboot the host for the change to take effect. The other method does not require a reboot, but you must temporarily unload all the HBA’s child devices.

Note— You must unload the child devices even if you are using SMIT. SMIT does not unload these devices automatically.

If you don’t have any LUNs mapped to the host, you can use a shorter way to change such attributes as the HBA queue depth (see “[Change the HBA queue depth with no LUNs mapped](#)” on page 117).

Changing the FCP HBA’s attributes and rebooting

If you only change the FCP HBA’s attributes in the ODM, you must reboot your host. To change the attributes this way, complete the following steps.

Step	Action
1	Enter the following command: <pre># chdev -P -l <i>adapter_name</i> -a num_cmd_elems=<i>val</i></pre> <i>adapter_name</i> is the name of the HBA whose values you want to change. <i>val</i> is the value to which you want to set the queue depth. Example: The following example sets the queue depth on the FCP HBA device named fcs1 to 400. <pre># chdev -P -l fcs1 -a num_cmd_elems=400</pre>
2	Reboot the host.

Changing the FCP HBA's attributes without rebooting

If you don't want to reboot the host, you can change the HBA attributes by temporarily unloading all the HBA child devices. To use this method to change the attributes, complete the following steps.

Note

The commands in these steps provide an example of changing the attribute. Depending on how your system is set up, you would probably see different output if you executed these commands on your system.

Step	Action
1	Use the <code>lsdev</code> command to find the HBA's child device. This is a device instance of SCSI over the FCP driver. If this command does not return any child devices, go to step 11. In this case, you will stop at step 12. Example: In this example, the <code>lsdev</code> command reports one FCP device. <pre># lsdev -C -F "name parent" awk '\$2~/^fcs1\$/ { print \$1 }'</pre> fscsi1
2	Now that you have a name for the FCP device, use the <code>lsdev</code> command to locate that device's child devices. These devices are among the LUN disk devices. If this command doesn't display any child devices, go to step 10 and stop after step 13. Example: In this example, the <code>lsdev</code> command displays four child devices. <pre># lsdev -C -F "name parent" awk '\$2~/^fscsi1\$/ { print \$1 }'</pre> hdisk2 hdisk3 hdisk6 hdisk7
3	Use the <code>lspv</code> command to find all the volume groups that contain at least one disk device that is a child of the FCP device. If the command does not report any volume groups, skip to step 8 and stop after step 14.

Step	Action
4	Find all the mounted file systems that belong to those volume groups and the applications that are currently accessing logical volumes in those volume groups. If there aren't any, skip to step 7 and stop after step 15.
5	Disable any applications that are accessing logical volumes in the volume groups.
6	Unmount any file systems and deactivate all disk groups using the <code>vxdg deport</code> command. If it doesn't display any child devices, go to step 10 and stop after step 13. Example: In this example, the <code>vxdg deport</code> command unmounts the file systems that contain the disk groups called <code>my_disk_groups</code> and deactivates the disk groups. <pre># vxdg deport my_disk_groups</pre>
7	Unload all the protocol's child devices. You need to keep the definition of these devices. Example: This example unloads the child devices that were discovered in step 2. <pre># rmdev -l hdisk2 hdisk2 Defined # rmdev -l hdisk3 hdisk3 Defined # rmdev -l hdisk6 hdisk6 Defined # rmdev -l hdisk7 hdisk7 Defined</pre>
8	Unload the FCP device that you discovered in step 1. Example: This example unloads the FCP device <code>fscsi1</code>. <pre># rmdev -l fscsi1 fscsi1 Defined</pre>

Step	Action
9	Change the value of the attribute. Example: This example changes the queue depth value to 400. <pre># chdev -l fcs1 -a num_cmd_elems=400 fcs1 changed</pre>
10	Reload the HBA device to enable the new setting. Example: This example reloads the FCP device fcs1. <pre># mkdev -l fcs1 fcs1 Available</pre>
11	If necessary, reload the FCP device fscsi1. Example: The following command line reloads the FCP device fscsi1. <pre># mkdev -l fscsi1 fscsi1 Available</pre>
12	If necessary, reload the child devices of the FCP device. Example: The following command line reloads the child device that you unloaded in step 9. <pre># mkdev -l hdisk2 hdisk2 Available # mkdev -l hdisk3 hdisk3 Available # mkdev -l hdisk6 hdisk6 Available # mkdev -l hdisk7 hdisk7 Available</pre>
13	Import the disk groups that you deported earlier. Example: To import the disk group called my_disk_group, you would enter the following command. <pre># vxdg import my_disk_groups</pre>
14	Remount any file systems that you unmounted.

Step	Action
15	Restart any applications that you halted.

Change the HBA queue depth with no LUNs mapped

Changing the HBA queue depth

If you need to change the HBA queue depth, and you don't have any LUNs mapped to the host, complete the following steps.

Note—————
If you have LUNs mapped to the host, you must perform the steps listed in [“Changing the FCP HBA’s attributes without rebooting”](#) on page 113.

Step	Action
1	Unload the child FCP device by using the <code>rmdev -l</code> command. Example: For HBA <code>fscsi0</code> , you would enter the following command: <code># rmdev -l fscsi0</code>
2	Change the value of the queue depth using the <code>chdev -l</code> command, which has the following format: <code># chdev -l fcs0 -a num_cmd_elems=val</code> <i>val</i> is the value to which you want to set the queue depth. Example: To change the value to 48, you would enter the following command. <code># chdev -l fcs0 -a num_cmd_elems=48</code>
3	Reload the HBA device using the <code>mkdev -l</code> command. Example: The following command line reloads the <code>fcs0</code> HBA. <code># mkdev -l fcs0</code>
4	Reload the child FCP device using the <code>mkdev -l</code> command. Example: The following command line reloads the child FCP device. <code># mkdev -l fscsi0</code>

Change the value for the queue depths on the disk

Setting the value of the queue depths

The installation automatically sets the queue depths for the disk to 12, which is the recommended value. If your system needs to use a different queue depth, change this value using the `chdev -l` command. This command has the following format:

```
# chdev -l hdiskx -a queue_depth=val
```

`hdiskx` is the device for which you want to change the depth. The *x* specifies the number for this device.

val is the value to which you want to set the queue depth.

Note

You should only change the queue depth if you are familiar with performance tuning on your system.

Example of changing the queue depth

This example sets the queue depth for the `hdisk6` to 12.

```
# chdev -l hdisk6 -a queue_depth=12
```

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. Check for faulty optical cabling. Also, check the fibre channel switch for excessive line errors.

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