

HP StorageWorks Disk Array XP operating system configuration guide: Tru64 UNIX

XP12000

XP10000

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Contents

Preface	5
About this guide	5
Intended audience	5
Disk arrays	5
Related documentation	5
Document conventions and symbols	6
HP technical support	7
Subscription service	7
Other HP web sites	7
Documentation feedback	7
1 Installation	9
Features and requirements	9
Fibre Channel interface	10
Device emulation types	10
Failover	10
SNMP configuration	11
RAID Manager command devices	11
Installation procedures	12
Install and configure the disk array	13
Setting the host mode and host group mode for the disk array ports	14
Setting the System Option Modes	15
Configuring the Fibre Channel ports	15
Fibre address	15
Fabric and connection parameter settings	16
Install and configure the host	16
Loading the OS and software	16
Installing and configuring the HBAs	16
Set HBA fabric mode	16
Using wwidmgr	17
Configuring system files	18
Clustering and fabric zoning	18
Fabric zoning and LUN security for multiple operating systems	19
Connect the disk array	19
Defining the paths	20
Verifying host recognition of disk array devices	21
Configure disk devices	21
Writing the partition labels	21
To write the partition label:	22
Creating the file systems	22
To create a file system for each device:	22
To create an advanced file system:	22
Creating mount directories	22
Mounting the file systems	23
To mount a Tru64 file system:	23
To mount an advanced file system:	23
Verifying the file systems	23
Setting and verifying automatic mounting at bootup	24
Checking path failover	25

2 Troubleshooting 27
 Error conditions 27
 Calling the HP support center 29
 Contact Information 29
 Before you call 29

A Path worksheet 31

B Disk array supported emulations 33
 Supported emulations 33
 Emulation specifications 34

Glossary 37

Index 41

Preface

About this guide

This guide provides information about:

- Requirements and procedures for connecting an XP disk array to a host system
- Configuring the disk array for use with the Tru64 UNIX operating system

Intended audience

This guide is intended for system administrators with knowledge of:

- The host hardware
- Tru64 operating system
- XP disk arrays

Disk arrays

Unless otherwise noted, the term “disk array” refers to these systems:

- HP StorageWorks XP10000 Disk Array
- HP StorageWorks XP12000 Disk Array

Related documentation

The following documents provide related information:

- *HP StorageWorks XP10000 Disk Array: Owner's Guide*
- *HP StorageWorks XP12000 Disk Array: Owner's Guide*

You can find these documents from the Manuals page of the HP Business Support Center web site:

<http://www.hp.com/support/manuals>

In the Storage section, click **Storage array systems** and then select your product.

Document conventions and symbols

Convention	Element
Blue text: Document conventions and symbols	Cross-reference links and e-mail addresses
Blue, underlined text: http://www.hp.com	Web site addresses
Bold text	<ul style="list-style-type: none">• Keys that are pressed• Text typed into a GUI element, such as a box• GUI elements that are clicked or selected, such as menu and list items, buttons, tabs, and check boxes
<i>Italic</i> text	Text emphasis
Monospace text	<ul style="list-style-type: none">• File and directory names• System output• Code• Commands, their arguments, and argument values
<i>Monospace, italic</i> text	<ul style="list-style-type: none">• Code variables• Command variables
Monospace, bold text	Emphasized monospace text

 **WARNING!**

Indicates that failure to follow directions could result in bodily harm or death.

 **CAUTION:**

Indicates that failure to follow directions could result in damage to equipment or data.

 **IMPORTANT:**

Provides clarifying information or specific instructions.

 **NOTE:**

Provides additional information.

 **TIP:**

Provides helpful hints and shortcuts.

HP technical support

Telephone numbers for worldwide technical support are listed on the HP support web site: <http://www.hp.com/support/>.

Collect the following information before calling:

- Technical support registration number (if applicable)
- Product serial numbers
- Product model names and numbers
- Error messages
- Operating system type and revision level
- Detailed questions

For continuous quality improvement, calls may be recorded or monitored.

Subscription service

HP recommends that you register your product at the Subscriber's Choice for Business web site: <http://www.hp.com/go/e-updates>.

After registering, you will receive e-mail notification of product enhancements, new driver versions, firmware updates, and other product resources.

Other HP web sites

For additional information, see the following HP web sites:

- <http://www.hp.com>
- <http://www.hp.com/go/storage>
- http://www.hp.com/service_locator
- <http://www.hp.com/support/manuals>

Documentation feedback

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To make comments and suggestions about product documentation, please send a message to feedback@hp.com. All submissions become the property of HP.

1 Installation

You and your HP service representative each play a role in installation. Your HP service representative is responsible for installing the disk array and formatting the disk devices. You are responsible for configuring the host server for the new devices with assistance from your HP service representative.

Features and requirements

Ask your HP service representative about the latest supported hardware and software.

The disk array has the following features:

- **Storage capacity:** The storage capacity for each model is listed below:
XP10000: Up to 240 drives for up to 69.2 TB, 48 FC ports
XP12000: Up to 1152 drives for up to 332 TB, 128 FC ports
- **Server support:** PCI-based AlphaStation or AlphaServer
- **Operating system support:** Tru64 UNIX, versions 5.1B-2 and later with latest supported patches

Before installing the disk array, ensure the following requirements are met::

- **Host Bus Adapters (HBAs):** Install HBAs and all utilities and drivers. Refer to the adapter documentation for installation details
- *(Recommended)* HP StorageWorks Remote Web Console XP, Command View XP Advanced Edition or Command View XP with LUN management feature for configuring disk array ports and paths
- *(Recommended)* HP StorageWorks LUN Configuration and Security Manager XP
- *(Optional)* Other available XP software (check with your HP representative for OS version applicability):
 - HP StorageWorks Business Copy XP
 - HP StorageWorks Continuous Access XP
 - HP StorageWorks Continuous Access Extension XP
 - HP StorageWorks Auto LUN XP
 - HP StorageWorks Data Exchange XP
 - HP StorageWorks Resource Manager XP
 - HP StorageWorks RAID Manager XP
 - HP StorageWorks Cache LUN XP
 - HP StorageWorks External Storage XP

Fibre Channel interface

The XP family of disk arrays supports these Fibre Channel elements:

- Connection speeds of 1 Gbps, 2 Gbps, and 4 Gbps
- Short-wave non-OFC (open fiber control) optical interface
- Multimode optical cables with SC or LC connectors
- Fibre Channel switches

Even though the interface is Fibre Channel, this guide uses the term “SCSI disk” because disk array devices are defined to the host as SCSI disks.

Device emulation types

The XP family of disk arrays supports these device emulation types:

- **OPEN-x devices:** OPEN-x logical units represent disk devices. Except for OPEN-V, these devices are based on fixed sizes. OPEN-V is a user-defined size. Supported emulations include OPEN-3, OPEN-8, OPEN-9, OPEN-E, OPEN-L, and OPEN-V devices.
- **LUSE devices (OPEN-x*n):** Logical Unit Size Expansion (LUSE) devices combine 2 to 36 OPEN-x devices to create expanded LDEVs larger than standard OPEN-x disk devices. For example, an OPEN-x LUSE volume created from ten OPEN-x volumes is designated as OPEN-x*10.
- **CVS devices (OPEN-x CVS):** Volume Size Configuration (VSC) defines custom volumes (CVS) that are smaller than normal fixed-sized logical disk devices (volumes). (OPEN-V is a CVS-based custom disk size that you determine. OPEN-L does not support CVS.)
- **LUSE (expanded) CVS devices (OPEN-x*n CVS):** LUSE CVS combines CVS devices to create an expanded device. This is done by first creating CVS custom-sized devices and then using LUSE to combine from 2 to 36 CVS devices. For example, if three OPEN-9 CVS volumes are combined to create an expanded device, this device is designated as OPEN-9*3-CVS.

Refer to [Emulation specifications](#) for detailed information.

Failover

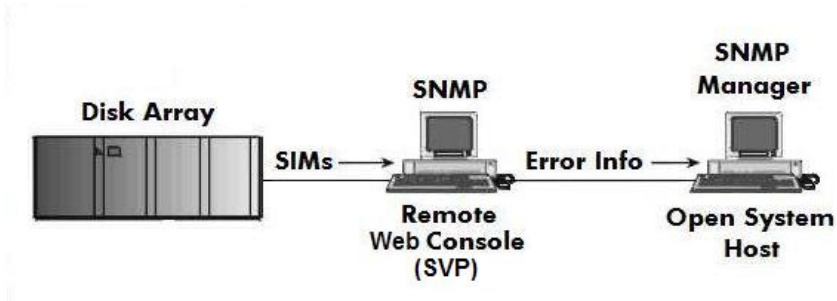
The XP family of disk arrays supports many standard software products that provide host, application, or I/O path failover and management. TruCluster is one of the supported applications.

△ CAUTION:

Tru64 version 5.1B and later fully support dynamic load balancing and failover when multiple HBAs are connected to the same LUN. This feature is ONLY available with version 5.1B and later.

SNMP configuration

The XP family of disk arrays supports standard Simple Network Management Protocol (SNMP) for remotely managing the disk array. The SNMP agent on the SVP performs error-reporting operations requested by the SNMP manager. SNMP properties are usually set from the SVP but they can also be set remotely using Remote Web Console XP, or Command View XP. For procedures, refer to the applicable user guide available at <http://www.hp.com/support/manuals>.



RAID Manager command devices

RAID Manager manages Business Copy (BC) or Continuous Access (CA) operations from a host server. To use RAID Manager with BC or CA, you use Remote Web Console or Command View, to designate at least one LDEV as a command device. Refer to the applicable user's guide for information about how to designate a command device.

Installation procedures

Perform these actions to install and configure the disk array:

- 1.** Install and configure the disk array
 - Setting the host mode for the disk array ports
 - Setting the System Option Modes
 - Configuring the Fibre Channel ports
- 2.** Install and configure the host
 - Loading the OS and software
 - Installing and configuring the HBAs
 - Setting up clustering and fabric zoning
 - Fabric zoning and LUN security for multiple operating systems
- 3.** Connect the disk array
 - Defining the paths
 - Verifying host recognition of disk array devices
- 4.** Configure disk devices
 - Writing the partition labels
 - Creating the file systems
 - Creating mount directories
 - Mounting the file systems
 - Verifying the file systems
 - Setting and verifying automatic mounting at bootup

Install and configure the disk array

The HP service representative performs these tasks:

- Assembling hardware and installing software
- Loading the microcode updates
- Installing and formatting devices
- Configuring array groups and creating LDEVs

After these tasks are finished, use Remote Web Console, Command View, Command View XP Advanced Edition, or LUN Configuration and Security Manager to complete the remaining tasks listed below. For procedures, refer to the applicable user guide available at <http://www.hp.com/support/manuals>. If you do not have these programs, your HP service representative can perform these tasks for you.

For optimal performance, the following recommendations apply when configuring any XP disk array with a Tru64 host:

- Sharing of CHA (channel adapter) microprocessors is not recommended
- Multiple host groups sharing the same CHA port is not recommended

 **NOTE:**

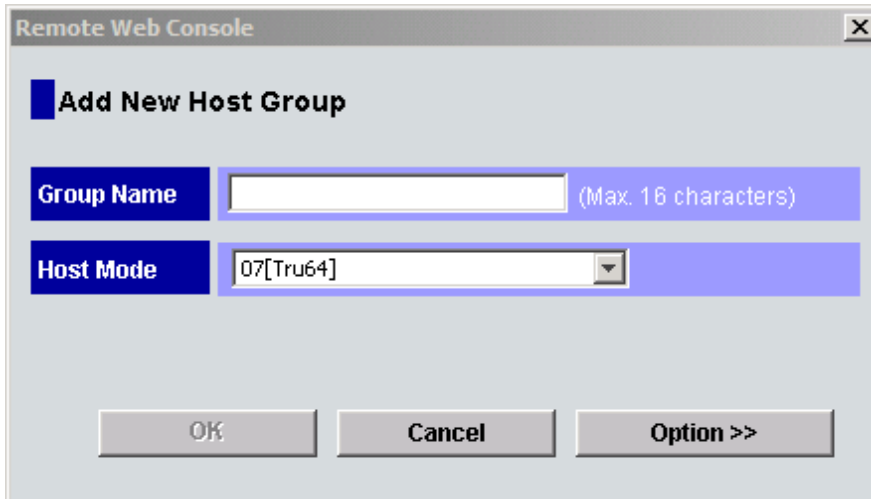
As illustrated in the following table, there is no microprocessor sharing with 8–port module pairs. With 16– and 32–port module pairs, alternating ports are shared.

Channel Adapter	Model	Description	Nr. of Ports per Micro-processor	Ports Shared
AE020A	8HSR	8-port 2GB CHIP Pair	1	N/A
AE006A	16HSR	16-port 2GB CHIP Pair	2	CL1 - 1 & 5; 3 & 7 CL2 - 2 & 6; 4 & 8
AE007A	32HSR	32-port 2GB CHIP Pair	2	CL1 - 1 & 5; 3 & 7 CL2 - 2 & 6; 4 & 8
AE021A	8FS2R	8-port 4GB CHIP Pair	1	N/A
AE022A	16FS2R	16-port 4GB CHIP Pair	2	CL1 - 1 & 5; 3 & 7 CL2 - 2 & 6; 4 & 8
AE023A	32FS2R	32-port 4GB CHIP Pair	2	CL1 - 1 & 5; 3 & 7 CL2 - 2 & 6; 4 & 8

Setting the host mode and host group mode for the disk array ports

After the disk array is installed, you must set the host mode for each disk array port to match the host OS. Set the host mode using LUN Manager in Remote Web Console XP (shown), Command View XP, or Command View XP Advanced Edition. For procedures, refer to the applicable user guide available at <http://www.hp.com/support/manuals>. If these are not available, the HP service representative can set the host mode using the SVP.

The required host mode setting for Tru64 is **07**.



Remote Web Console

Add New Host Group

Group Name (Max. 16 characters)

Host Mode

OK Cancel Option >>

△ CAUTION:

The correct host mode must be set for all new installations (newly connected ports) to Tru64 hosts. Do not select a mode other than **07** for Tru64. Changing a host mode after the host has been connected is disruptive and requires the server to be rebooted.

When a new host group is added, additional host group modes (options) may be configured. The storage administrator must verify if an additional host group mode is required for the host group.



Remote Web Console

Add New Host Group

Group Name (Max. 16 characters)

Host Mode

Option

Select	No.	Explanation
<input type="checkbox"/>	2	VERITAS Database Edition/Advanced Cluster
<input type="checkbox"/>	6	TPRLO
<input type="checkbox"/>	7	Automatic recognition function of LUN
<input type="checkbox"/>	12	Undisplay function of ghost LUN
<input type="checkbox"/>	13	SIM report at link failure

OK Cancel << Option

The following host group modes are available for Tru64:

Host Group Mode	Function	Default	Comments
14	Enable use of Continuous Access on Tru64 TruClusters.	Inactive	Previously MODE272

△ **CAUTION:**

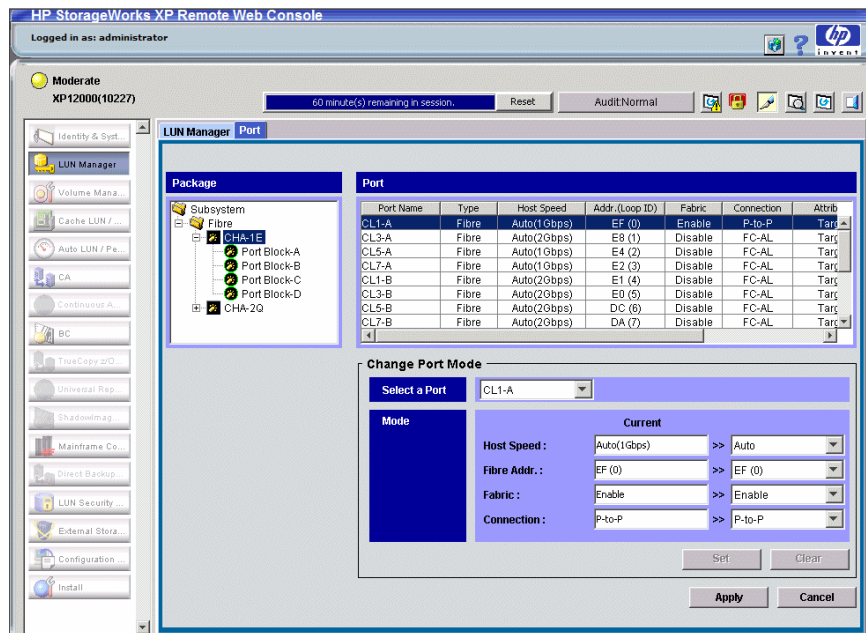
Changing host group modes for ports where servers are already installed and configured is disruptive and requires the server to be rebooted.

Setting the System Option Modes

The HP service representative sets the System Option Mode(s) based on the operating system and software configuration of the host.

Configuring the Fibre Channel ports

Configure the disk array Fibre Channel ports by using Remote Web Console (shown), Command View, or Command View XP AE. Select the settings for each port based on your storage area network topology. Use switch zoning if you connect different types of hosts to the array through the same switch. For detailed procedures, refer to *HP StorageWorks LUN Configuration and Security Manager XP user guide* available at <http://www.hp.com/support/manuals>.



Fibre address

In fabric environments, the port addresses are assigned automatically.

Fabric and connection parameter settings

Set each array port to FABRIC ENABLE with connections of POINT-TO-POINT (P-to-P) as shown in the previous figure. For detailed topology information, refer to the *HP StorageWorks SAN Design Reference Guide* available at <http://www.hp.com/support/manuals> website.

Install and configure the host

This section explains how to install and configure the host and host bus adapters (HBAs) that connect the host to the disk array.

Loading the OS and software

Follow the manufacturer's instructions to load the operating system and software onto the host. Load all OS patches and configuration utilities supported by HP and the HBA manufacturer.

Installing and configuring the HBAs

Install and configure the host bus adapters using the HBA manufacturer's instructions.

Set HBA fabric mode

Set the HBAs to run in fabric mode as follows.

1. Display the HBA configuration.

```
P00>>>wwidmgr -show adapter
```

2. Set the HBA topology to fabric. The 9999 qualifier sets all adapters with one command.

```
P00>>>wwidmgr -set adapter -item 9999 -topo fabric
```


Using wwidmgr

When booting from an XP12000/XP10000, use the following procedure to create the bootable device within the console:

1. Show all wwid

wwidmgr -show wwid

```
P00>wwidmgr -show wwid
[0] UDI D: 176 WWI D: 01000010: 6006-0e80-0350-6200-0009-0010-5062-00b0 (ev: none)
[1] UDI D: 177 WWI D: 01000010: 6006-0e80-0350-6200-0009-0010-5062-00b1 (ev: none)
[2] UDI D: 178 WWI D: 01000010: 6006-0e80-0350-6200-0009-0010-5062-00b2 (ev: none)
[3] UDI D: 179 WWI D: 01000010: 6006-0e80-0350-6200-0009-0010-5062-00b3 (ev: none)
[4] UDI D: 180 WWI D: 01000010: 6006-0e80-0350-6200-0009-0010-5062-00b4 (ev: none)
[5] UDI D: 181 WWI D: 01000010: 6006-0e80-0350-6200-0009-0010-5062-00b5 (ev: none)
[6] UDI D: 182 WWI D: 01000010: 6006-0e80-0350-6200-0009-0010-5062-00b6 (ev: none)
[7] UDI D: 183 WWI D: 01000010: 6006-0e80-0350-6200-0009-0010-5062-00b7 (ev: none)
[8] UDI D: 184 WWI D: 01000010: 6006-0e80-0350-6200-0009-0010-5062-00b8 (ev: none)
[9] UDI D: 185 WWI D: 01000010: 6006-0e80-0350-6200-0009-0010-5062-00b9 (ev: none)
[10] UDI D: 186 WWI D: 01000010: 6006-0e80-0350-6200-0009-0010-5062-00ba (ev: none)
```

2. Set the disk you installed the boot file system on

wwidmgr -quickset -item 2 -unit 1

```
P00>wwidmgr -quickset -item 2 -unit 1
Disk assignment and reachability after next initialization:
6006-0e80-0350-6200-0009-0010-5062-00b2 via adapter: via fc nport: connected:
dga1.1001.0.4.1 pga0.0.0.4.1 5006-0e80-0350-6211 Yes
dgb1.1001.0.3.0 pgb0.0.0.3.0 5006-0e80-0350-6211 Yes
```

3. Initialize the system

init

```
P00>init
```

4. Show devices

show dev d

```
P00>show dev d
dga1.1001.0.4.1 $1$DGA1 HP OPEN-V 2114
dgb1.1001.0.3.0 $1$DGA1 HP OPEN-V 2114
dka0.0.0.2004.0 DKA0 COMPAQ BFO1863644 3B05
dka500.5.0.2004.0 DKA500 COMPAQ BFO1863644 3B05
dqa0.0.0.15.0 DQA0 COMPAQ CRD-8402B 1.03
dva0.0.0.1000.0 DVA0
```

The list of adapters is displayed, showing fabric topology.

5. Set the Boot default device

set bootdef_dev dga1.1001.0.4.1,dgb1.1001.0.3.0

```
P00>set bootdef_dev dga1.1001.0.4.1,dgb1.1001.0.3.0
```

6. Boot the system

boot

```
P00>boot
```

Configuring system files

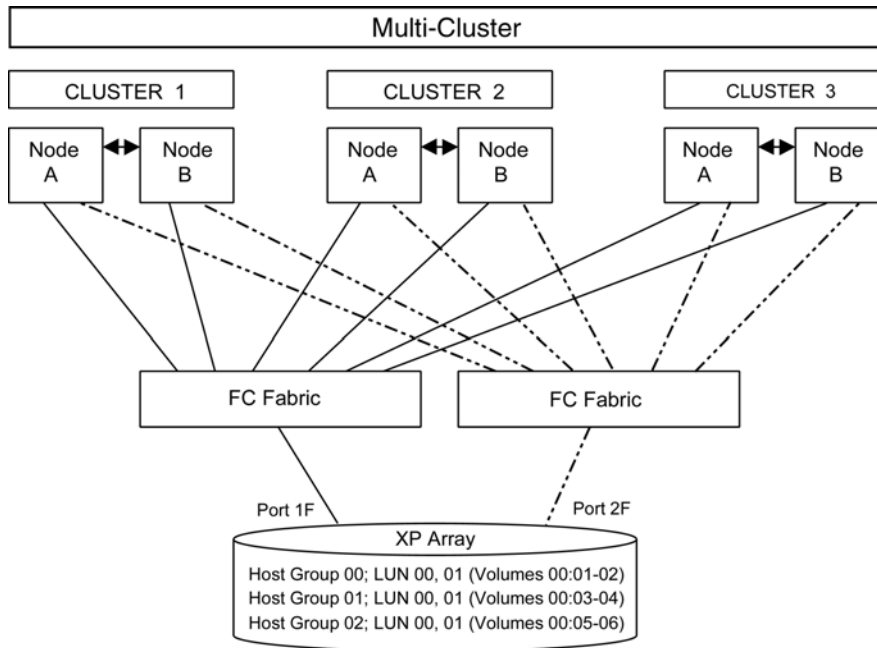
Configure the Tru64 system to recognize the HBA as explained in the Tru64 Installation Guide or New Hardware Delivery (NHD) kit. This usually consists of booting **genvmunix** and executing **doconfig** (as explained in the Installation Guide). This can also sometimes be done by editing the system kernel configuration file as explained below.

1. Use the **doconfig -c config_file** command to reconfigure the kernel, where *config_file* is usually the system name.
2. When you add a new HBA after an HBA of the same type has already been installed, a simple reboot causes the host to recognize the new HBA. No rebuilding or reconfiguration is required.

Clustering and fabric zoning

If you plan to use clustering, install and configure the clustering software on the servers.

Clustering is the organization of multiple servers into groups. Within a cluster, each server is a node. Multiple clusters compose a multi-cluster environment. The following example shows a multi-cluster environment with three clusters, each containing two nodes. The nodes share access to the disk array. In this example, the array is configured so that Host Group 00 is presented only to Cluster 1, Host Group 01 only to Cluster 2, and Host Group 02 only to Cluster 3. Always configure an array so that a host group is presented to only 1 cluster.



Within the Storage Area Network (SAN), the clusters may be homogeneous (all the same operating system) or they may be heterogeneous (mixed operating systems). How you configure LUN security and fabric zoning depends on the operating system mix and the SAN configuration.

Fabric zoning and LUN security for multiple operating systems

You can connect multiple clusters of various operating systems to the same switch and fabric using appropriate zoning and LUN security as follows:

- Heterogeneous operating systems may share an XP array port if you use Secure Manager and set the appropriate host group and mode. All others must connect to a dedicated XP array port.
- Use Secure Manager for LUN isolation when multiple hosts connect through a shared array port. Secure Manager provides LUN security by allowing you to restrict which LUNs each host can access. For detailed procedures, refer to *HP StorageWorks Secure Manager XP user guide* available at <http://www.hp.com/support/manuals>.

Environment	OS Mix	Fabric Zoning	LUN Security
Standalone SAN (non-clustered)	homogeneous (a single OS type present in the SAN)	Not required (Required with multiple nodes)	N/A
	heterogeneous (more than one OS type present in the SAN)	Not recommended	
Clustered SAN	homogeneous (a single OS type present in the SAN)	Not required (Required with multiple clusters)	Must be used when multiple cluster nodes connect through a shared port
	heterogeneous (more than one OS type present in the SAN)	Not recommended	
Multi-Cluster SAN	homogeneous (a single OS type present in the SAN)	Not required	Must be used when multiple cluster nodes connect through a shared port
	heterogeneous (more than one OS type present in the SAN)	Not recommended	

Connect the disk array

The HP service representative connects the disk array to the host by:

1. Verifying operational status of the disk array channel adapters, LDEVs, and paths.
2. Connecting the Fibre Channel cables between the disk array and the fabric switch or host.
3. Verifying the ready status of the disk array and peripherals.

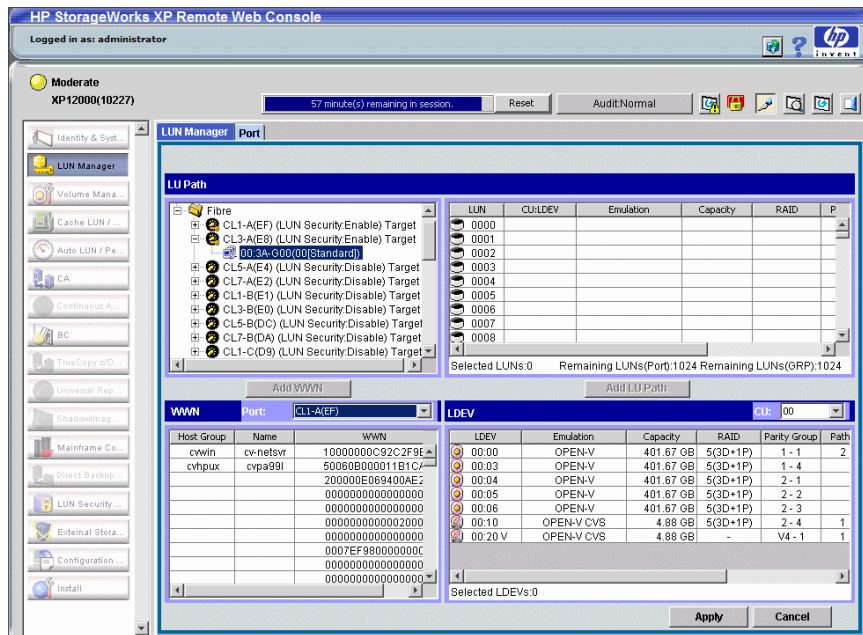
Defining the paths

Use Remote Web Console (shown), Command View, or Command View XP AE to define paths (LUNs) between hosts and volumes in the disk array.

This process is also called “LUN mapping.” In Remote Web Console and Command View, LUN mapping includes:

- Configuring ports
- Enabling LUN security on the ports
- Creating host groups
- Assigning host bus adapter WWNs to host groups
- Mapping volumes to host groups (by assigning LUNs)

The figure below shows an example of a Remote Web Console LUN Management display used to perform LUN mapping.



In Command View XP AE, LUN mapping includes:

- Configuring ports
- Creating storage groups
- Mapping volumes and WWN/host access permissions to the storage groups

For details see *HP StorageWorks LUN Configuration and Security Manager XP user guide* or *Command View XP Advanced Edition Device Manager Web Client User's Guide*. Note the LUNS and their ports, WWNs, nicknames, and LDEVs for later use in verifying host and device configuration.

Verifying host recognition of disk array devices

Use the **scu show edt** command at the UNIX prompt to see the list of new disk array devices.

The device files are created automatically in Tru64 UNIX during system startup. Device files are created for each logical unit.

1. Verify the character-type device files have been automatically created:

Example — Tru64 v5.1B

```
# file /dev/rdisk/dsk*
```

2. Verify the block-type device files have been automatically created:

Example — Tru64 v5.1B

```
# file /dev/disk/dsk*
```

Configure disk devices

Configure disks in the disk array using the same procedure for configuring any new disk on the host. This includes the following procedures:

1. [Writing the partition labels](#)
2. [Creating the file systems](#)
3. [Creating mount directories](#)
4. [Mounting the file systems](#)
5. [Verifying the file systems](#)
6. [Setting and verifying automatic mounting at bootup](#)
7. [Checking path failover](#)

Creating scripts to configure all devices at once may save you considerable time. Refer to *Tru64 UNIX System Administration* for detailed procedures.

Writing the partition labels

Use the **disklabel** command to label the partition for each logical unit. Partition **c** specifies the entire area in the logical unit. Check that no errors are found in the partition settings after the labeling.

You can edit the disk partition size using the **disklabel** command with option **-e**. When the **disklabel -e** command is executed, the **vi** editor for the environment in which you are working starts up. After completing the editing, save the file and execute the **disklabel** command again; the partition setting is renewed.

To write the partition label:

1. Enter **disklabel -rw**.

Specify the disk name.

Example — Tru64 v5.1B

```
# disklabel -rw dsk10 OPEN-3
```

2. Enter **disklabel -r** to verify labeling and partition settings.

Specify the disk name.

Example — Tru64 v5.1B

```
# disklabel -r dsk10
```

Creating the file systems

Create a file system for each new OPEN-x device. Optionally, you can create and use an advanced file system (AdvFS) to overcome the size and speed limitations of the file system. If you are not sure which file system is right for your setup, contact HP customer support.

To create a file system for each device:

```
# newfs device_file_name
```

To create an advanced file system:

You can create a new advanced file system domain, or you can add a new fileset to an existing domain. If you allocate multiple disk partitions to a domain, the advanced file system utilities must be installed.

Example

```
# addvol /dev/rzb8c domain1
```

1. Create a new domain.

```
# mkfdmn device_file_name domain_name
```

2. Create a new fileset in the new or existing advanced file system domain.

```
# mktset domain_name fileset_name
```

Creating mount directories

Create a mount directory for each device. Assign each mount directory a unique name that identifies the device being mounted.

1. Create a mount directory.

```
# mkdir /mount_directory_name
```

Example

To create a mount directory for LUN 2 (partition c) on the disk array, enter:

```
# mkdir /HP5700_LU2c
```

2. Verify the new mount directory.

Example

```
# ls /
```

Mounting the file systems

After the file systems and mount directories have been created, you can mount the file system for each new device.

To mount a Tru64 file system:

1. Mount device:

```
# mount device_file_name mount_directory
```

Example — Tru64 v5.1B

To mount device dsk10c with mount directory name HP5700_LU2c, enter:

```
# mount /dev/disk/dsk10c HP5700_LU2c
```

2. Assign the appropriate ownership and permissions:

```
# chown owner.group *device_file_name*
```

Example — Tru64 v5.1B

To assign ownership to dsk10c with owner Oracle, group dba enter:

```
# chown oracle:dba *dsk10c*
```

To mount an advanced file system:

1. Mount the file system:

```
# mount -t advfs domain_name#fileset_name mount_directory
```

Example

To mount the file system with mount directory:

```
mount -t advfs domain1#fileset1 /HP5700_LU2c
```

2. Assign the appropriate ownership and permissions:

```
# chown owner.group *device_file_name*
```

Example

To assign ownership to dsk10c with owner Oracle, group dba, enter:

```
chown oracle:dba *dsk10c*
```

Verifying the file systems

Verify that the new file systems were created correctly and are functioning properly.

1. Display all mounted file systems.

```
# df
```

The default display for drive capacity is 512-byte blocks. To view the capacity in KB rather than in 512-byte blocks, enter **df -k**.

2. Go to a new device directory:

```
# cd /mount_directory
```

Example

```
cd /HP5700_LU2c
```

- Copy a file from the root directory to the new device:

```
# cp /filename file_name.back1
```

Example

To copy file vmunix from the root directory to the HP5700_LU2c device, enter:

```
cp /vmunix vmunix.back1
```

- Copy a file to the new device again:

```
# cp /filenamefile_name.back2
```

Example

To copy the same file again, enter:

```
cp /vmunix vmunix.back2
```

- List the files in the current directory:

Example

```
# ls -l
```

The **vmunix.back1** and **vmunix.back2** files should be shown.

- Delete the files you copied:

```
# rm file_name
```

Example

To remove the file.

```
Tru64 is
```

Setting and verifying automatic mounting at bootup

The **/etc/fstab** file contains boot time mounting parameters for disk devices.

- Edit the **/etc/fstab** file after first making a backup copy of the file. Add a line for each new device to be mounted.

Example

```
#vi /etc/fstab
/dev/dsk4a / ufs rw 1 1
/proc /proc procfs rw 0 0
/dev/dsk12a /usr ufs rw 1 2
/dev/dsk12b swap1 ufs rw 0 2
/dev/dsk12c /HP5700_LU2c ufs rw 1 3
```

Example explanation:

Device	Mnt Point	File system	Options (r/w)	Backup (no=0, yes=1)	fsck order
/dev/dsk4	/	ufs	rw	1	1
/proc	/proc	procfs	rw	0	0
/dev/dsk12a	/usr	ufs	rw	1	2
/dev/dsk12b	swap1	ufs	rw	0	2
/dev/dsk12c	/HP700_LU2c	ufs	rw	1	3

Notes: For UFS systems, you must File System Check (fsck) disks that contain mount points before mounting other disks on those mount points.

2. Shut down and reboot the system.
3. Use the **df** or **df -k** command to verify file system auto mounting.

Checking path failover

The disk array supports Tru64 path failover (**Tru64 v5.1B–2 and later only**). You can connect multiple HBAs to the disk array with shared LUNs. Confirm the existence of multiple paths for devices as follows:

1. Type **hwmgr -view device** to obtain the HWID for the device.
2. Type **hwmgr -show scsi -full -id HWID** to confirm the status of paths to the device.

If more than one path is currently connected, the status of each path shows as **Valid**. If you change the cabling configuration, the old paths will show as **Stale**. Use the **hwmgr -refresh** command to remove the stale paths.

△ CAUTION:

Tru64 version 5.1B and later fully support dynamic load balancing and failover when multiple HBAs are connected to the same LUN. This feature is **ONLY** available with version 5.1B and later.

2 Troubleshooting

This section includes resolutions for various error conditions you may encounter.

If you are unable to resolve an error condition, ask your HP support representative for assistance. See [Calling the HP support center](#).

Error conditions

Depending on your system configuration, you may be able to view error messages (R-SIMS) as follows:

- In Remote Web Console (Status tab)
- In Command View (Event History or Event Notification panels)

Error Condition	Recommended Action
The logical devices are not recognized by the host.	<p>Verify that the READY indicator lights on the disk array are ON.</p> <p>Verify that fiber cables are correctly installed and firmly connected.</p> <p>Verify that the target IDs are properly configured. The LUNs for each TID must start at 0 and continue sequentially without skipping any numbers.</p> <p>Verify that the TIDs/WWNs on each bus are unique. Do not install two devices with the same ID on the same bus. Recheck the buses for new devices.</p> <p>Verify that LUSE devices are not intermixed with normal LUNs on the same port.</p> <p>Verify that the maximum number of LUSE devices per port has not been exceeded.</p> <p>Verify that the disk array host mode is set correctly.</p> <p>Verify the data in the emx_data.c file correctly maps each WWN to a TID between 0 and 7.</p>
The host does not reboot properly after hard shutdown.	If you power off the host without executing the shutdown process, wait three minutes to allow the disk array's internal timeout process to purge queued commands. If the host restarts while the disk array is processing queued commands, the host may not reboot successfully.
Physical volumes cannot be created.	Verify that the disk array logical devices are correctly formatted.
Logical volumes cannot be created.	<p>Verify that the volume capacity for OPEN-x volumes is not greater than the maximum capacity allowed. See Disk array supported emulations for capacities.</p> <p>Verify that the capacity of the volume group is not less than the total capacity of the partitioned logical volume.</p>
A file system cannot be created.	Verify that logical volume name is a character-type volume.
A file system is not mounted after rebooting.	<p>Verify that the host was restarted correctly.</p> <p>Verify that the file system attributes are correct.</p>
The disk array performs a self reboot because the disk array was busy or it logged a panic message.	Reboot the host.
The disk array responds "Not Ready" or the disk array has displayed "Not Ready" and timed out.	Contact HP.
The host detects a parity error.	<p>Check the HBA and make sure it was installed properly.</p> <p>Reboot the host.</p>
The host hangs or devices are declared and the host hangs.	Make sure there are no duplicate disk array TIDs and that disk array TIDs do not conflict with any host TIDs.

Calling the HP support center

If you are unable to resolve an error condition, contact the HP support center for assistance.

Contact Information

Telephone numbers for worldwide technical support are listed on the HP support web site:
<http://www.hp.com/support/>.

Before you call

Be sure to have the following information available:

- Technical support registration number (if applicable)
- Product serial numbers
- Product model names and numbers
- Applicable error messages
- Operating system type and revision level
- Detailed, specific questions

For continuous quality improvement, calls may be recorded or monitored.

A Path worksheet

LDEV (CU:LDEV) (CU = control unit)	Device Type	SCSI Bus Number	Path 1	Alternate Paths		
0:00				TID: LUN:	TID: LUN:	TID: LUN:
0:01				TID: LUN:	TID: LUN:	TID: LUN:
0:02				TID: LUN:	TID: LUN:	TID: LUN:
0:03				TID: LUN:	TID: LUN:	TID: LUN:
0:04				TID: LUN:	TID: LUN:	TID: LUN:
0:05				TID: LUN:	TID: LUN:	TID: LUN:
0:06				TID: LUN:	TID: LUN:	TID: LUN:
0:07				TID: LUN:	TID: LUN:	TID: LUN:
0:08				TID: LUN:	TID: LUN:	TID: LUN:
0:09				TID: LUN:	TID: LUN:	TID: LUN:
0:10				TID: LUN:	TID: LUN:	TID: LUN:
0:11				TID: LUN:	TID: LUN:	TID: LUN:
0:12				TID: LUN:	TID: LUN:	TID: LUN:
0:13				TID: LUN:	TID: LUN:	TID: LUN:
0:13				TID: LUN:	TID: LUN:	TID: LUN:
0:14				TID: LUN:	TID: LUN:	TID: LUN:
0:15				TID: LUN:	TID: LUN:	TID: LUN:
0:16				TID: LUN:	TID: LUN:	TID: LUN:
0:17				TID: LUN:	TID: LUN:	TID: LUN:

B Disk array supported emulations

This appendix provides information about supported emulations and device type specifications. Some parameters may not be relevant to your array. Consult your HP representative for information about supported configurations for your system.

Supported emulations

XP Model	OPEN Emulation Type	OPEN Emulation Supported	LUSE	CVS	LUSE & CVS
XP10000 XP12000	OPEN-3	Yes	Yes	Yes	Yes
	OPEN-8	Yes	Yes	Yes	Yes
	OPEN-9	Yes	Yes	Yes	Yes
	OPEN-E	Yes	Yes	Yes	Yes
	OPEN-K				
	OPEN-L	Yes	Yes		
	OPEN-M				
	OPEN-V	Yes	Yes		

Emulation specifications

Emulation (Note 1)	Category (Note 2)	Blocks (512 bytes)	Sector Size (bytes)	# of Cylinders	Heads	Sectors per Track	Capacity MB* (Note 3)
OPEN-3	SCSI disk	4806720	512	3338	15	96	2347
OPEN-8	SCSI disk	14351040	512	9966	15	96	7007
OPEN-9	SCSI disk	14423040	512	10016	15	96	7042
OPEN-E	SCSI disk	28452960	512	19759	15	96	13893
OPEN-L	SCSI disk	71192160	512	49439	15	96	34761
OPEN-V	SCSI disk	max=125827200	512	Note 5	15	128	Note 6
LUSE							
OPEN-3*n	SCSI disk	4806720*n	512	3338*n	15	96	2347*n
OPEN-8*n	SCSI disk	14351040*n	512	9966*n	15	96	7007*n
OPEN-9*n	SCSI disk	14423040*n	512	10016*n	15	96	7042*n
OPEN-E*n	SCSI disk	28452960*n	512	19759*n	15	96	13893*n
OPEN-L*n	SCSI disk	71192160*n	512	49439*n	15	96	34761*n
OPEN-V*n	SCSI disk	max=125827200 Note 4	512	Note 5	15	128	Note 6
CVS							
OPEN-3 CVS	SCSI disk	Note 4	512	Note 5	15	96	Note 6
OPEN-8 CVS	SCSI disk	Note 4	512	Note 5	15	96	Note 6
OPEN-9 CVS	SCSI disk	Note 4	512	Note 5	15	96	Note 6
OPEN-E CVS	SCSI disk	Note 4	512	Note 5	15	96	Note 6
CVS LUSE							
OPEN-3*n CVS	SCSI disk	Note 4	512	Note 5	15	96	Note 6
OPEN-8*n CVS	SCSI disk	Note 4	512	Note 5	15	96	Note 6
OPEN-9*n CVS	SCSI disk	Note 4	512	Note 5	15	96	Note 6
OPEN-E*n CVS	SCSI disk	Note 4	512	Note 5	15	96	Note 6
OPEN-V*n	SCSI disk	Note 4	512	Note 5	15	128	Note 6

*Capacity = (512 x number of blocks) ÷ 1024²

Note 1:

The availability of an emulation depends on the disk array.

Note 2:

The devices are defined to the host as SCSI disk devices, even though the interface is Fibre Channel.

Note 3:

The device capacity can sometimes be changed by the BIOS or host adapter board. This may make actual capacity different from that listed in the table.

Note 4:

The number of blocks for a CVS volume is calculated as follows:

$\# \text{ of blocks} = (\# \text{ of cylinders}) \times (\# \text{ of heads}) \times (\# \text{ of sectors per track})$

Example

```
For an OPEN-3 CVS volume with capacity = 37 MB:  
# of blocks = (53 cylinders-see Note 5) × (15 heads) ×  
(96 sectors per track) = 76320
```

Example

```
For an OPEN-V CVS volume with capacity = 49 MB:  
# of blocks = (53 cylinders-see Note 5) × (15 heads) ×  
(128 sectors per track) = 101760
```

Note 5:

The number of cylinders for a CVS volume is calculated as follows ($\uparrow \dots \uparrow$ means that the value should be rounded up to the next integer):

OPEN-3/8/9/E: The number of cylinders for a CVS volume = $\# \text{ of cylinders} = \uparrow (\text{capacity (MB) specified by user}) \times 1024/720 \uparrow$

Example

```
For an OPEN-3 CVS volume with capacity = 37 MB:  
# of cylinders =  $\uparrow 37 \times 1024/720 \uparrow = \uparrow 52.62 \uparrow$   
(rounded up to next integer) = 53 cylinders
```

OPEN-V: The number of cylinders for a CVS volume = $\# \text{ of cylinders} = \uparrow (\text{capacity (MB) specified by user}) \times 16/15 \uparrow$

Example

```
For an OPEN-V CVS volume with capacity = 49 MB:  
# of cylinders =  $\uparrow 49 \times 16/15 \uparrow = \uparrow 52.26 \uparrow$   
(rounded up to next integer) = 53 cylinders
```

OPEN-3/8/9/E: The number of cylinders for a CVS LUSE volume = $\# \text{ of cylinders} = \uparrow (\text{capacity (MB) specified by user}) \times 1024/720 \uparrow \times n$

Example

```
For a CVS LUSE volume with capacity = 37 MB and n = 4:  
# of cylinders =  $\uparrow 37 \times 1024/720 \uparrow \times 4 = \uparrow 52.62 \uparrow \times 4 = 53 \times 4 = 212$ 
```

OPEN-V: The number of cylinders for a CVS LUSE volume = $\# \text{ of cylinders} = \uparrow (\text{capacity (MB) specified by user}) \times 16/15 \uparrow \times n$

Example

```
For an OPEN-V CVS LUSE volume with capacity = 49 MB and n = 4:  
# of cylinders =  $\uparrow 49 \times 16/15 \uparrow \times 4 = \uparrow 52.26 \uparrow \times 4 = 53 \times 4 = 212$ 
```

Note 6:

The capacity of an OPEN-3/8/9/E CVS volume is specified in MB, not number of cylinders. The capacity of an OPEN-V CVS volume can be specified in MB or number of cylinders. You set the volume size using Remote Web Console, Command View or Command View XP Advanced Edition.

Glossary

array group	A group of 4 or 8 physical hard disk drives (HDDs) installed in an XP disk array and assigned a common RAID level. RAID1 array groups consist of 4 (2D+2D) or 8 HDDs (4D+4D). RAID5 array groups include a parity disk but also consist of 4 (3D+1P) or 8 HDDs (7D+1P). All RAID6 array groups are made up of 8 HDDs (6D+2P).
BC	HP StorageWorks Business Copy XP. BC lets you maintain up to nine local copies of logical volumes on the disk array.
CA	HP StorageWorks Continuous Access XP. CA lets you create and maintain duplicate copies of local logical volumes on a remote disk array.
CHA	Channel Adapter: Front end PCBs in XP arrays responsible for communication to other devices, typically HOSTs, though they are also involved in data exchange with external storage.
Command View (CVXP)	HP StorageWorks Command View XP, a software product for managing XP arrays. Command View runs on a Windows-based management workstation.
Command View XP Advanced Edition (CVXP AE)	HP StorageWorks Command View XP Advanced Edition, installs on the user-provided Device Manager server and provides a browser-based platform from which you can manage the XP family of disk arrays—even globally distributed arrays.
command device	A volume on the disk array that accepts Continuous Access or Business Copy control operations which are then executed by the disk array.
CU	Control Unit. Contains LDEVs and is approximately equivalent to SCSI Target ID.
CVS	Custom volume size. CVS devices (OPEN-x CVS) are custom volumes configured using array management software to be smaller than normal fixed-size OPEN system volumes. Synonymous with volume size customization (VSC).
DKC	The array cabinet that houses the channel adapters and service processor (SVP).
DKU (disk cabinet unit)	The array cabinets that house the disk array physical disks.
emulation modes	The logical devices (LDEVs) associated with each RAID group are assigned an emulation mode that makes them operate like OPEN system disk drives. The emulation mode determines the size of an LDEV: OPEN-3: 2.46 GB OPEN-8: 7.38 GB OPEN-9: 7.42 GB OPEN-E: 13.56 GB OPEN-L: 36 GB OPEN-V: User-defined custom size
failover	Disconnecting a failed unit or path and replacing it with an alternative unit or path in order to continue functioning.
FC	Fibre Channel.
FC-AL	Fibre Channel arbitrated loop.
FCP	Fibre Channel Protocol.
GB	Gigabytes.

HBA	Host bus adapter.
host mode	Each port can be configured for a particular host type. These modes are represented as two-digit hexadecimal numbers. For example, host mode 08 represents an HP-UX host.
LDEV	Logical device. An LDEV is created when a RAID group is carved into pieces according to the selected host emulation mode (that is, OPEN-3, OPEN-8, OPEN-L). The number of resulting LDEVs depends on the selected emulation mode. The term LDEV is often used synonymously with the term volume.
LUN	Logical unit number. A LUN results from mapping a SCSI logical unit number, port ID, and LDEV ID to a RAID group. The size of the LUN is determined by the emulation mode of the LDEV and the number of LDEVs associated with the LUN. For example, a LUN associated with two OPEN-3 LDEVs has a size of 4,693 MB.
LUSE	A LUN is normally associated with only a single LDEV. The LUSE feature allows a LUN to be associated with 1 to 36 LDEVs. Essentially, LUSE makes it possible for applications to access a single large pool of storage. The LUSE feature is available when the HP StorageWorks LUN Configuration Manager product is installed.
OFC	Open Fibre Control.
OPEN-x	A general term describing any one of the supported OPEN emulation modes (for example, OPEN-L).
OS	Operating system.
PA	Physical address.
path	Paths are created by associating a port, a target, and a LUN ID with one or more LDEVs.
port	A physical connection that allows data to pass between a host and the disk array. The number of ports on an XP disk array depends on the number of supported I/O slots and the number of ports available per I/O adapter. The XP family of disk arrays supports Fibre Channel (FC) ports as well as other port types. Ports are named by port group and port letter, such as CL1-A. CL1 is the group, and A is the port letter.
RAID	Redundant array of independent disks.
remote console PC	The PC running HP StorageWorks Remote Control XP.
Remote Web Console (RWC)	HP StorageWorks XP Remote Web Console. A browser-based program installed on the SVP that allows you to configure and manage the disk array.
R-SIM	Remote service information message.
SCSI	Small computer system interface.
SIM	Service information message.
SNMP	Simple Network Management Protocol.
SVP	Service processor, which is the PC built into the disk controller. The SVP provides a direct interface into the disk array. SVP use is reserved for HP support representatives only.
TB	Terabyte.
TID	Target ID.
Volume	On the XP array, a volume is a uniquely identified virtual storage device composed of a control unit (CU) component and a logical device (LDEV)

component separated by a colon. For example 00:00 and 01:00 are two uniquely identified volumes; one is identified as CU = 00 and LDEV = 00, and the other as CU = 01 and LDEV = 00; they are two unique separate virtual storage devices within the XP array.

VSC

Volume size customization. Synonymous with CVS.

WWN

World Wide Name. A unique identifier assigned to a Fibre Channel device.

Index

A

advanced file system (AdvFS), 22
arbitrated-loop physical address, 15
audience, 5
Auto LUN XP, 9
automatic mounting, 24

B

Business Copy XP, 9, 11

C

Cache LUN XP, 9
clustering, 18, 19
command device(s)
 designate at least one LDEV as a, 11
 RAID Manager, 11
Command View, 9, 11, 13, 15, 20
Command View XP Advanced Edition, 9, 13, 15, 20
configuration
 device, 21
 emulation types, 10
 Fibre Channel ports, 15
 HBAs, 16
 host, 16
 host mode, setting, 14
 port, 15
 system files, 18
console commands
 df, 23
 mkfset, 22
 mount, 23
Continuous Access Extension XP, 9
Continuous Access XP, 9, 11
conventions
 document, 6
 text symbols, 6

D

Data Exchange XP, 9
device(s)
 automatic mounting, 24
 configuration, 21
 emulation types, 10
 logical, not recognized by host, 28
 mount file system, 23
 recognition, 21
 type specifications, 34
 verifying, 21

directories, mount, 22
disk array(s)
 connecting, 19
 features, 9
 installation, 13
 installation overview, 12
 Not Ready error message, 28
 operating system versions, 9
 self reboots, 28
 server support, 9
 system requirements, 9
disk partition(s)
 allocate multiple, 22
 change size, 21
document
 conventions, 6
 related documentation, 5
documentation
 HP web site, 5
 providing feedback, 7

E

emulation(s)
 device emulation types, 10
 supported, 34
error conditions, 27
External Storage XP, 9

F

fabric environment
 parameter settings, 16
 port addresses, 15
 zoning, 18, 19
failover, 10
 checking, 25
fiber parameter settings, 16
Fibre Channel
 connection speed, 10
 interface, 10
 parameter settings, 16
 ports, configuring, 15
 supported elements, 10
 topology example, 16
file system(s)
 advanced (AdvFS), 22, 23
 cannot be created, 28
 creating, 22
 mounting, 23
 not mounted after rebooting, 28
 verify installation, 23

H

- HBA(s)
 - configuring, 16
 - supported, 16
- HBA(s) card, verify installation, 17
- help
 - obtaining, 7
- host
 - configuration, 16
 - doesn't reboot properly, 28
 - hangs up, 28
- host bus adapters, see "HBAs", 9
- host mode, setting, 14
- HP
 - technical support, 7, 29

I

- installation, 9
 - connecting disk array, 19
 - disk array, 13
 - overview, 12
 - verify file system, 23
 - verify HBA card, 17
- interface, Fibre Channel, 10

L

- LDEV(s)
 - designate at least one as a command device, 11
- logical volumes, cannot be created, 28
- LUN Configuration and Security Manager XP, 9, 13, 20
- LUN(s)
 - creating, 20
 - mapping, 20
- LUN(s), security, 18, 19

M

- mount directories, creating, 22
- multi-cluster environment, 18

O

- operating system(s)
 - loading, 16
 - LUN security for, 19
 - multiple, fabric zoning for, 19
 - supported versions, 9

P

- parity error, 28
- partition labels, 21
- path(s)
 - defining, 20
 - worksheet, 31

- physical volumes, cannot be created, 28
- port(s)
 - address, 15
 - Fibre Channel, 15
 - host mode, setting, 14

R

- R-SIMS, 27
- RAID Manager command devices, 11
- RAID Manager XP, 9
- related documentation, 5
- Remote Web Console, 9, 11, 13, 15, 20
- Resource Manager XP, 9

S

- SCSI disk, Fibre Channel interface and term "SCSI disk", 10
- Secure Manager XP, 19
- security, LUN, 18, 19
- server, support, 9
- SNMP configuration, 11
- software, optional, 9
- Subscriber's Choice, HP, 7
- symbols in text, 6
- system file(s)
 - configuring, 18
- System Option Mode, 15

T

- technical support, 29
 - HP, 7
 - service locator web site, 7
- text symbols, 6
- topology, fabric, 16
- troubleshooting, 27
 - error conditions, 27
 - technical support, 29

V

- volume(s)
 - logical, cannot be created, 28
 - physical, cannot be created, 28

W

- web sites
 - HP, 7
 - HP Subscriber's Choice for Business, 7
 - product manuals, 5
- worksheet, path, 31

X

- XP family
 - optional software, 9

Z

zoning, fabric, [18](#), [19](#)