

HP LTO Ultrium 5 tape drives

UNIX, Linux and OpenVMS configuration guide



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1 Introduction

Purpose of this manual

This manual provides basic information on configuring the drives with various operating systems. See the top-level release notes that accompany the drive for expected functionality and features.

LTO Ultrium drives are supported on the following platforms:

- [HP \(HP-UX\) servers and workstations](#), page 7
- [HP \(OpenVMS\) servers and workstations](#), page 15
- [IBM \(AIX\) servers and workstations](#), page 21
- [Linux servers and workstations](#), page 17
- [Sun servers and workstations](#), page 25

For versions of the operating systems supported, see <http://www.hp.com/go/connect>.

For platforms not mentioned here, contact HP because there may be new connectivity details available that arrived after the release notes were published.

See “[Verifying the installation](#)” on page 31 for details of how to verify the installation.

LTO Ultrium drives in a library

Although LTO Ultrium drives may also be used in a library, instructions about installing device drivers for automatic robotics are not included in this manual.

SAS drives

For supported UNIX, Linux and OVMS versions, go to <http://www.hp.com/go/connect>.

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, visit the HP Tape Compatibility website:

<http://www.hp.com/products1/storage/compatibility/tapebackup/index.html>.

Follow the “Software compatibility” link then click a tick in the appropriate matrix to drill down into detailed application support information.

See the *Getting Started Guide* for more information about usage models.

2 HP (HP-UX) servers and workstations

For supported versions of HP-UX, go to <http://www.hp.com/go/connect>.

Before you install your tape drive, visit the HP web site, www.hp.com, and search to locate IT Resource Center (you may be required to set up a new login). Download the latest hardware enablement (HWE) patch bundle for your operating system. This ensures that you will 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-UX11i v3 and agile addressing

HP-UX11i 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-UX11i 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 please refer to www.docs.hp.com.



NOTE:

A block size no larger than 256 KB is strongly recommended when working with HP-UX. See “Using large block sizes” on page 14.

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 v2 and 11i v3 (legacy format)

Enter the command:

```
% /sbin/ioscan -f
```

The output should look similar to the following (which shows an LTO 5 drive):

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)
OO	0	0/0/2/0	UsbOhci	CLAIMED	INTERFACE	USB OHCI Interface
OO	1	0/0/2/0.0	UsbMiniBus	CLAIMED	INTERFACE	USB Composite Device
OO	4	0/0/2/0.0.0	UsbBootKeyboard	CLAIMED	DEVICE	Virtual Keyboard
unknown	-1	0/0/2/0.0.1		UNCLAIMED	UNKNOWN	OO Device Driver
OO	11	0/0/2/1	UsbOhci	CLAIMED	INTERFACE	USB OHCI Interface
OO	5	0/0/2/1.0	UsbMiniBus	CLAIMED	INTERFACE	USB Composite Device
OO	9	0/0/2/1.0.0	UsbBulkOnlyMS	CLAIMED	DEVICE	USB Bulk Only
disk	1	0/0/2/1.0.16	UsbScsiAdaptor	CLAIMED	DEVICE	USB SCSI Stack Adaptor
OO	12	0/0/2/1.1	UsbMiniBus	CLAIMED	INTERFACE	USB Composite Device
OO	18	0/0/2/1.1.0	UsbBootKeyboard	CLAIMED	DEVICE	EP1 Interrupt
OO	20	0/0/2/1.1.1	UsbBootMouse	CLAIMED	DEVICE	USB Boot Protocol Mouse
OO	16	0/0/2/2	UsbEhci	CLAIMED	INTERFACE	USB EHCI Interface
graphics	0	0/0/3/0	gvid_core	CLAIMED	INTERFACE	PCI Display (1002515e)
ba	1	0/1	lba	CLAIMED	BUS_NEXUS	LocalPCI-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	PCItPCI	CLAIMED	BUS_NEXUS	PCItPCI Bridge
slot	0	0/2/0/0/0	pci_slot	CLAIMED	SLOT	PCI Slot
escsi_ctlr	1	0/2/0/0/0/0	sasd	CLAIMED	INTERFACE	HP PCI-E SAS MPT Adapter
ext_bus	4	0/2/0/0/0/0.0.0	sasd_vbus	CLAIMED	INTERFACE	SAS Device Interface
target	3	0/2/0/0/0/0.0.0.9	tgt	CLAIMED	DEVICE	
tape	29	0/2/0/0/0/0.0.0.9.0	stape	CLAIMED	DEVICE	HP Ultrium 5-SCSI
ba	4	0/3	gh2p	CLAIMED	BUS_NEXUS	Local Bus Adapter
ba	5	0/3/0/0	PCItPCI	CLAIMED	BUS_NEXUS	PCItPCI 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

Fibre Channel drives have a slightly different format in `ioscan` output, similar to the following segment:

Class	I	H/W Path	Driver	S/W State	H/W Type	Description
ba	4	0/4	lba	CLAIMED	BUS_NEXUS	Local PCI-X Bus Adapter (783)
fc	2	0/4/1/0	fcd	CLAIMED	INTERFACE	HP AB378-60001 4Gb Single Port
			PCI/PCI-X Fibre Channel Adapter (FC Port 1)			
fc	1	0/4/1/0.84	fcd_fcp	CLAIMED	INTERFACE	FCP Domain
ext_bus	6	0/4/1/0.84.3.255.0	fcd_vbus	CLAIMED	INTERFACE	FCP Device Interface
target	3	0/4/1/0.84.3.255.0.0	tgt	CLAIMED	DEVICE	
tape	2	0/4/1/0.84.3.255.0.0.0	stape	CLAIMED	DEVICE	HP Ultrium 5-SCSI
fc	0	0/4/1/0.180	fcd_fcp	CLAIMED	INTERFACE	FCP Domain
ext_bus	10	0/4/1/0.180.2.255.0	fcd_vbus	CLAIMED	INTERFACE	FCP Device Interface
target	7	0/4/1/0.180.2.255.0.0	tgt	CLAIMED	DEVICE	
tape	9	0/4/1/0.180.2.255.0.0.0	stape	CLAIMED	DEVICE	HP Ultrium 4-SCSI

For 11i v3 (Agile I/O tree view)

Enter the command:

```
% ioscan -m lun
```

The output should look similar to the following¹ which includes an LTO 5 SAS drive. Fibre Channel tape drives have a similar format in this type of `ioscan` output:

¹Note that device files (such as `/dev/rtape/tape9_BEST`) may or may not be in place initially.

```
(blakey) DataProtector11.31.08.03 >ioscan -m lun
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
      0/3/0/0/0/0/0.0x0.0x0
      /dev/pt/pt0
disk   3  64000/0xfa00/0x1      esdisk CLAIMED   DEVICE    online   HP   LOGICAL VOLUME
      0/3/0/0/0/0/0.0x0.0x4000000000000000
      /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
tape   28 64000/0xfa00/0x45      estape CLAIMED   DEVICE    online   HP   Ultrium 3-SCSI
      64000/0x0/0x0.0x6.0x0
      /dev/rtape/tape28_BEST /dev/rtape/tape28_BESTn
      /dev/rtape/tape28_BESTb /dev/rtape/tape28_BESTnb
autoch 7  64000/0xfa00/0x46      eschgr CLAIMED   DEVICE    online   HP   MSL G3 Series
      64000/0x0/0x0.0x7.0x0
      /dev/rchgr/autoch7
tape   30 64000/0xfa00/0x4a      estape CLAIMED   DEVICE    online   HP   Ultrium 5-SCSI
      0/2/0/0/0/0.0x500110a0013091b8.0x0
      /dev/rtape/tape30_BEST /dev/rtape/tape30_BESTn
      /dev/rtape/tape30_BESTb /dev/rtape/tape30_BESTnb
```

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

The lunpath hardware path for the above tape drive is "0/2/0/0/0/0/0.0x500110a0013091b8.0x0".

- 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 giventape 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 stape/estape and eschgr/schgr (media changer driver) to the kernel

For HP-UX 11i v2

If your tape drive or media changer does not appear in `ioscan` listing or is listed with H/W Type "UNKNOWN" you may need to install the appropriate drivers.

Use the 'sam' utility. Sam runs as a mouse driven GUI (Figure 1) on a system with full graphics capability, or as a console text-based interface (Figure 2). If you use the text-based interface, use the Tab and arrow keys to navigate, and the Return key to select.

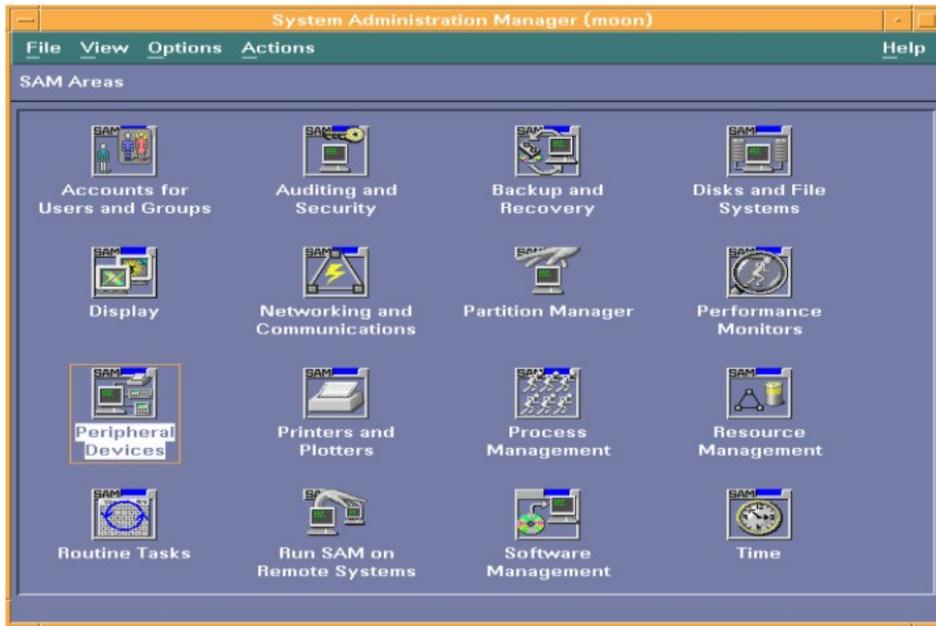


Figure 1 SAM GUI

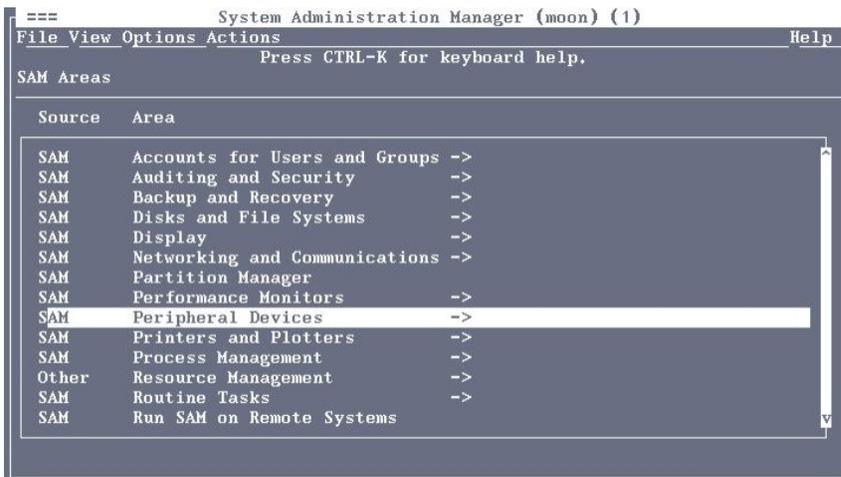


Figure 2 SAM text-based interface

1. Enter `sam` at the command line.


```
% sam
```
2. Select the following:

Kernel Configuration > Kernel Configuration (character mode) > Modules
3. Highlight the stape driver. If the driver has not been added to the kernel, both Current State and Planned State will read "unused".
4. Type "m" to modify the stape driver and "s" to set it to "static". The Planned State will now read "static".
5. The stape driver is now added to the kernel.
6. If you are going to attach a media changer, use a similar procedure to change `eschgr` or `schgr` to "static".

7. Reboot the system.

For HP-UX 11i v3 (11.31)

1. Start up the SMH web-based interface.

```
% smh -w
```

This 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 Modules from the Kernel Configuration section:

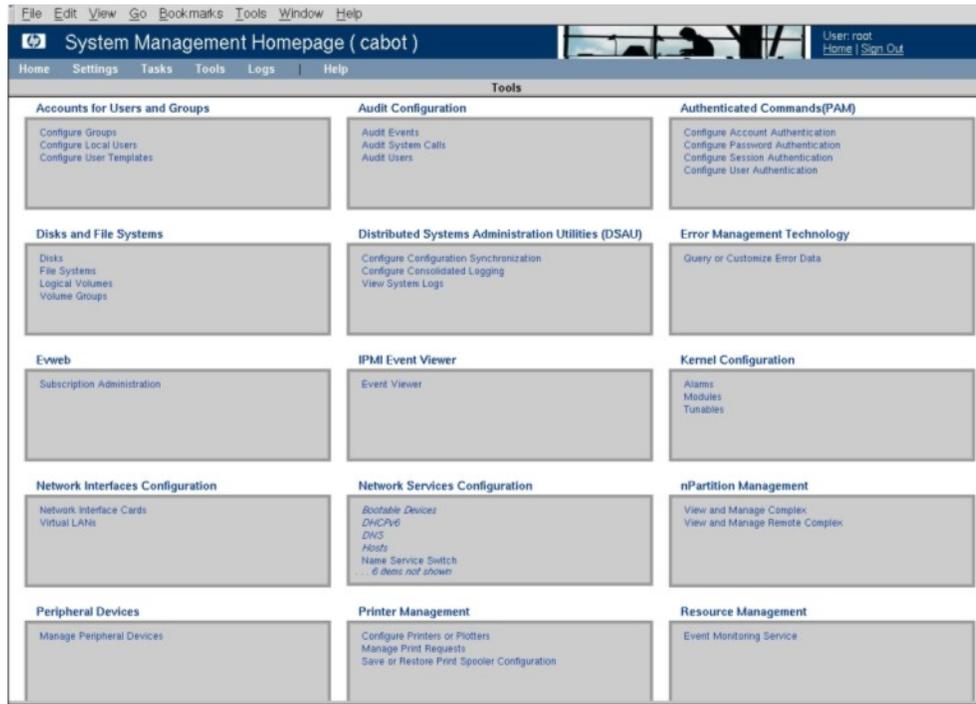


Figure 3 SMH web-based interface (HP-UX11i v3)

3. In the Search box on the Kernel Configuration page, type `stape` and execute the search. The search results list will include both `estape` and `stape` modules. If either of these modules is not installed both Current State and Next Boot State will be shown as “unused”. A state of “static” indicates that the module is installed.
4. Select the `estape` module³ radio button. Its details will appear in a panel below the modules list. From the right hand panel on the web page, click the **Modify Module** link.

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

³The `estape` and `stape` modules are linked, so it is sufficient to select the `estape` module alone for installation.

- On the Modify Kernel Module: estape page, for **Next Boot State**, select the “static” radio button. Check the box entitled **Backup** to create a backup copy of the existing kernel:

Figure 4 Adding estape driver to the kernel

- If you wish, type in a Reason for Change, such as “Initial estape installation May 1st 2007” and then select the **Modify** tab.
- Click the **OK** button at the Operation Successful page. Both estape and stape drivers will now be shown with **Next Boot State** as “static”.
- For media changers, use a similar procedure to prepare the eschgr (with schgr) module.
- From the right-hand panel on the Kernel Configuration page, click **View Pending Changes and reboot** and proceed to reboot the system as directed.
- Following the reboot ,re-run SMH and search again for the driver as in step 3 above. **Current State** and **Next Boot State** should both be listed as “static”.

Add device files

For HP-UX 11i v2

Use the `sam` utility to create device files. `sam` runs as a mouse-driven GUI (see [Figure 1](#) on page 10) on a system with full graphics capability, or as a console text-based interface (see [Figure 2](#) on page 10). If you use the text-based interface, use the Tab and arrow keys to navigate, and the Return key to select.

- Enter `sam` at the command line:

```
% sam
```

2. Select the following:

Peripheral Devices > Tape Drives

sam will then scan the system for any tape drives connected.

For example, when an HP LTO Ultrium 5 drive is found, for example, it will be displayed as something like:

Hardware Path	Driver	Description
8/0/2/0.3.0	stape	HP Ultrium 5-SCSI

3. Highlight the drive and select the following from the tool bar:

Actions > Create Device Files > Create Default Device Files

This will create default device files for the drive. To view the device files that have been created, select:

Actions > Create Device Files > Show Device Files

4. When you have exited sam, run ioscan to see the tape drive:

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

All default device files displayed have compression enabled.

NOTE:

HP recommends the 'Berkeley' device files of most applications:

cXtYdZBESTnb = Berkeley, no rewind, best available density

cXtYdZBESTb = Berkeley, with rewind, best available density

where:

X = card number

Y = target number

Z = LUN number

For HP-UX 11i v3 (HP-UX 11.31)

1. Start up the SMH web-based interface:

```
% smh -w
```

This will attempt to launch a web browser. Mozilla browser⁴ is the default when HP-UX 11i v3 is installed.

2. From the SMH Tools page (see [Figure 3](#) on page 11), select Manage Peripheral Devices from the Peripheral Devices section.
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 this will be indicated under the Properties header (see [Figure 5](#))⁵.

⁴If Mozilla is being invoked for the first time you may be asked to agree to license terms for the software.

⁵Depending 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.

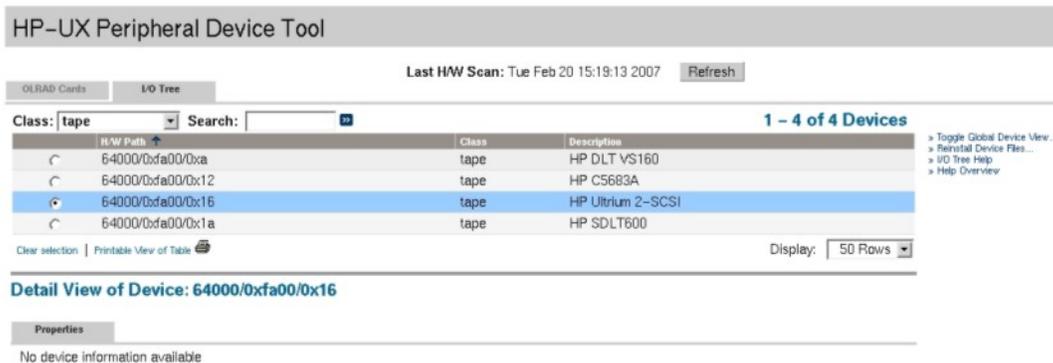


Figure 5 Selecting a tape device to create its device files (Agile View)

- From the right-hand panel on the HP-UX Peripheral Device Tool page, click on **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.

Using large block sizes

A block size no larger than 256 KB (262144 bytes) is strongly recommended when working with HP-UX and tape or VTL devices. Backup applications should be configured to work with I/O block sizes that are no larger than 256 KB. Please check your application documentation to find out how to check or configure block sizes used for transfers to and from tape or VTL devices.

This is because, by default, the HP-UX stape driver processes a block size larger than 256 KB by subdividing it into 256 KB blocks for writing to tape (giving a net effect of 256 KB I/O transfers)⁶. For example a 1 MB block (1048576 bytes) is written to tape as four 256 KB blocks. During restore, stape attempts to reconstruct the original block size that was larger than 256 KB with the 256 KB blocks from tape. This subdivision and subsequent reconstruction process of block sizes larger than 256 KB adds unnecessary complexity and risk to tape positioning and restore operations and offers no net gain in terms of increased block size. It should therefore be avoided.

What next?

Once device files have been created, you should confirm that your new tape drive is working properly. “[Verifying the installation](#)” on page 31 provides instructions on backing up and restoring a sample file to test your installation.

⁶The maximum block size limit of 256 KB (262144 bytes) applies to all versions of HP-UX and is strongly recommended for broad backup/restore compatibility across all supported HP-UX versions. Different HP-UX kernel configurations or later versions of HP-UX may not use 256 KB ‘chunks’ as described; however all HP-UX versions and kernel configurations are compatible and interoperable with a block size limit of 256 KB.

3 HP (OpenVMS) servers and workstations



NOTE:

SAS drives are not supported on Alpha Server systems.

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.

For FC drives, first:

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

Then, for all drives:

\$mc sysman io find

\$mc sysman io auto

\$ sho dev mk

Device	Device	Error	Volume	Free	Trans	Mnt
Name	Status	Count	Label	Blocks	Count	Cnt
MKA400:	Online	0				

^ use this value in the next command line

\$ sho dev MKA400/full

Magtape SIT058\$MKD300:, device type HP Ultrium 5-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. Please consult your OpenVMS system documentation for details.

4 Linux servers and workstations

 **TIP:**

Where convenient, do the original install of the Linux operating system with the tape drive attached to the SAS port, so that the `st` driver gets loaded with the kernel during boot up. Otherwise, see the guidelines below for cases where the operating system was already installed without the tape drive being available.

Ensure the correct HBA and driver are installed

Visit the HP Tape Compatibility website for details of supported Linux OS versions and SAS HBA controllers: <http://www.hp.com/products1/storage/compatibility/tapebackup/index.html>

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

Check the driver modules are loaded in the kernel

In order to communicate with a tape device, the operating system needs to have drivers loaded for both the tape drive and the host bus adaptor. 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. This should not be attempted by novice users.

The following guidelines assume the use of loadable driver modules.

Run the `lsmod` command to list all driver modules currently loaded in the kernel. 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 below. Also shown below are two examples of HBA drivers—`cciss` driver (for HP SmartArray SAS HBAs) and `mptsas` driver (for LSI SAS HBA):

```
Module  Size  Used by
st      38749   0
.
.
cciss   68484   3
.
```

```
.  
mptsas 37321 0
```

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:**

Loading of the `st` driver should happen naturally if your system is rebooted after attaching the drive.

Determining the attached devices

HBAs which use the `cciss` driver may 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
```

Check the contents of the file `/proc/scsi/scsi` to determine whether the system discovered the tape drive at module load time:

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

Examine the contents for something like:

```
Host: SCSI0 Channel: 00 Id:00 Lun:00  
Vendor: HP      Model: Ultrium 5-SCSI Rev: ZxxD  
Type: Sequential-Access ANSI SCSI Revision 06
```

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

 **NOTE:**

The exact format and style of the listing may 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: HP      Model: Ultrium 5-SCSI  Rev: ZxxD  
  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...

A list of tape device files gets 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, this will be 0)
- `n` Indicates this is a no-rewind driver.

Using the seek and tell features of `mt`

To use the seek and tell features of `mt`, the `st` driver needs to be configured for logical block addressing with HP 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 however that this information is not preserved across reboots, so you need to 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. Note that 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 `HP` and the model to `"Ultrium 5-SCSI"`.

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

```
stinit
```

What next?

Once device files have been created, you should confirm that your new tape drive is working properly. ["Verifying the installation"](#) on page 31 provides instructions on backing up and restoring a sample file to test your installation.

5 IBM (AIX) servers and workstations

For supported versions of AIX, see <http://www.hp.com/go/connect>.

Identifying attached devices

For SAS, to list existing devices, use the following:

```
% lsdev -C |grep SAS
```

This produces output similar to:

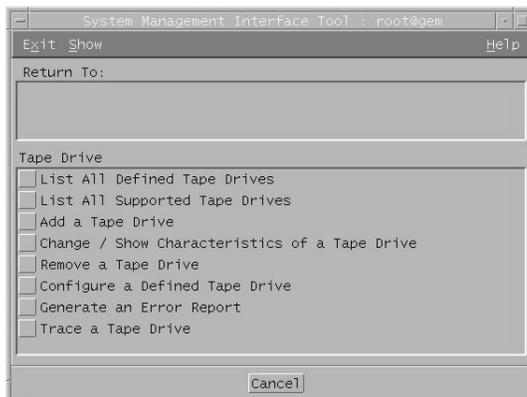
```
hdisk0      Available 00-08-00 SAS Disk Drive
hdisk1      Available 00-08-00 SAS Disk Drive
rmt0        Defined   03-08-00 Other SAS Tape Drive
sas0        Available 00-08-00 Controller SAS Protocol
sas1        Available 03-08-00 Controller SAS Protocol
ses0        Available 00-08-00 SAS Enclosure Services Device
ses1        Available 00-08-00 SAS Enclosure Services Device
ses2        Available 00-08-00 SAS Enclosure Services Device
sissas0     Available 00-08      PCI-X266 Planar 3Gb SAS Adapter
sissas1     Available 03-08      PCI-X266 Ext Dual-x4 3Gb SAS Adapter
```

Configuring the device files

Reboot the server/workstation with the tape drive attached and powered on.

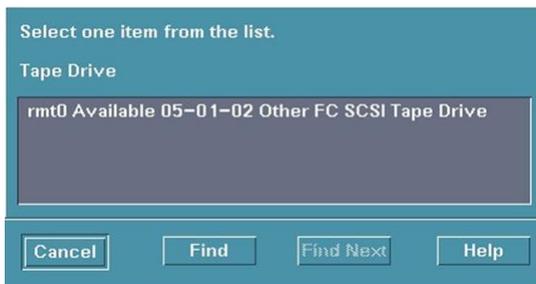
If you are using a graphics terminal running X-Windows

1. At a Windows terminal, type:
smit tape
2. The following window is displayed:



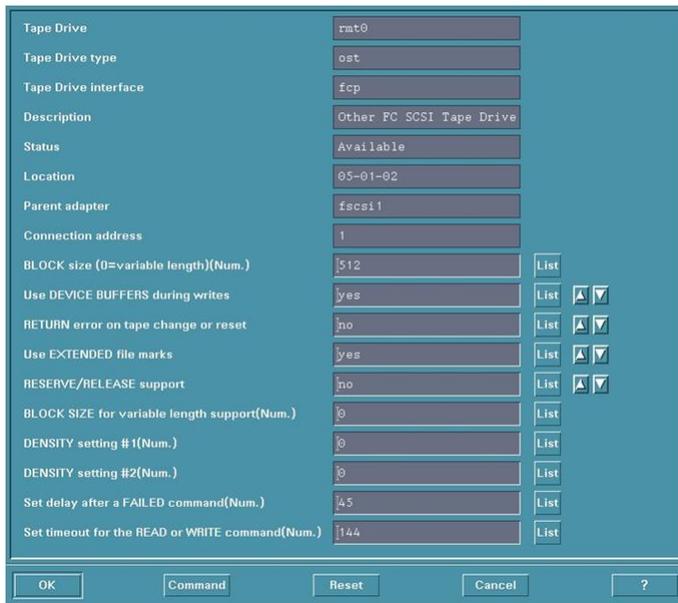
Select "change/show characteristics of a tape drive"

3. A pop-up window is displayed:



Select the tape drive you wish to change. The example above shows an LTO FC tape drive as available for selection.

4. The following details are displayed:



Check the following values and change them if necessary:

- BLOCK Size (0=variable length)= 0
- Use EXTENDED file marks = "no"
- RESERVE/RELEASE support = "yes"
- Set timeout for the READ or WRITE command = 1200

Click on the "OK" button to apply the changes.

If you are using a non-graphics terminal

1. At the command line type:
`% smit -C tape`

- The following is displayed:

```

Tape Drive
Move cursor to desired item and press Enter.

List All Defined Tape Drives
List All Supported Tape Drives
Add a Tape Drive
Change / Show Characteristics of a Tape Drive
Remove a Tape Drive
Configure a Defined Tape Drive
Generate an Error Report
Trace a Tape Drive

```

Select "change/show characteristics of a tape drive"

- A pop-up window is displayed:

```

Tape Drive
Move cursor to desired item and press Enter.

rmt0 Available 05-01-02 Other FC SCSI Tape Drive

Esc +1=Help          Esc +2=Refresh      Esc +3=Cancel
Esc +8=Image         Esc +0=Exit         Enter=Do
/=Find              n=Find Next

```

Select the tape drive you wish to change. The example above shows an LTO FC tape drive as available for selection.

- The following details are displayed:

```

Change / Show Characteristics of a Tape Drive
Type or select values in entry fields.
Press Enter AFTER making all desired changes.

Tape Drive           [Entry Fields]
Tape Drive type      rmt0
Tape Drive interface ost
Description          fcp
Status               Other FC SCSI Tape Dr>
Location             Available
Parent adapter       05-01-02
Connection address  fscsil
BLOCK size (0=variable length) 1
Use DEVICE BUFFERS during writes [0]      +#
RETURN error on tape change or reset yes      +
Use EXTENDED file marks no           +
RESERVE/RELEASE support yes          +
BLOCK SIZE for variable length support [0]      +#
DENSITY setting #1 [0]             +#
DENSITY setting #2 [0]             +#
Set delay after a FAILED command [45]     +#
Set timeout for the READ or WRITE command [1200] +#

```

Check the following values and change them if necessary:

- BLOCK Size (0=variable length) = 0
- Use EXTENDED file marks = "no"
- RESERVE/RELEASE support = "yes"
- Set timeout for the READ or WRITE command = 1200

Press the Enter key ("Do") to apply the changes.

Refer to <http://www.hp.com/go/connect> for up-to-date information on supported applications

Once device files have been configured, you should confirm that your new tape drive is working properly. "Verifying the installation" on page 31 provides instructions on backing up and restoring a sample file to test your installation.

Device filenames under AIX

Use device filenames as listed below for the combination of Rewind on Close, Retension on Open, and Compression that you want:

Filename	Rewind on Close	Retension on Open	Compression
/dev/rmt <i>n</i>	Yes	No	enabled
/dev/rmt <i>n</i> .1	No	No	enabled
/dev/rmt <i>n</i> .2	Yes	Yes	enabled
/dev/rmt <i>n</i> .3	No	Yes	enabled
/dev/rmt <i>n</i> .4	Yes	No	disabled
/dev/rmt <i>n</i> .5	No	No	disabled
/dev/rmt <i>n</i> .6	Yes	Yes	disabled
/dev/rmt <i>n</i> .7	No	Yes	disabled

The *n* in the filename is the instance number assigned to the drive by the operating system, where 0 is the first device, 1 is the second and so on.

- Rewind on Close** Normally, the drive repositions the tape to BOT (Beginning of Tape) when the device file is closed. Using the no rewind option is useful when creating and reading tapes that contain multiple files.
- Retension on Open** Retensioning consists of winding to EOT (End of Tape) and then rewinding to BOT, in order to reduce errors. If this option is selected, the tape is positioned at BOT as part of the open process.
- Compression** Compression can be disabled or enabled.

6 Sun (Solaris) servers and workstations

For supported versions of Solaris, see <http://www.hp.com/go/connect>.

Fibre Channel drives

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

Configuring the device files

Before configuring FC-attached drives, ensure the operating system is updated with the latest recommended patches. On Solaris 9 you also need to install the Sun/StorageTek StorEdge SAN Foundation software from www.sun.com/download (select the Storage Management link, then StorageTek SAN x.x).

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

```
% cfgadm -al
```

This should produce an output similar to:

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

This 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 example above, 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`, type the following:

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

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

To verify the particular devices associated with a specific WWN then 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
```

This 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 above example, `rmt/0` indicates a set of device file options for one tape drive, such as `/dev/rmt/0cb`, `/dev/rmt/0cbn`, and so on.⁷

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 via an LSI SAS HBA.

Kernel patch levels

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

	Minimum patch*
Solaris 9	The latest version of the <code>st</code> , <code>sd</code> and <code>ssd</code> drivers patch (currently 122300-48, though this version may be superceded)
Solaris 10	The latest version of the kernel patch (05/09 release (update 5) or later)

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 command `"uname -a"`. To access Solaris patch upgrades, you need to set up an Online Account with Sun to use <http://www.sunsolve/sun/com/>.

NOTE:

Patch levels are liable to change every 6 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 "Search the SunSolve Knowledgebase" found on <http://www.sunsolve/sun/com/>.

If for some reason you cannot upgrade to the minimum patch level, you can make the following file modifications to enhance performance:

⁷Device 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, and `n`, no rewind behaviour. HP recommends the 'Berkeley' device file option for most applications with compressed density `c`: `/dev/rmt/0cb` or `/dev/rmt/0cbn`

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 6 significant spaces between the first occurrences of HP and Ultrium in line 2):

```
tape-config-list =  
    "HP      Ultrium 5","HP Ultrium LTO 5","HP_LTO_GEN_5";  
HP_LTO_GEN_5 = 2,0x3B,0,0x18659,4,0x00,0x44,0x46,0x58,3,60,  
1200,600,1200,600,600,18000  
name="st" class="scsi" target=X lun=0;
```

where `X` is the SCSI target address⁸ of the device you have attached.

See “[HP-data values](#)” on page 28 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 further details, see *How do you load st.conf changes without rebooting*, SunSolve document 18010, on <http://sunsolve.sun.com/search/document.do?assetkey=1-9-18010-1&searchclause=18010>

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

⁸Typically `st.conf` already contains a range of target address entries by default, listed after the comments section (`#` prefixes) in the above 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.

3. You should now be able to use the drive.

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

Once the device files have been created, you should confirm that your new tape drive is working properly. “[Verifying the installation](#)” on page 31 provides instructions on backing up and restoring a sample file to test your installation.

HP-data values

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

The syntax for `HP_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																		
<code><version></code>	1 or 2	Indicates the format of the following parameters.																		
<code><type></code>	0x3B	The value for an LTO drive in <code>/usr/include/sys/mtio.h</code> . The value 0x3B indicates a type of <code>MT_LTO</code> .																		
<code><bsize></code>	0	Indicates variable block size.																		
<code><options></code>	0xd639 or 0x18659	This value is derived from constants provided in <code>/usr/include/sys/scsi/targets/stddef.h</code> . The value determines which operations the driver can perform with the attached device 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: <table border="1" data-bbox="568 1291 1351 1831"> <tbody> <tr> <td>0x001</td> <td>Device supports variable length records.</td> </tr> <tr> <td>0x008</td> <td>Device can backspace over files (as in the <code>'mt bsf'</code> option).</td> </tr> <tr> <td>0x010</td> <td>Device supports backspace record (as in <code>'mt bsr'</code>).</td> </tr> <tr> <td>0x020</td> <td>Device requires a long time-out period for erase functions.</td> </tr> <tr> <td>0x040</td> <td>Device will automatically determine the tape density.</td> </tr> <tr> <td>0x0200</td> <td>Device knows when end of data has been reached.</td> </tr> <tr> <td>0x0400</td> <td>Device driver is unloadable.</td> </tr> <tr> <td>0x1000</td> <td>Time-outs five times longer than normal.</td> </tr> <tr> <td>0x4000</td> <td>Driver buffers write requests and pre-acknowledges success to application.</td> </tr> </tbody> </table>	0x001	Device supports variable length records.	0x008	Device can backspace over files (as in the <code>'mt bsf'</code> option).	0x010	Device supports backspace record (as in <code>'mt bsr'</code>).	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 pre-acknowledges success to application.
0x001	Device supports variable length records.																			
0x008	Device can backspace over files (as in the <code>'mt bsf'</code> option).																			
0x010	Device supports backspace record (as in <code>'mt bsr'</code>).																			
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 pre-acknowledges success to application.																			

Parameter	Value	Meaning
		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.
		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 pre-acknowledge 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>	4	There are four densities following in the parameter list.
<density 0>	0x00	Creates a device file with compression disabled.
<density 1>	0x44	The Ultrium 3 density code for data compression with Ultrium 3 media
<density 2>	0x46	The Ultrium 4 density code for data compression with Ultrium 4 media
<density 3>	0x58	The density code for data compression enabled by default.
<default density>	3	Density 3 (0x58) is the default for Generation 5 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 ⁸ of the device.
lun	0	Specifies the LUN for the device.

7 Verifying the installation

Verifying the installation of the drive (UNIX)

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 the installation has been performed correctly.

In outline, the procedure is as follows:

1. Check the tape drive responds to a rewind command.
2. Write test data to a tape.
3. Read the test data from the tape.
4. Compare the data read from the tape with the original data on disk.

To verify the installation:

1. Test the SCSI 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 rewind
```

For example, on HP-UX 11i v2:

```
% mt -f /dev/rmt/c4t3d0BESTnb
```

For example, on HP-UX 11i v3 (using a persistent device file):

```
% mt -f /dev/rtape/tape0_BESTnb rewind
```

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:

<code>c</code>	Create a new archive (backup file) on the device.
<code>v</code>	Operate in verbose mode.
<code>f</code>	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 in the appropriate operating system chapter. The arguments are as follows:

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

 **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>
```

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

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

Example

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

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
```

Note that the original filename is *not* prefixed with `'.'`.

8 Support and other resources

Related documents

For a general background to LTO technology and licensing, go to <http://www.lto-technology.com>.

See http://www.t10.org/t10_main.htm for INCITS SCSI Primary Commands—3 (SPC-3), SCSI Streaming Commands (SSC-3) and other specifications

Copies of documents of other standards bodies can be obtained from:

INCITS 11 West 42nd Street New York, NY
10036-8002 USA

ISO CP 56
CH-1211 Geneva 20
Switzerland

ECMA 114 Rue du Rhône
CH-1204 Geneva
Switzerland

Tel: +41 22 849 6000
Web URL: <http://www.ecma.ch>

Global Engineering Documents 2805 McGaw
Irvine, CA 92714
USA

Tel: 800 854 7179 or 714 261 1455

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	<i>Beginning Of Tape</i> . The first point on the tape that can be accessed by the drive.
buffered mode	A mode of data transfer in write operations that facilitates tape streaming. It is selected by setting the Buffered Mode Field to 1 in the SCSI MODE SELECT Parameter List header.
compression	A procedure in which data is transformed by the removal of redundant information in order to reduce the number of bits required to represent the data. This is basically 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 neither a channel nor 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. On the other hand, data is not flushed to tape in response to a filemark command.
infinite flush	By default, the buffer in the drive is flushed every 5 seconds. Infinite flush avoids frequent starting and stopping of the mechanism when using a very slow application. It also avoids losing capacity through the flushing of partly written

groups. On the other hand, infinite flush means that data can remain in the buffer for very long periods of time, and could be lost in the event of a power failure.

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 a 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.

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