



**Hewlett Packard
Enterprise**

StoreEver LTO-8 Ultrium Tape Drives

Technical Reference Manual Volume 5: UNIX, Linux, and OpenVMS Configuration Guide

Abstract

This document provides basic information on configuring the StoreEver LTO-8 Ultrium Tape Drives (Fibre Channel and SAS) with UNIX, Linux, and OpenVMS operating systems. This document is for system administrators and others who need to configure the tape drive for use with operating systems other than Windows.

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Contents

Introduction.....	5
LTO Ultrium drives in a library.....	5
Backup applications.....	5
 HP-UX servers.....	 6
Identifying connected devices.....	6
For HP-UX 11i v3 (legacy format).....	6
For HP-UX 11i v3 (Agile I/O tree format).....	8
Adding device files.....	9
For HP-UX 11i v3 (11.31).....	9
Using large block sizes.....	11
What next?.....	11
 OpenVMS servers and workstations	 12
Determining attached devices.....	12
What next?.....	12
 Linux servers and workstations.....	 13
Ensure that the correct HBA and driver are installed.....	13
Verify that the driver modules are loaded in the kernel.....	13
Determining the attached devices.....	14
Using the seek and tell features of mt.....	15
What next?.....	15
 IBM (AIX) servers and workstations.....	 16
Installing and configuring the Atape driver.....	16
Configuring the tape drive.....	17
Deconfiguring tape drives.....	18
Uninstalling the Atape driver.....	18
What next?.....	18
 Oracle (Solaris) servers and workstations.....	 19
Fibre Channel drives.....	19
Configuring the device files.....	19
SAS drives.....	19
Identifying attached devices.....	19
Kernel patch levels.....	20
HPE-data values.....	21
 Verifying the installation.....	 24
To verify the installation:.....	24
Example.....	25

Support and other resources.....	27
Accessing Hewlett Packard Enterprise Support.....	27
Accessing updates.....	27
Customer self repair.....	28
Remote support.....	28
Warranty information.....	28
Regulatory information.....	29
Documentation feedback.....	29
 Glossary	 30

Introduction

The LTO-8 tape drive is supported on the following platforms:

- HP-UX servers
- Hewlett Packard Enterprise (OpenVMS) servers and workstations
- Linux servers and workstations
- IBM (AIX) servers and workstations
- Oracle (Solaris) servers and workstations
- Microsoft Windows. For configuration information, see the *HPE StoreEver LTO-8 Ultrium 30750 SAS Tape Drive User Guide*.

For versions of the OS supported, and additional OS support that might have been added since the publication of this document, see the Data Availability, Protection, and Retention Compatibility Matrix website at: <http://hpe.com/storage/DAPRcompatibility>.

For information on how to verify the installation, see [Verifying the installation](#).

LTO Ultrium drives in a library

For instructions about installing device drivers for tape libraries and autoloaders, see the tape library or autoloader user guide.

Backup applications

For optimum performance, it is important to use a backup application that supports the drive's features within your system's configuration.

For details of which backup applications are supported with your tape drive and system, see the *Data Agile BURA Compatibility Matrix* at:

<http://www.hpe.com/storage/buracompatibility>

HP-UX servers

For supported versions of HP-UX, see the HPE Data Availability, Protection, and Retention Compatibility Matrix at: <http://hpe.com/storage/DAPRcompatibility>

Before you install your tape drive, visit the HPE website www.hpe.com and download the latest hardware enablement (HWE) patch bundle for your operating system (1603 HWE or later update release of 11i v3). Installing the latest bundle ensures that you have the correct device driver for your tape drive.

System Administration Management (SAM) tools have evolved with ongoing HP-UX version releases. As a result, the procedures for setting up with different HP-UX versions differ. They are described separately in this chapter.

HP-UX 11i v3 and agile addressing

HP-UX 11i v3 introduces **agile addressing** of devices. Agile addressing uses a different format of the device special file (dsf) to represent the tape drive — known as a **persistent dsf**. However, HP-UX 11i v3 retains support for the legacy dsf format as used in 11i v2.

For more information about HP-UX releases including HP-UX 11i v3, refer to <http://www.hpe.com/support/manuals>.

Identifying connected devices

Scan the system to list the existing devices attached. From a shell window (hpterm/xterm), execute `ioscan` as follows:

For HP-UX 11i v3 (legacy format)

Enter the command:

```
% ioscan -f
```

The output will look similar to the following (which shows a Fibre Channel drive). SAS drives have a similar output in a slightly different format.

Class	I	H/W Path	Driver	S/W State	H/W Type	
Description						
====						
====						
root	0		root	CLAIMED	BUS_NEXUS	
ioa	0 0		sba	CLAIMED	BUS_NEXUS	
System Bus Adapter (4030)						
ba	0 0/0		lba	CLAIMED	BUS_NEXUS	Local
PCI-X Bus Adapter (122e)						
tty	0 0/0/1/0		rmp3f01	CLAIMED	INTERFACE	PCI
class(255,0) (103c1303)						
tty	1 0/0/1/1		rmp3f01	CLAIMED	INTERFACE	PCI
SimpleComm (103c1302)						
tty	2 0/0/1/2		asio0	CLAIMED	INTERFACE	PCI
Serial (103c1048)						
usb	0 0/0/2/0		hcd	CLAIMED	INTERFACE	NEC
OHCI Controller						
usbcomp	0 0/0/2/0.1		usbcomposite	CLAIMED	DEVICE	USB
Composite Device						
usbhid	0 0/0/2/0.1.0		hid	CLAIMED	DEVICE	USB
HID Kbd(0)						

usbhid	1	0/0/2/0.1.1	hid	CLAIMED	DEVICE	USB
HID Pointer(1)						
usbcomp	1	0/0/2/0.3	usbcomposite	CLAIMED	DEVICE	USB
Composite Device						
usbhid	2	0/0/2/0.3.0	hid	CLAIMED	DEVICE	USB
HID Kbd(2)						
usbhid	3	0/0/2/0.3.1	hid	CLAIMED	DEVICE	USB
HID Mouse(3)						
usb	1	0/0/2/1	hcd	CLAIMED	INTERFACE	NEC
OHCI Controller						
usb	2	0/0/2/2	ehci	CLAIMED	INTERFACE	NEC
EHCI Controller						
usbms	0	0/0/2/2.2	ms	CLAIMED	DEVICE	USB
Mass Storage [0]						
graphics	0	0/0/3/0	gvid_core	CLAIMED	INTERFACE	PCI
Display (1002515e)						
ba	1	0/1	lba	CLAIMED	BUS_NEXUS	Local
PCI-X Bus Adapter (122e)						
escsi_ctlr	0	0/1/1/0	sasd	CLAIMED	INTERFACE	HP
PCI/PCI-X SAS MPT Adapter						
lan	0	0/1/2/0	igelan	CLAIMED	INTERFACE	HP
PCI-X 1000Base-T Dual-port Built-in						
lan	1	0/1/2/1	igelan	CLAIMED	INTERFACE	HP
PCI-X 1000Base-T Dual-port Built-in						
ba	2	0/2	gh2p	CLAIMED	BUS_NEXUS	Local
Bus Adapter						
ba	3	0/2/0/0	PCIttoPCI	CLAIMED	BUS_NEXUS	
PCIttoPCI Bridge						
slot	0	0/2/0/0/0	pci_slot	CLAIMED	SLOT	PCI
Slot						
fc	0	0/2/0/0/0/0	fcd	CLAIMED	INTERFACE	HP
AH401A 8Gb Dual Port PCIe Fibre Channel Adapter (FC Port 1)						
fcp	8	0/2/0/0/0/0.1	fcd_fcp	CLAIMED	INTERFACE	FCP
Domain						
ext_bus	24	0/2/0/0/0/0.1.36.255.0	fcd_vbus	CLAIMED		
INTERFACE FCP Device Interface						
target	2	0/2/0/0/0/0.1.36.255.0.0	tgt	CLAIMED	DEVICE	
tape	27	0/2/0/0/0/0.1.36.255.0.0.0	stape	CLAIMED		
DEVICE HP Ultrium 8-SCSI						
fc	1	0/2/0/0/0/1	fcd	CLAIMED	INTERFACE	HP
AH401A 8Gb Dual Port PCIe Fibre Channel Adapter (FC Port 2)						
ba	4	0/3	gh2p	CLAIMED	BUS_NEXUS	Local
Bus Adapter						
ba	5	0/3/0/0	PCIttoPCI	CLAIMED	BUS_NEXUS	
PCIttoPCI Bridge						
slot	1	0/3/0/0/0	pci_slot	CLAIMED	SLOT	PCI
Slot						
ext_bus	0	0/3/0/0/0/0	ciss	CLAIMED	INTERFACE	PCIe
SAS SmartArray P400 RAID Controller						
target	0	0/3/0/0/0/0.0	tgt	CLAIMED	DEVICE	
disk	2	0/3/0/0/0/0.0.0	sdisk	CLAIMED		
DEVICE HP LOGICAL VOLUME						
ba	6	0/4	lba	CLAIMED	BUS_NEXUS	Local
PCI-X Bus Adapter (12ee)						
slot	2	0/4/1	pci_slot	CLAIMED	SLOT	PCI
Slot						
ba	7	0/5	gh2p	CLAIMED	BUS_NEXUS	Local

```

Bus Adapter
ba      8  0/5/0/0      PCItPCI      CLAIMED      BUS_NEXUS
PCItPCI Bridge
slot    3  0/5/0/0/0    pci_slot     CLAIMED      SLOT          PCI
Slot
processor 0  120      processor    CLAIMED      PROCESSOR
Processor
processor 1  122      processor    CLAIMED      PROCESSOR
Processor
ba      9  250      pdh          CLAIMED      BUS_NEXUS      Core
I/O Adapter
ipmi    0  250/0      ipmi         CLAIMED      INTERFACE      IPMI
Controller
tty     3  250/1      asio0        CLAIMED      INTERFACE      Built-
in RS232C
acpi_node 0  250/2      acpi_node    CLAIMED      INTERFACE      Acpi
Hardware
usbmsvbus 1  255/1      mass_storage CLAIMED      VIRTBUS        USB
Mass Storage
ext_bus  3  255/1/0      usb_ms_scsi  CLAIMED      INTERFACE      USB
Mass Storage SCSI
target   1  255/1/0.0      tgt          CLAIMED      DEVICE
disk     0  255/1/0.0.0    sdisk        CLAIMED      DEVICE
TEAC     DV-28E-N

```

For HP-UX 11i v3 (Agile I/O tree format)

Enter the command:

```
% ioscan -m lun
```

The output will look similar to the following¹, which includes an LTO-8 Fibre Channel drive. SAS tape drives have a similar format:

```

Class      I  Lun H/W Path  Driver  S/W State  H/W Type  Health  Description
=====
ctl        0  64000/0xfa00/0x0      esctl   CLAIMED    DEVICE    online  HP      P400
          0/3/0/0/0/0.0x0.0x0
          /dev/pt/pt0
disk       3  64000/0xfa00/0x1      esdisk  CLAIMED    DEVICE    online  HP      LOGICAL VOLUME
          0/3/0/0/0/0.0x0.0x4000000000000000
          /dev/disk/disk3      /dev/rdisk/disk3
          /dev/disk/disk3_p1    /dev/rdisk/disk3_p1
          /dev/disk/disk3_p2    /dev/rdisk/disk3_p2
          /dev/disk/disk3_p3    /dev/rdisk/disk3_p3
disk       4  64000/0xfa00/0x5      esdisk  CLAIMED    DEVICE    online  TEAC    DV-28E-N
          64000/0x0/0x0.0x0.0x0
          /dev/disk/disk4      /dev/rdisk/disk4
tape       28  64000/0xfa00/0x9b      estape  CLAIMED    DEVICE    online  HPE     Ultrium 8-SCSI
          0/2/0/0/0/0.0x500507631251d31f.0x0
          /dev/rtape/tape28_BEST  /dev/rtape/tape28_BESTn
          /dev/rtape/tape28_BESTb /dev/rtape/tape28_BESTnb

```

For a given SAS device, the SAS address can be obtained from the Lun H/W Path. For example:

¹ Device files (such as /dev/rtape/tape9_BEST) may or may not be in place initially.

The `lunpath` hardware path for the previous tape drive is
“0/2/0/0/0/0.0x500110a0013091b8.0x0”.

The SAS bus ID is “0/2/0/0/0/0” (including all the numbers separated by “/”).

From the remaining “0x500110a0013091b8.0x0” portion:

- Tape drive SAS address (hexadecimal) = 0x500110a0013091b8
- Tape drive SCSI LUN = 0x0 (hexadecimal SCSI-3 64-bit LUN identifier)

Similarly, for a given FC device the FC bus ID, the World Wide Name (WWN) and the LUN ID can be decoded from the Lun H/W Path. For example:

If the `lunpath` hardware path for a given tape drive is “0/4/1/0.0x50060b0000b7f3c8.0x0”.

The FC bus ID is “0/4/1/0” (including all the numbers separated by “/”).

From the remaining “0x50060b0000b7f3c8.0x0” portion:

- Tape drive WWN (hexadecimal) = 0x50060b0000b7f3c8
- Tape drive SCSI LUN = 0x0 (hexadecimal SCSI-3 64-bit LUN identifier)

Adding device files

For HP-UX 11i v3 (11.31)

1. Start up the SMH web-based interface:

```
% smh -w
```

It will attempt to launch a web browser. Mozilla browser² is the default when HP-UX 11i v3 is installed.

2. From the SMH Tools page, select Manage Peripheral Devices from the Peripheral Devices section.

² If Mozilla is being invoked for the first time, you may be asked to agree to license terms for the software.

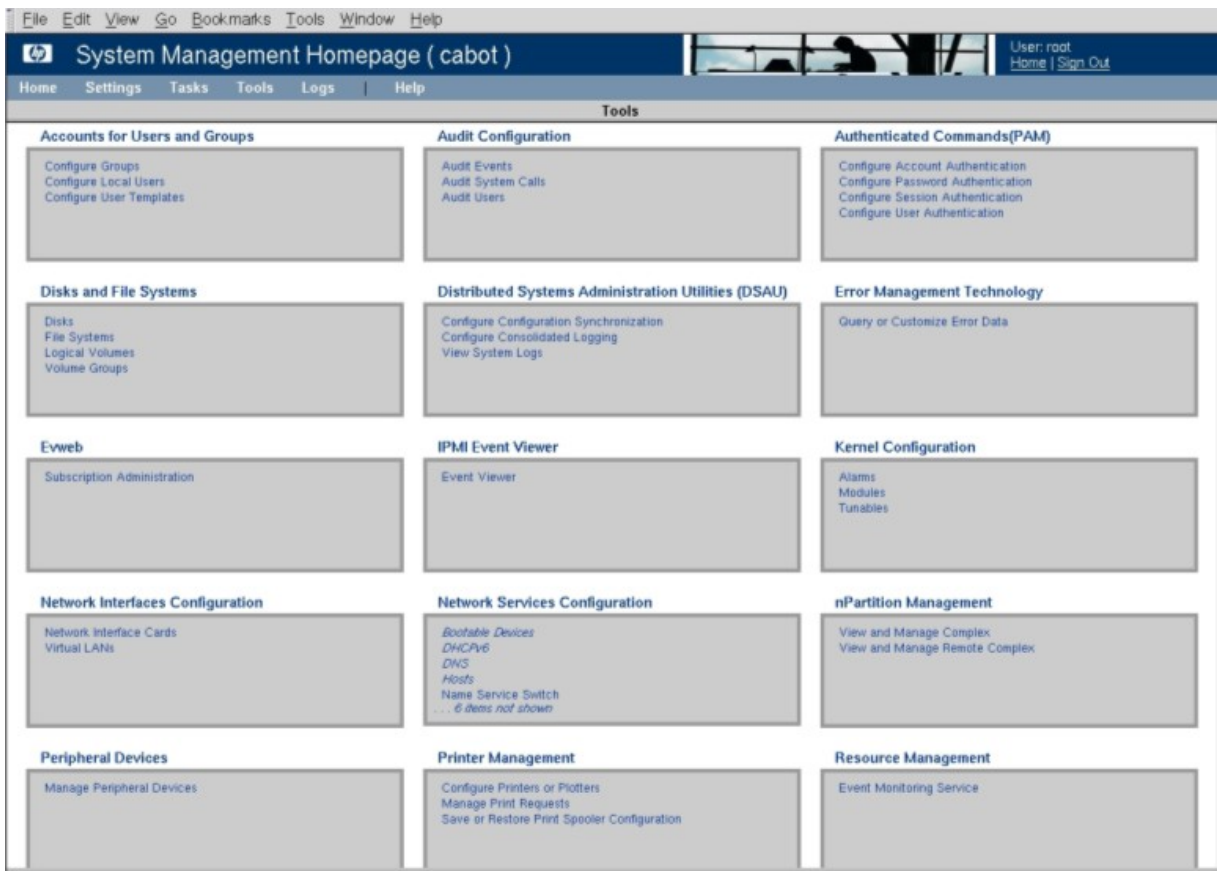


Figure 1: SMH web-based interface (HP-UX 11i v3)

3. Select tape from the **Class** drop-down box on the HP-UX Peripheral Device Tool page. Select the tape device (radio button) requiring device files from the resulting list. If device files are not already present, it will be indicated under the Properties header (see [Figure 2: Selecting a tape device to create its device files \(Agile View\)](#) on page 10)³.

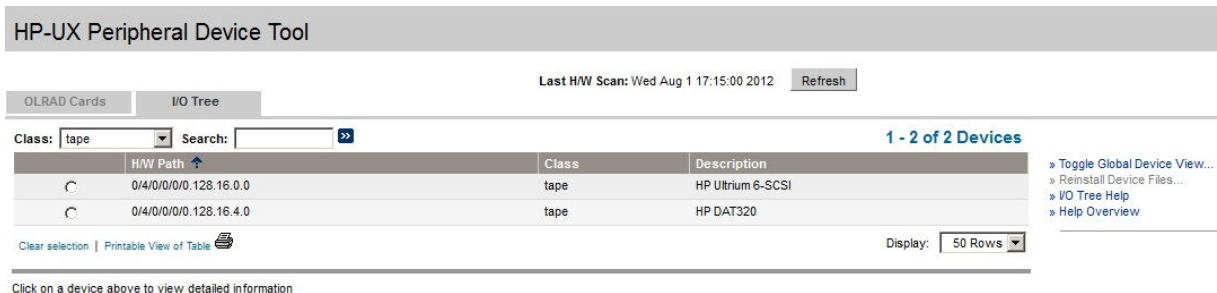


Figure 2: Selecting a tape device to create its device files (Agile View)

4. From the right-hand panel on the HP-UX Peripheral Device Tool page, click **Reinstall Device Files**. At the next page, click the **Reinstall** button. When the browser returns to the HP-UX Peripheral Device Tool page, click the **Refresh** button one or more times until the list of device files appears under the Properties header.

³ Depending on how SMH was last used, the HP-UX Peripheral Device Tool page will display either the **Agile View** or the **Legacy View** as described at the beginning of this chapter. To switch between these views, use the **Toggle Global Device View** link on the right-hand side of the HP-UX Peripheral Device Tool page. In this chapter, the Agile View is assumed. The process is similar for the Legacy View.

Using large block sizes

HP-UX versions prior to 11i v3 were restricted to using block sizes no greater than 256 KB when communicating with tape devices. This restriction no longer exists in HP-UX 11i v3, although limitations may be imposed by other system components. For additional information, refer to the `scsimgr_estape(7)` man page.

What next?

Once device files have been created, you will confirm that your new tape drive is working properly.

Verifying the installation on page 24 provides instructions on backing up and restoring a sample file to test your installation.

OpenVMS servers and workstations

Determining attached devices

After connecting the tape drive to your system, boot OpenVMS and check for the presence of the new tape device. Execute the following commands.

```
$mc sysman io find
$mc sysman io auto
```

```
$ sho dev mg
```

Device Name	Device Status	Error Count	Volume Label	Free Blocks	Trans Count	Mnt Cnt
\$2\$MGA4:	Online	0				

^use this value in the next command line

```
$ sho dev $2$MGA4:/full
```

Magtape \$2\$MGA4: device type HPE Ultrium 8-SCSI, is online, file-oriented device, available to cluster, error logging is enabled, controller supports compaction (compaction disabled), device supports fastskip (per_io).

Error count	0	Operations completed	0
Owner process	""	Owner UIC	[SYSTEM]
Owner process ID	00000000	Dev Prot	S:RWPL,O:RWPL,G:R,W
Reference count	0	Default buffer size	2048
Density	default	Format	Normal-11

Volume status: no-unload on dismount, beginning-of-tape, odd parity.

What next?

You are now ready to begin using your tape drive. Consult your OpenVMS system documentation for details.

Linux servers and workstations



TIP:

When possible, do the original install of the Linux operating system with the tape drive attached to the SAS port, so that the `st` driver is loaded with the kernel during boot up. Otherwise, see the guidelines in this chapter for when the operating system was already installed without the tape drive.

Ensure that the correct HBA and driver are installed

NOTE:

Be sure to update the drivers, even if the in-box driver provided during installation supports the tape drives. Updates sometimes contain defect fixes and often contain improved support.

For details of supported Linux versions and SAS HBA controllers, see the HPE Data Availability, Protection, and Retention Compatibility Matrix at: <http://hpe.com/storage/DAPRcompatibility>.

Download and install the latest controller driver from the manufacturer's website – for example, for an HPE-branded HBA, visit www.hpe.com to download the latest driver.

More recent Linux distributions on later generations of ProLiant servers might use a different HBA driver than earlier counterparts. For additional information, see the HBA documentation or Service Pack for ProLiant (SPP) documentation.

Verify that the driver modules are loaded in the kernel

The operating system must have drivers loaded for both the tape drive and the HBA to communicate with a tape device. Ensure that both are available as either loadable modules (for example, usable with `insmod` and visible with `lsmod`) or are statically built into your kernel.

NOTE:

To add drivers to the statically built kernel, you need the Linux source code available on disk and knowledge of how to use the kernel building tools that ship with various Linux distributions. It must not be attempted by novice users.

The following guidelines assume the use of loadable driver modules.

To list all driver modules currently loaded in the kernel, run the `lsmod` command. Check whether the `st` driver for tape is listed and also whether the relevant HBA driver is listed.

```
lsmod
```

For example, the `st` driver for tape listing would resemble the entry shown following. Also shown are three examples of HBA drivers—`cciss` and `hpsa` drivers (for SmartArray SAS HBAs), and `mptsas` driver (for LSI SAS HBA):

Module	Size	Used by
<code>st</code>	38749	0
.		
.		
<code>cciss</code>	68484	3
.		
.		
<code>mptsas</code>	37321	0

```
.  
.
hpsa          47277      2
```

If a particular driver module is not listed as above, use the `modprobe` utility to load it. For example if the `st` driver is missing, execute:

```
modprobe st
```

NOTE:

If your system is rebooted after attaching the drive, loading of the `st` driver will happen naturally. If the `st` driver does not load automatically, confirm that it has not been blacklisted.

Determining the attached devices

HBAs that use the `cciss` driver might require an explicit scan procedure to allow the attached tape drive to be discovered after each reboot. Execute the following from the command line (or from a shell script):

```
for x in /proc/driver*/cciss/c*;do echo engage scsi > $x; done; dmesg
```

HBAs that use the `hpsa` driver may also require an explicit scan procedure to allow the attached tape drive to be discovered after each reboot; execute the following from the command line (or from a shell script):

```
for x in /sys/class/scsi_host/host*/rescan; do echo 1 > $x; done
```

To determine whether the system discovered the tape drive at module load time, check the contents of the file `/proc/scsi/scsi`:

```
cat /proc/scsi/scsi
```

Examine the contents for something like:

```
Host: SCSI0 Channel: 00 Id:00 Lun:00
Vendor: HPE Model: Ultrium 8-SCSI Rev: xxxx
Type: Sequential-Access ANSI SCSI Revision 06
```

To discover which tape drive instance is used (`st0` in the following example), look through the output of `dmesg`, and to review the SCSI HBA driver (`cciss` in the extract following).

NOTE:

The exact format and style of the listing might vary with different Linux distributions and versions.

**TIP:**

You may prefer to redirect a lengthy `dmesg` output to a file for browsing at your convenience:

```
dmesg > my_boot_messages.txt
```

Or pipe the output of `dmesg` to a page scrolling utility:

```
dmesg | more
```

Extract from `dmesg` output:

```
.
.
scsi3 : cciss
        Vendor: HPE          Model: Ultrium 8-SCSI      Rev: xxxx
        Type:   Sequential-Access      ANSI SCSI revision: 06
scsi 3:0:0:0: Attached scsi generic sg0 type 1
```

```
st: Version 20050830, fixed bufsize 32768, s/g segs 256
st 3:0:0:0: Attached scsi tape st0
.
.
```

The tape drive instance identifies which device files are applicable to the tape drive. For example:

- `st0` indicates device files `/dev/st0` or `/dev/nst0`
- `st1` indicates device files `/dev/st1` or `/dev/nst1`

And so on...

Tape device files are created automatically when the `st` driver module and the correct HBA driver have been added. They reside in the `/dev` directory and have the syntax:

```
/dev/stp or dev/nstp
```

Where:

- `p` is the instance number of the device file (if only one drive is connected to the system, it will be 0)
- `n` indicates it is a no-rewind driver

The following `dmesg` sample output shows the `hpsa` driver:

```
hpsa 0000:07:00.0: Sequential-Access device c4b2t0l0 added.
scsi 4:2:0:0: Sequential-Access HPE Ultrium 8-SCSI xxxx PQ: 0 ANSI: 6
scsi 4:2:0:0: Attached scsi generic sg5 type 1
st: Version 20081215, fixed bufsize 32768, s/g segs 256
st 4:2:0:0: Attached scsi tape st0
st 4:2:0:0: st0: try direct i/o: yes (alignment 4 B)
```

Using the seek and tell features of `mt`

To use the seek and tell features of `mt`, the `st` driver must be configured for logical block addressing with Ultrium drives.

With some Linux distributions, it is possible to do this using the `stsetoptions` function with `mt` utility:

```
mt -f <devicefile> stsetoptions scsi2logical
```

where `<devicefile>` is `/dev/stp` or `/dev/nstp`.

Note that information is not preserved across reboots. Execute this command each time the system comes up. Some Linux distributions include the `stinit` utility, which offers a convenient way of handling this using the `/etc/stinit.def` configuration file. The file `/etc/stinit.def` may not exist in a new installation and so may need to be created. See the examples of `stinit.def` entries in `/usr/share/doc/mt-st-<version>/stinit.def.examples`. If you use this approach, set the manufacturer parameter to `HPE` and the model to "Ultrium 8-SCSI".

Where `stinit` is available, you can also reinitialize the drive to new parameters as entered in `/etc/stinit.def` without reboot by running:

```
stinit
```

What next?

Once device files have been created, confirm that the new tape drive is working properly. **Verifying the installation** on page 24 provides instructions on backing up and restoring a sample file to test the installation.

IBM (AIX) servers and workstations

The tape drive uses the IBM Atape driver on AIX servers and workstations. For supported versions of AIX, see the HPE Data Availability, Protection, and Retention Compatibility Matrix at: <http://hpe.com/storage/DAPRcompatibility>.

Installing and configuring the Atape driver

Uninstall the currently installed version of the driver before installing a new version. For instructions on uninstalling the driver, see **Uninstalling the Atape driver** on page 18.

Understanding bosboot command messages

At the end of the installation procedure, the `installp` facility automatically runs the AIX `bosboot` command to update the boot record with the newly installed Atape files. When the `bosboot` command completes, the following messages are displayed:

```
0503-292 This update does not fully take effect until after a system reboot.
installp: bosboot process completed.
```

This message refers to the updates to the boot record only. If the installation summary shows that the Atape driver was installed successfully, it is not necessary to reboot the machine currently.

If the installation summary shows that the installation failed, you must reboot the machine and attempt to install the Atape driver a second time.

System file entries made during installation

During the Atape install, the following entries are entered into the two system files:

Procedure

1. `/usr/lpp/bosinst/cdfs.optional.list` to help the system image backup to DVD/CD media

The entry list in `/usr/lpp/bosinst/cdfs.optional.list`:

<code>/usr/lib/drivers/Atape</code>	<code>/usr/lib/drivers/Atape</code>	<code>Atape.driver</code>
<code>/usr/lib/methods/cfgAtape</code>	<code>/usr/lib/methods/cfgAtape</code>	<code>Atape.driver</code>
<code>/usr/lib/methods/ucfgAtape</code>	<code>/usr/lib/methods/ucfgAtape</code>	<code>Atape.driver</code>
<code>/usr/lib/methods/defAtape</code>	<code>/usr/lib/methods/defAtape</code>	<code>Atape.driver</code>
<code>/usr/lib/methods/udefAtape</code>	<code>/usr/lib/methods/udefAtape</code>	<code>Atape.driver</code>
<code>/usr/lib/methods/chgAtape</code>	<code>/usr/lib/methods/chgAtape</code>	<code>Atape.driver</code>

2. `/usr/lpp/bosinst/tape/tapefiles1` to create a bootable tape

The entry list in `/usr/lpp/bosinst/tape/tapefiles1`:

```
/usr/lib/drivers/Atape
/usr/lib/methods/ucfgAtape
/usr/lib/methods/cfgAtape
/usr/lib/methods/udefAtape
/usr/lib/methods/defAtape
/usr/lib/methods/chgAtape
```

The entries are removed from the files when Atape is uninstalled.

NOTE:

The entries might be lost after upgrading the AIX `bos.sysmgt.sysbr` file set for System Backup and BOS Install Utilities after Atape installation. After upgrading verify that these entries still exist, and if not, add the entries into the files.

Preinstallation considerations

Before the installation starts, verify the following:

- The tape drive is functioning and is properly attached to the server. The tape drive and server are powered on.
- You are logged on to the server on an account that has **root** authority.
- You have a command shell window open on the server to run the installation procedure.
- The current path is defined in the command shell PATH variable. This definition can be accomplished in the Korn shell by using the following command:

```
EXPORT PATH=.: $PATH
```

- If the tape drive was configured previously by another device driver (not Atape), remove any existing device definitions for it. The following command is an example:

```
rmdev -l ost1 -d
```

Installing the Atape driver

To list the currently installed **Atape.driver** version, enter the following command:

```
lsllpp -l Atape.driver
```

To install the Atape driver in the current directory, enter the following command:

For example

```
installp -acXd Atape.x.x.x.x Atape.driver
```

This command installs and commits the Atape driver on the system.

Configuring the tape drive

After the driver software is installed and a tape drive is connected to the HBA, the drive can be configured and made available for use. The tape drive is not accessible until the drive is configured.

NOTE:

If the tape drive was configured previously by another SCSI device driver, such as OST (Other SCSI Tape), issue the following command to remove the device definition before completing one of the following steps.

```
rmdev -l [device]
```

Configure the tape drive using one of the following procedures:

- Enter the following command with no parameters.

```
cfgmgr
```

The command configures all devices automatically, including any new tape devices.

- Power off your subsystem and then reboot the system to configure it automatically and make available any new tape devices on the system.

Deconfiguring tape drives

NOTE:

In the following examples, replace the letter **n** with the appropriate number for the device.

Deconfigure the tape drive by using one of the following methods:

- This method leaves the tape drive that is defined in the configuration database. It is similar to bringing the device offline (not in use).

To bring the `/dev/rmtn` tape device offline, but leave it defined in the device database, enter the following command:

```
rmdev -l rmtn
```

- This method brings the tape device offline and removes its definition from the device database.

Enter the following command.

```
rmdev -l rmtn -d
```

The device driver is not unloaded from the kernel until the last device is deconfigured.

Uninstalling the Atape driver

⚠ IMPORTANT:

All devices that use the Atape driver must be closed and cannot be in use when Atape is uninstalled. Otherwise, the uninstall fails.

You can uninstall the Atape device driver by using the `smit` command menu to uninstall software and selecting `Atape.driver` or by using the following `installp` command.

```
installp -u Atape.driver
```

What next?

Once device files have been created, confirm that the new tape drive is working properly. **Verifying the installation** on page 24 provides instructions on backing up and restoring a sample file to test the installation.

Oracle (Solaris) servers and workstations

For supported versions of Solaris, see the HPE Data Availability, Protection, and Retention Compatibility Matrix at: <http://hpe.com/storage/DAPRcompatibility>.

Fibre Channel drives

Before configuring your system to support an HPE LTO Ultrium drive, ensure that the drive is visible to the Oracle system HBA by correctly zoning the fabric switch (if one is being used).

Configuring the device files

Before configuring FC-attached drives, ensure that the operating system is updated with the latest recommended patches.

When SAN configuration is complete, verify that the drive is visible to the HBA by typing:

```
% cfgadm -al
```

The output is similar to:

```
c3::50060b000xxxxxxx      tape      connected      configured      unknown
```

It indicates that the drive is configured and the device files built. In this example

`c3::50060b000xxxxxxx` is the attachment point identifier with `50060b000xxxxxxx` being the WWN of the drive port attached to the SAN and visible to the HBA.

If you do not see anything similar to the previous example, recheck the SAN connections and the zoning configuration to ensure that the HBA and drive ports are visible to each other.

If the tape device shows as `unconfigured`, enter the following:

```
% cfgadm -c configure c3::50060b000xxxxxxx
```

It will build the necessary device file in the `/dev/rmt` directory.

To verify the particular devices associated with a specific WWN, use the following command:

```
% ls -al /dev/rmt | grep 50060b000xxxxxxx
```

Replace `50060b000xxxxxxx` with the appropriate WWN for the drive.

SAS drives

Identifying attached devices

Use the `cfgadm` command to list attached tape devices:

```
% cfgadm -al |grep tape
```

It produces output lines with a format similar to the following:

```
c9::rmt/0                  tape      connected      configured      unknown
```

The `rmt/K` entry indicates the tape device file, where *K* is the instance number. In the previous example, `rmt/0` indicates a set of device file options for one tape drive, such as `/dev/rmt/0cb`, or `/dev/rmt/0cbn`.⁴

⁴ Device file variants for a given tape device are listed in `/dev/rmt` with various suffixes—l, m, h, u, c specifying the ‘density’ (low, medium, high, ultra, compressed), plus additional options b, ‘Berkeley’ behavior,

The `cfgadm` command may also be used with the `-v` (verbose) option to list a full path including the SAS controller:

```
% cfgadm -val |grep tape
```

An output containing, for example, `"/devices/pci@0/pci@0/pci@8/pci@0/pci@1/LSILogic,sas@0:scsi::rmt/1"` indicates an SAS tape drive connected through an LSI SAS HBA.

Kernel patch levels

For optimal performance, ensure that you have the following minimum patch number:

	Minimum patch
Solaris 10	Update 11
Solaris 11	Update 2

Upgrading to the minimum patch level will ensure that the necessary support for officially supported drives is included in the driver. You can view your existing patch level using the following command:

```
% uname -a
```

To access Solaris patch upgrades, set up an Online Account with Oracle to use <http://support.oracle.com>.

NOTE:

Patch levels are likely to change every six months or so, so these “minimum” levels may quickly become out-of-date.

To obtain the latest levels, enter the patch names into the search utility on <http://support.oracle.com>.

It is always recommended that you upgrade to the latest patch level. However, if that is not possible, the following changes can be made to provide support for LTO-8 and to enhance performance:

Procedure

1. In the file `/kernel/drv/st.conf`, after these lines:

```
#####
#
# Copyright 2004 Sun Microsystems, Inc. All rights reserved.
# Use is subject to license terms.
#
#
#pragma ident    "@(#)st.conf    1.34    04/06/24 SMI"
#
```

Add the following (there are five significant spaces between the first occurrences of HPE and Ultrium in line 2):

```
tape-config-list =
"HPE Ultrium 8","HPE Ultrium LTO 8","HPE_LTO_GEN_8";
HPE_LTO_GEN_8 = 2,0x3B,0,0x18659,3,0x00,9x5C,0x5E,2,60,
1200,600,1200,600,600,18000
```

and `n`, no rewind behavior. HPE recommends the ‘Berkeley’ device file option for most applications with compressed density `c: /dev/rmt/0cb` or `/dev/rmt/0cbn`

```
name="st" class="scsi" target=X lun=0;
```

Where *X* is the SCSI target address⁵ of the device you have attached.

See **HPE-data values** on page 21 for the values of the parameters in these lines.

2. Instead of rebooting the device, follow these steps:

a. Find the kernel module ID:

```
# modinfo | grep "st ("
96 60dcc000 cdb0 33 1 st (SCSI Sequential Access Driver)
```

In this example, the ID is 96.

b. Unload the kernel module:

```
# modunload -i 96
```

c. Load the kernel module back in:

```
# modload -p drv/st
```

d. Rebuild the device paths:

```
devfsadm -C
devfsadm -i st
```

For additional details, see the Oracle documentation site at <https://docs.oracle.com>.

This link is valid for registered Oracle users with a valid Oracle Service Plan.

3. You are now able to use the drive.

a. Use `/dev/rmt/Kcb` if you require a compression rewind device file, where *K* is the relevant device file instance.

b. Use `/dev/rmt/Kcbn` when you require a compression nonrewind device.

Once the device files have been created, you will confirm that your new tape drive is working properly.

Verifying the installation on page 24 provides instructions on backing up and restoring a sample file to test your installation.

HPE-data values

The values for `HPE_LTO_GEN_n` and `name`, which provide normal LTO mode, have the following meanings:

⁵ Typically `st.conf` already contains a range of target address entries by default, listed after the comments section (`#` prefixes) in the preceding format: `name="st" class="scsi" target=X lun=0`; While SAS drives contain a unique 64-bit SAS address, they are also allocated a target address value in the operating system. To obtain a particular tape drive's target address, run the following command to identify it:

```
% ls -l <tape device_file>
```

This produces a line of output which includes a path which in turn contains an `st@X` element, where *X* is the target address.

For example: `% ls -l /dev/rmt/0cbn` would produce output containing something like the following path:

```
/dev/rmt/0cbn -> ../../devices/pci@0/pci@0/pci@8/pci@0/pci@8/pci@0/
pci1077,14f@1,1/st@3,0:cbn
```

The element `st@3` here indicates target address = 3.

The syntax for HPE_LTO_GEN_n is:

```
<drive type> = <version>, <type>, <bsize>, <options>, <no. of densities>,
<density 0>, <density 1>, <density 2>,<density 3>, <default density>,
<non-motion timeout>, <read/write timeout>, <rewind timeout>, <space timeout>,
<load timeout>, <unload timeout>, <erase timeout>
```

where:

Parameter	Value	Meaning
<version>	1 or 2	Indicates the format of the following parameters.
<type>	0x3B	The value for an LTO drive in /usr/include/sys/mtio.h. The value 0x3B indicates a type of MT_LTO.
<bsize>	0	Indicates variable block size.
<options>	0xd639 or 0x18659	The value is derived from constants provided in /usr/include/sys/scsi/targets/stddef.h. The value determines which operations the driver can perform with the attached device. It is accomplished by using a unique value for each feature and then adding them together to form the options value. Supported features will vary with OS revision, and may include the following:
		0x001 Device supports variable length records.
		0x008 Device can backspace over files (as in the 'mt bsf' option).
		0x010 Device supports backspace record (as in 'mt bsr').
		0x020 Device requires a long time-out period for erase functions.
		0x040 Device will automatically determine the tape density.
		0x0200 Device knows when end of data has been reached.
		0x0400 Device driver is unloadable.
		0x1000 Time-outs five times longer than normal.
		0x4000 Driver buffers write requests and preacknowledges success to application.
		0x8000 Variable record size not limited to 64 KB.
		0x10000 Device determines which of the two mode pages the device supports for selecting or deselecting compression.

Table Continued

Parameter	Value	Meaning
		So 0xd639 indicates variable record length, bsf and bsr enabled, long timeouts for erase, EOD recognition, Unloadable device driver, 5 x longer timeouts, buffer writes and preacknowledge success, variable records not limited to 64 KB, auto-density over-ride, and MODE SELECT compression. Similarly, 0x018659 indicates variable record length, bsf and bsr enabled, automatic density determination, EOD recognition, unloadable device driver, variable records not limited to 64 KB, and device selection of mode pages for controlling compression.
<no. of densities>	3	There are three densities following in the parameter list.
<density 0>	0x00	Creates a device file with compression disabled.
<density 1>	0x5C	The Ultrium 7 density code for data compression with Ultrium 7 media
<density 2>	0x5E	The Ultrium 8 density code for data compression with Ultrium 8 media
<default density>	3	Density 2 (0x5E) is the default for Generation 7 drives.
<X timeout>		All timeouts are in seconds

Values for the parameters for **name** are as follows:

Parameter	Value	Meaning
target	x	x specifies the target address ⁵ of the device.
lun	0	Specifies the LUN for the device.

Verifying the installation

As part of the installation process, you will have installed the appropriate device driver for your UNIX system, and created device files to communicate with the tape drive.

This section describes how you can verify that the installation has been performed correctly. Before completing the steps in the topics that follow, first complete these steps (if using HP-UX 11i v3):

Procedure

1. Use the following command to check whether the drive description in `ioscan` output is correct:

```
ioscan -knNfC tape
```

2. Use the following command to check whether the density of the tape is correct:

```
scsimgr get_attr -D <agile tape dsf> -a best_density
```

This command will report density as 92.

In outline, the procedure is as follows:

- Verify that the tape drive responds to a rewind command.
- Write test data to a tape.
- Read the test data from the tape.
- Compare the data read from the tape with the original data on disk.

To verify the installation:

Procedure

1. Test the SAS or Fibre Channel connection to the tape drive by performing a rewind:

- a. If there is a tape cartridge already in the drive, remove it.
- b. Insert a tape cartridge.
- c. Rewind the tape using the command line: `% mt -f <device_file> rew`

For example, on HP-UX 11i v3 (using a persistent device file): `% mt -f /dev/rtape/tape0_BESTnb rew`

If the command completes successfully, there will be no feedback. If it fails, you will see an error message on the console. There may be a reservation by another host, or a zone change, or the hardware installation may be faulty. Check the troubleshooting section of the *User's Guide* for help in identifying the problem.

2. Write a sample file to tape, using 'tar':

```
% cd /% tar cvf <device_file> <file>
```

The options to `tar` have the following meanings:

c	Create a new archive (backup file) on the device.
v	Operate in verbose mode.
f	Specify the device file explicitly.

The arguments follow the `cvf` options in the command line. Their values depend on the operating system; suggested values are given the appropriate operating system chapter. The arguments are as follows:

<device_file>	The name of the device file for the drive. Example: <code>/dev/rmt/c4t3d0BESTnb</code>
<file>	The name of the file to archive, prefixed with <code>./</code> . Example: <code>./stand/vmunix</code>

NOTE:

Make sure you prefix the file name with `./` when you back it up to tape. If you do not, the restore operation in step 3 will overwrite the original copy on disk.

3. Read the file back from tape:

```
% cd /tmp
% tar xvf<device_file>
```

The `'x'` option to `tar` here means “extract from the archive”.

Use the same value for the `<device_file>` argument as in step 2.

4. Compare the original with this retrieved file:

```
% cmp <original file> /tmp/<retrieved file>
```

It compares the files byte by byte. If they are the same, there will be no output, and it verifies that the installation is correct. The arguments are:

<original file>	The name of the original file, prefixed with <code>./</code> . Example: <code>./stand/vmunix</code>
<retrieved file>	The name of the file retrieved from the archive. Example: <code>stand/vmunix</code>

Example

Suppose that you are verifying the installation of an LTO Ultrium tape drive on an HP-UX 11i v3 system. The procedure would be as follows:

Procedure

1. Use `ioscan` to obtain the tape drive device file options:

```
%/sbin/ioscan -fnC tape
```

Identify the Berkeley 'no-rewind' option, for example: `/dev/rmt/c4t3d0BESTnb`

2. Change directory to root: `% cd /`

3. Back up `/stand/vmunix` to tape: `% tar cvf /dev/rmt/c4t3d0BESTnb ./stand/vmunix`

Note the prefix of `'.'` to the filename.

4. Change to the temporary directory: `% cd /tmp`

5. Extract the file from the tape: `% tar xvf /dev/rmt/c4t3d0BESTnb`

6. Compare the original with the restored version: `% cmp /stand/vmunix /tmp/stand/vmunix`

The original filename is **not** prefixed with `'.'`

Support and other resources

Accessing Hewlett Packard Enterprise Support

- For live assistance, go to the Contact Hewlett Packard Enterprise Worldwide website:
<http://www.hpe.com/assistance>
- To access documentation and support services, go to the Hewlett Packard Enterprise Support Center website:
<http://www.hpe.com/support/hpesc>

Information to collect

- Technical support registration number (if applicable)
- Product name, model or version, and serial number
- Operating system name and version
- Firmware version
- Error messages
- Product-specific reports and logs
- Add-on products or components
- Third-party products or components

Accessing updates

- Some software products provide a mechanism for accessing software updates through the product interface. Review your product documentation to identify the recommended software update method.
- To download product updates:

Hewlett Packard Enterprise Support Center

www.hpe.com/support/hpesc

Hewlett Packard Enterprise Support Center: Software downloads

www.hpe.com/support/downloads

Software Depot

www.hpe.com/support/softwaredepot

- To subscribe to eNewsletters and alerts:
www.hpe.com/support/e-updates
- To view and update your entitlements, and to link your contracts and warranties with your profile, go to the Hewlett Packard Enterprise Support Center **More Information on Access to Support Materials** page:

❗ IMPORTANT:

Access to some updates might require product entitlement when accessed through the Hewlett Packard Enterprise Support Center. You must have an HPE Passport set up with relevant entitlements.

Customer self repair

Hewlett Packard Enterprise customer self repair (CSR) programs allow you to repair your product. If a CSR part needs to be replaced, it will be shipped directly to you so that you can install it at your convenience. Some parts do not qualify for CSR. Your Hewlett Packard Enterprise authorized service provider will determine whether a repair can be accomplished by CSR.

For more information about CSR, contact your local service provider or go to the CSR website:

<http://www.hpe.com/support/selfrepair>

Remote support

Remote support is available with supported devices as part of your warranty or contractual support agreement. It provides intelligent event diagnosis, and automatic, secure submission of hardware event notifications to Hewlett Packard Enterprise, which will initiate a fast and accurate resolution based on your product's service level. Hewlett Packard Enterprise strongly recommends that you register your device for remote support.

If your product includes additional remote support details, use search to locate that information.

Remote support and Proactive Care information

HPE Get Connected

www.hpe.com/services/getconnected

HPE Proactive Care services

www.hpe.com/services/proactivecare

HPE Proactive Care service: Supported products list

www.hpe.com/services/proactivecaresupportedproducts

HPE Proactive Care advanced service: Supported products list

www.hpe.com/services/proactivecareadvancedsupportedproducts

Proactive Care customer information

Proactive Care central

www.hpe.com/services/proactivecarecentral

Proactive Care service activation

www.hpe.com/services/proactivecarecentralgetstarted

Warranty information

To view the warranty for your product or to view the *Safety and Compliance Information for Server, Storage, Power, Networking, and Rack Products* reference document, go to the Enterprise Safety and Compliance website:

www.hpe.com/support/Safety-Compliance-EnterpriseProducts

Additional warranty information

HPE ProLiant and x86 Servers and Options

www.hpe.com/support/ProLiantServers-Warranties

HPE Enterprise Servers

www.hpe.com/support/EnterpriseServers-Warranties

HPE Storage Products

www.hpe.com/support/Storage-Warranties

HPE Networking Products

www.hpe.com/support/Networking-Warranties

Regulatory information

To view the regulatory information for your product, view the *Safety and Compliance Information for Server, Storage, Power, Networking, and Rack Products*, available at the Hewlett Packard Enterprise Support Center:

www.hpe.com/support/Safety-Compliance-EnterpriseProducts

Additional regulatory information

Hewlett Packard Enterprise is committed to providing our customers with information about the chemical substances in our products as needed to comply with legal requirements such as REACH (Regulation EC No 1907/2006 of the European Parliament and the Council). A chemical information report for this product can be found at:

www.hpe.com/info/reach

For Hewlett Packard Enterprise product environmental and safety information and compliance data, including RoHS and REACH, see:

www.hpe.com/info/ecodata

For Hewlett Packard Enterprise environmental information, including company programs, product recycling, and energy efficiency, see:

www.hpe.com/info/environment

Documentation feedback

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Glossary

AT&T mode

Berkeley and AT&T functional modes differ in “read-only” close functionality. In AT&T mode, a device close operation will cause the tape to be repositioned just after next filemark on the tape (the start of the next file).

Berkeley mode

Berkeley and AT&T functional modes differ in “read-only” close functionality. In Berkeley mode the tape position will remain unchanged by a device close operation.

BOT

Beginning Of Tape. The first point on the tape that can be accessed by the drive.

buffered mode

A mode of data transfer in write operations that facilitate tape streaming. It is selected by setting the Buffered Mode Field to 1 in the SCSI MODE SELECT Parameter List header.

compression

A procedure where data is transformed by the removal of redundant information to reduce the number of bits required to represent the data. It is done by representing strings of bytes with codewords.

In LTO drives, the data is compressed using the LTO-DC compression format which is based on ALDC (licensed from Stac/IBM) with two enhancements. One limits the increase in size of data that cannot be compressed that ALDC produces. The other is the use of embedded codewords.

Fibre Channel

Fibre Channel provides an inexpensive yet expendable means of quickly transferring data between workstations, mainframes, supercomputers, desktop computers, storage devices, displays, and other peripherals. Although it is called Fibre Channel, its architecture represents not a channel or a real network topology. It allows for an active intelligent interconnection scheme, called a fabric, to connect devices. All a Fibre Channel port has to do is to manage a simple point-to-point connection between itself and the fabric.

Several common ULPs (Upper Level Protocols) including IP and SCSI can run on Fibre Channel, merging high-speed I/O and network functionality in a single connectivity technology.

filemark

A mark written by the host to the tape that can be searched for, often using the drive’s fast-search capability. It does not necessarily separate files. It is up to the host to assign a meaning to the mark.

immediate mode

A mode of responding to SCSI commands where the drive or other peripheral does not wait until the command has finished before returning status information back to the host. For writing filemarks, Immediate mode can significantly improve the performance of systems that do not set the Immediate bit when sending a SCSI WRITE FILEMARKS command. Data is not flushed to tape in response to an immediate write filemark command.

LUN

Logical Unit Number, by which different logical units within a particular device can be addressed individually. Each logical unit contains a device server. The drive provides an SSC device server, typically at LUN 0, and an ADC device server, typically at LUN 7. Both may be reassigned, for example the ADI automation controller may reassign the ADC LUN by using the ADC Device Server

configuration mode sub-page. Finally, the drive also provides optional SMC LUN(s), which may be assigned by an ADI automation controller at the time of enablement, typically at LUN 1.

SAN

Storage Area Network. A dedicated, high-speed network that establishes a direct connection between storage elements and servers. The hardware that connects workstations and servers to storage devices in a SAN is referred to as a fabric. The SAN fabric enables any-server-to-any-storage device connectivity through the use of Fibre Channel switching technology.

sequential access

Sequential access devices store data sequentially in the order in which it is received. Tape devices are the most common sequential access devices. Devices such as disk drives are **direct access** devices, where data is stored in blocks, not necessarily sequentially. Direct access allows speedy retrieval, but is significantly more costly.