
**HP World 2001
Tutorial #285**

Managing and Configuring Tape Libraries on HP-UX

**Presented by: Rick Ridderhoff
Hewlett-Packard Education Services
2001 Butterfield Rd.
Downers Grove, IL
Email: richard_ridderhoff@hp.com
Fax: 630-724-5730**

Presentation Overview

Objectives

Upon completion of this tutorial, you will:

- Understand the HP 9000 hardware addressing for the library hardware presented by ioscan
- Configure and test library robotics device files with utilities such as mknod, mt, and mc
- Troubleshoot device operations if backup failures occur

Intro. SLIDE: Title

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Managing and
Configuring Tape
Libraries on HP-UX
Servers

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Notes

1. SLIDE: Overview

Overview

- Library Components
- HP 9000 Hardware Addressing
- Device File Configuration
- Troubleshooting/Testing Device Operations

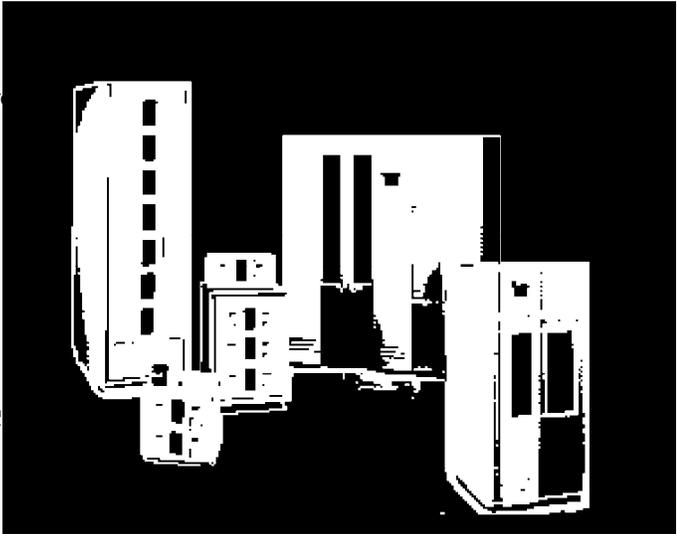
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Notes

2. SLIDE: Tape Library Terminology

Tape Library Terminology

- Tape Library: A data storage system
- Library Components
 - Tape Drive(s)
 - Repository Slots
 - Media Exchanger
 - Barcode Scanner
 - MailSlot(s)
 - Management Interface C



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Notes

Tape Library

The tape library is a complex system used for offline data storage. Data is typically written onto high capacity tape cartridges by utilizing multiple tape drives. The tape library system differs from a tape drive in that tapes may be loaded and unloaded automatically from the tape drive.

Library Components

Most tape library systems contain some or all of the following components:

- Tape Drives: similar to a stand-alone drive
- Repository Slots tape storage positions
- Media Exchanger the robotic mechanism that moves tape cartridges
- Barcode Scanner device used to read the barcode label on the tape cartridges
- Mail-Slot provides the import/export capability; may be repository slots or an entry/exit door on the outside of the library
- Management Interface a network interface available on many newer HP libraries

3. SLIDE: Mail Slot

MailSlot

- ExternalAccess
 - enter/eject tapes

- Configured in Repository
 - 0,1,or 5 slots



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Notes

Mail Slot

On some older libraries the mail-slot was accessible from the outside of the library. This mail-slot allows for easy insertion and removal of tape cartridges.

The most common means of ejecting tapes with software is to access the mail-slot. This is also commonly referred to as the import/export slot, or just the export slot.

The newer library systems from HP now use a range of the repository slots to serve as the mail-slots. These usually range from 0, 1 or 5 slots and are configurable by the library operation interface.

4. SLIDE: HP 9000 Hardware Addressing

HP 9000 Hardware Addressing

- Components of Hardware Path
 - Bus Adapter Path
 - SCSI Target
 - Device Unit (SCSI LU)

- Fibre Channel/SCSI						
ext_bus	13	1/2/0/0.8.0.255.7	fcpdev	CLAIMED	INTERFACE	FCP Device Interface
target	17	1/2/0/0.8.0.255.7.11	tgt	CLAIMED	DEVICE	
autoch	1	1/2/0/0.8.0.255.7.11.0	schgr	CLAIMED	DEVICE	HP C7200-8000
- SCSI						
ext_bus	2	56/52	scsil	CLAIMED	INTERFACE	HP 28655A - SE SCSI ID=7
target	4	56/52.4	target	CLAIMED	DEVICE	
spt	0	56/52.4.0	spt	CLAIMED	DEVICE	HP C5177-7000



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Notes

Host Connections

The tape library systems typically connect to the Host Bus Adapter of the host system or systems. The most common interface is SCSI, although Fibre Channel connections are becoming increasingly common. In some cases, the library system will connect to the host via fibre channel and then to the internal drives and library controller with SCSI. When this is the case, the library includes a protocol converter interface card.

Another possibility is the connection of the SCSI library to an SCSI/Fibre bridge device. In this case the library is SCSI, but is connected to the host through the bridge device.

HP 9000 Hardware Addressing

The hardware addressing for the SCSI library is essentially the same regardless of whether the library is connected directly to the host or by way of some protocol conversion device that is internal or external to the library. The three main components of the hardware path displayed by ioscan include: the controller (host bus adapter), the SCSI target ID, and the device unit number, or SCSI LU.

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Knowledge of the hardware used to connect the library system is critical to the understanding of the device file that is used to control the library operations.

In the case of the SCSI connected device, the controller is simply the system path from the system bus to the SCSI device, and it will be displayed as a class of device called `ext_bus` by the `ioscan` command.

In the case of Fibre Channel, the actual hardware path for the controller can represent several different parameters including the back-plane slot of the interface card and all of the Fibre Channel values. The `ioscan` command, however, still displays the `ext_bus` as the class of the device controller. It does not matter from a local perspective, if the device is on a public or private loop, `ioscan` will still show the hardware path to the library controller.

The key to the configuration of the library controller device is the location and identification of the `ext_bus` interface that connects to the library device. Once this is known we can easily locate the SCSI target and LU of the controller that needs to be configured.

The three components will be used to construct the minor number (once converted to hex) used to create the device file for the library controller.

5. SLIDE: Device File Components

Device File Components

```
crw-r--r-- 1 root sys 241 0x024000 Jan 31 17:06 /dev/dltrobot
```

- Type
- Major Number
- Minor Number
- Device Name

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Notes

The Device File

The device file is needed by applications as well as HP-UX commands that access the library for backup, restore and media management tasks.

The components of the device file include the mode, major number and minor number as well as the device name. The mode used for the library device is character, the other choice of mode is block mode, and this is used for disk type devices. The major number is the numeric value associated with the device driver. The minor number is the hardware path converted to hexadecimal.

In order to create a device file for use in controlling the tape library, you will need to gather all three components.

6. SLIDE: Device File Tools

Device File Tools

- `mknod` - manually create device file
 - Synopsis:
`mknod <name> <type> <major> <minor>`
- `insf` - automatically create device file(s)
 - Synopsis
`insf [-d driver] [-H hardware path]`
- `lsdf` - display device file properties
- `lsdev` - list available device drivers in the system
- `ioscan` - scan and display all system devices

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Notes

Device File Tools

The most common tools associated with device files are listed above. For this tutorial, the `mknod` command will be used to create the device for the library controller. The `lsdev` command will be used to collect the major number of the necessary driver, and `ioscan` will be used to display the hardware path needed to construct the minor number.

7. SLIDE: Drivers for the Library Control Device

Drivers for the Library Control Device

- `schgr` autochanger driver
- `sctl` SCSI pass-thru driver (HSC, PCI)
- `spt` SCSI pass-thru driver (HP-PB)

- Use `lsdev` to list device drivers (Character = major number)

```
# lsdev -d spt -d sctl -d schgr
```

Character	Block	Driver	Class
203	-1	sctl	ctl
231	29	schgr	autoch
241	-1	spt	spt

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Notes

The HP tape libraries may generally be supported on several different HP 9000 servers such as the legacy HP 9000's like the E-series to T-series, the more recent K and A-class, or the L, and N-class servers. In each case there may be different system drivers needed to support the device for the library controller.

Systems that have the library connected to a HP-PB card slot will need to use the `spt` driver. Systems that have HSC or PCI will use the `sctl` driver, or may use `schgr` if it is configured into the system. Most HP-UX systems prior to HP-UX 11.11 (11i) do not have the `schgr` driver configured by default; it is available and supported but not as widely used as the `sctl` driver. The `schgr` driver is also used for HP Magneto-Optical (MO) Libraries, which are not covered by this tutorial. The reason for the block mode support for `schgr` is the use for MO and access to both sides of the MO platters.

The HP-UX command `kmsystem` may be used to check if the drivers are available on the system. This command will also display the configured state for the driver. If the drivers are configured into the system, the `lsdev` command will display them along with their character major number.

The output above shows the major number 203 for the `sctl` driver, 231 for `schgr`, and 241 for `spt`. It is not very common to have all three drivers on the same system but these drivers may be used for more

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than just tape libraries and so they are all available on the sample system from where this data was taken.

8. SLIDE: Convert Hardware Path to Hex

Convert Hardware Path to Hex

- Fibre Channel/SCSI			
ext_bus	13	1/2/0/0/8/0/255/7	fcpdev CLAIMED INTERFACE FCP Device Interface
target	17	1/2/0/0/8/0/255/7/11	tgt CLAIMED DEVICE
autoch	1	1/2/0/0/8/0/255/7/11/0	schgr CLAIMED DEVICE HP C7200-8000

- SCSI			
ext_bus	2	56/52	scsil CLAIMED INTERFACE HP 28655A - SE SCSI ID=7
target	4	56/52/4	target CLAIMED DEVICE
spt	0	56/52/4/0	spt CLAIMED DEVICE HP C5177-7000

0xnntd00 → c##t##d##

(output from the "ioscan -f" command)

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Notes

The Hardware Path Converted to Hex

The minor number for the device is taken from the output of the ioscan command. The command output displays all the hardware paths for the connected devices. Once the hardware path is known, it must be converted to hex to be used as the minor number.

The diagram above illustrates how to locate the three components needed to construct the minor number. They include the controller, the target and the device unit number (the target is commonly called the SCSI ID, and the device unit number is called the SCSI LU).

To convert the hardware path of the device to hex, we must locate break the hardware path into its three components, and then isolate them. Once isolated, the Instance (I column) number of the ext_bus is easily identified.

Next locate the SCSI target; it will be the last number in the target output line. The last component is usually a zero (0), but for the HP six tape autoloaders it will be a one. This device unit number is very often displayed with an UNKNOWN, UNCLAIMED S/W state and H/W type. This is the case because of the lack of the schgr driver being configured into the kernel.

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In both of the samples of ioscan output shown above, the drivers are known to the kernel for the PCI bus in sample 1, and the HP-PB bus in sample 2.

9. SLIDE: Create the Library Device File

Create the Library Device File

Class	I	H/W Path	Driver	S/W State	H/W Type	Description
ext_bus	1	8/4	c720	CLAIMED	INTERFACE	GSC add-on Fast/Wide
SCSI Interface						
target	3	8/4.0	tgt	CLAIMED	DEVICE	
unknown	-1	8/4.0		UNCLAIMED	UNKNOWN	HP C7200-8000
target	4	8/4.1	tgt	CLAIMED	DEVICE	
tape	1	8/4.1.0	stape	CLAIMED	DEVICE	QUANTUM DLT8000
			/dev/rmt/lm		/dev/rmt/clt1d0BEST	
			/dev/rmt/lmb		/dev/rmt/clt1d0BESTb	
			/dev/rmt/lmn		/dev/rmt/clt1d0BESTn	
			/dev/rmt/lmnb		/dev/rmt/clt1d0BESTnb	

- `mknod /dev/lib_cntl c 203 0x010000`

8 bit major number 8 bit controller, 4 bits SCSI Target, 4 bits LU

24 bit minor number 8 bit device options, set to 0

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Notes

Create the Library Device File

To convert the hardware values from `ioscan` to hexadecimal for the minor number convert them each separately.

The minor number is stored as a 24-bit value in the inode of the device file. The number consists of 8 bits for the hexadecimal value of the controller Instance number, 4 bits for the hexadecimal SCSI id, and 4 bits for the SCSI LU, also in hexadecimal. The last 8 bits of the minor number are reserved for device options, and are usually set to zero (0).

Notice in sample above, the highlighted entry. This is the way that tape libraries most often show up in the `ioscan` for systems prior to HP-UX 11.11, due to the lack of inclusion of the `schgr` driver.

Using the `mknod` command, construct the device file as follows:

```
mknod <device name> <mode> <major number> <minor number>
```

```
mknod /dev/lib_cntl c 203 0x010000
```

10. SLIDE: Bind the Device Driver

Bind the Device Driver (optional)

- `ioscan -M sctl-H 8/4.0.0`
- `ioscan -fkn`

Class	I	H/W Path	Driver	S/W State	H/W Type	Description
ext_bus	1	8/4	c720	CLAIMED	INTERFACE	GSC add-on Fast/Wide

SCSI Interface						
target	3	8/4.0	tgt	CLAIMED	DEVICE	
ctl	4	8/4.0.0	sctl	UNCLAIMED	UNKNOWN	HP C7200-8000
target	4	8/4.1	tgt	CLAIMED	DEVICE	
tape	1	8/4.1.0	stape	CLAIMED	DEVICE	QUANTUM DLT8000
			/dev/rmt/lm		/dev/rmt/ctl1d0BEST	
			/dev/rmt/lmb		/dev/rmt/ctl1d0BESTb	
			/dev/rmt/lmn		/dev/rmt/ctl1d0BESTn	
			/dev/rmt/lmnb		/dev/rmt/ctl1d0BESTnb	

- S/W State and H/W Type are unchanged by manual binding

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Notes

Bind the Device Driver

The `ioscan` output will not reflect the fact that you have manually constructed a device file for an “unknown, unclaimed” device. The `ioscan` output on the previous page will not change as a result of using the `mknod` command. This does not affect the ability to use the device, but most system administrators would like to see a “cleaner” `ioscan` report.

The `ioscan` command offers a partial solution, in that the driver and a particular hardware path may be manually bound together. The example above binds the `sctl` driver to the specific hardware path. Once bound the device is assigned an individual instance number and the device class changes from unknown to `ctl`, the driver is also then recognized by the kernel. The kernel does not recognize the device file for the manual binding in this case because a “generic” SCSI driver is used. The `sctl` driver is considered to be a SCSI pass-thru driver, and is not device specific. This is also the reason for the lack of automatic binding of this driver to the device. Neither the `mksf` nor the `insf` utilities are capable of creating the device file for the library controller using the `sctl` device driver.

11. SLIDE: Automatic Device Configuration

Automatic Device Configuration

- `ioscan -fk`

```
Class      I  H/W Path  Driver      S/W State H/W Type  Description
=====
ext_bus    1  8/4      c720        CLAIMED   INTERFACE GSC add-on Fast/Wide
SCSI Interface
target     3  8/4.0    tgt         CLAIMED   DEVICE
autoch     0  8/4.0.0  schgr       CLAIMED   DEVICE    HP      C7200-8000
                                         /dev/rac/clt0d0
```

- Device file automatically generated when "schgr" driver is configured into the system
- Device directory is `/dev/rac`, for character (raw) mode autochanger devices

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Notes

Automatic Device Configuration

If you would like HP-UX to automatically generate device files for a new tape library, you will need to first add the schgr driver to the kernel. This driver is not included by default in the kernel in HP-UX prior to version 11.11.

Once the schgr driver is added, and the system rebooted, you will find the device files for the "raw" or character mode autochangers in the `/dev/rac` device file directory. You may simply use the "-n" option to the ioscan command to display the auto-generated device file.

The quickest way to find the device file associated with the library is to list the system devices as follows: (note the class may be different on different HP-UX systems)

```
ioscan -fkC autoch
```

12. SLIDE: Device Operation Commands

Device Operation Commands

- HP-UX provides the "mc" command
 - Synopsis:

```
mc -p <device file> <options.. >
```
 - or
 - ```
export LIBRARY=<device file>
```
  - ```
mc <options.. >
```

- HP OpenView OmniBack provides the "uma" utility
 - Synopsis:

```
/opt/omni/bin/uma -ioctl <device file>
```

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Notes

Most library systems are employed as output devices for 3rd party backup products such as HP OpenView OmniBack or one its competitors. Prior to turning the device over to the backup software we should test its operation by way of our control device.

The HP-UX operating system provides a media changer command, "mc" for use with library devices and autochangers. This command is useful for testing the device operations as well as for controlling the device.

Very often system administrators are faced with failed backups due to incorrect device configuration or device errors or conflicts.

The rest of this presentation will deal with manual device interactions. Understanding what tools are available and how to use them will allow you to effectively troubleshoot failed backup jobs.

These tools when used in conjunction with your backup software should allow you to control and manage tape libraries without having to enter the data center to check the device operations.

13. SLIDE: Testing Device Communications and Status

```
Testing Device Communications and
Status (m c)

# export LIBRARY=/dev/rac/c1t0d0
# mc -q
Vendor ID      : HP
Product ID    : C7200-8000
Product Rev   : 1140

# mc -e S
NUM_ST_ELEMENTS 35

# mc -e D
NUM_DT_ELEMENTS 4

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```

Notes

Testing Device Communications and Status

To use the “mc” command, you may first create an environment variable with the device path to the library controller. If the LIBRARY variable is not created, each invocation of the mc command must include the “-d” option followed by the device file path. All of the examples here will use the exported LIBRARY variable as listed above.

To verify device communication to the host system, use the “-q” option to inquire about the device connected to the system. Receiving some information back the command is a good sign that the device file is communicating with the library controller.

Once this communication is established as operational, several other possibilities exist to remotely manage the library. Two examples above show how to inquire about the number of repository slots as well as the number of tape drive elements. Each element is an addressable tape position.

14. SLIDE: Device Element Status

Device Element Status (mc)

```
# mc -r D (Drive Report)
DT_slot_1 FULL CLN904
DT_slot_2 EMPTY
DT_slot_3 EMPTY
DT_slot_4 EMPTY

# mc -r S (Storage Slot Report)
ST_slot_1 FULL CLN904
ST_slot_2 EMPTY
ST_slot_3 EMPTY
ST_slot_4 FULL DF3501
ST_slot_5 EMPTY
...
```

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Notes

Device Element Status

The “mc” command may be used to check the status of each addressable tape position within the tape library.

The drive report above includes the drive status, as well as the barcode label of the tape that is within the device. The prefix common to the cleaning tapes is CLN, many applications will recognize these as the cleaning cartridge if this barcode labeling scheme is used. The labels shown above are from the sample set that may be included with your library if it was purchased from HP.

Most tape libraries will read the barcode labels when new tapes are inserted into the library, and then cache them for quicker access to inquiries.

15. SLIDE: Testing with the OmniBack Media Agent

```
Testing with the OmniBack Media Agent

/opt/omni/sbin/uma -ioctl /dev/rac/clt0d0
*** PROGRAM: UMA    VERSION: HP OpenView OmniBack II A.03.50

*** Copyright (C) 1996 Hewlett-Packard Company
*** License is restricted for use with licensed
*** HP OpenView OmniBack II products.

/dev/rac/clt0d0> inq
SCSI Inquiry:
      Type:                8
      Vendor ID:           "HP          "
      Product ID:          "C7200-8000   "
      F/W Revision:       "1140"

/dev/rac/clt0d0> test
Device C7200-8000    ready.
```

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Notes

HP OpenView OmniBack includes distributable agents to control tape devices. The OmniBack Media Agent is needed in order to use perform these tests. OmniBack is briefly covered here since many HP customers are using this client-server backup application.

The component available with OmniBack is the uma utility. This Universal Media Agent (uma) is an interactive program; unlike the HP-UX command “mc” which requires a new invocation for each activity.

The examples shown above essentially show the same information that is available from the “mc” command. The “inq” is used to check library access and verify operation of the device file. Keep in mind that we are not recommending that you need to manually control the device for your backup application, but you may chose to do this when things are not working as expected.

We recommend to OmniBack customers to “exercise” the “uma” to verify OmniBack’s access to the newly configured tape libraries.

16. SLIDE: Testing with the OmniBack Media Agent

```
Testing with the OmniBack Media Agent

# print addr | uma -ioctl /dev/rac/clt0d0 -tty
*** PROGRAM: UMA          VERSION: HP OpenView OmniBack II A.03.50

*** Copyright (C) 1996 Hewlett-Packard Company
*** License is restricted for use with licensed
*** HP OpenView OmniBack II products.

/dev/rac/clt0d0> addr
Element Addresses (T=Transport, X=Im/Export, D=Drive,
S=Storage):
      Transport:      0 .. 0          (T1 .. T1)
      Im/Export:     20 .. 24         (X1 .. X5)
      Data Drive(s):  1 .. 4          (D1 .. D4)
      Repository:    31 .. 65         (S1 .. S35)
/dev/rac/clt0d0> <EOD>
```

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Notes

The “uma” utility may be driven from a shell script, since it is able to read commands sent from the stdin. You may pipe commands in when “uma” is invoked with the “-tty” option. This can be a very powerful feature to take advantage of when trying to automate tape movements outside of backup jobs executing.

The “uma” can also take advantage of the shell here document, or as it is sometimes called, the here list feature. This would involve the use of the “<<” followed by a termination string. This would allow “uma” to read from a list of commands, one after the other.

17. SLIDE: Exercising the Media Changer

Exercising the Media Changer (mc)

```
# mc -s S4 -d D1 (move tape from slot 4 to drive 1)

# mc -s D1 -d S4 (move tape from drive 1 to slot 4)

# mc -rDIMS | grep FULL
IE_slot_1 FULL DF3500
DT_slot_1 FULL DF3501
ST_slot_1 FULL CLN904
```

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Notes

Exercising the Media Changer

Once we have established successful contact with the library device via the device file we created, it is not a bad idea to test the device operations. Once again we can call upon the “mc” command to exercise the library robotics.

Operations such as loading and unloading tapes are very useful tests of the library. The examples shown above move tapes from repository slots to drives and back. The report feature of “mc”, the “-r” option allows us to check all of possible tape positions within the library. The four possible positions are the repository slots (ST), import/export slots (IE), the media transport (MT) or tape drives (DT). The arguments to the “-r” option, DIMS allow each position to be checked.

When backups fail, the “mc -rDIMS” command may be used to check on the current positions of tapes within the tape library. Other “mc” commands may be used to move tapes back to repository slots from the drives if the backup application didn’t clean up after a failure.

18. SLIDE: Exercising the Media Changer

```
Exercising the Media Changer (uma)

# /opt/omni/sbin/uma -ioctl /dev/rac/ctl0d0
*** PROGRAM: UMA          VERSION: HP OpenView OmniBack II A.03.50

*** Copyright (C) 1996 Hewlett-Packard Company
*** License is restricted for use with licensed
*** HP OpenView OmniBack II products.

/dev/rac/ctl0d0> move S4 D1
/dev/rac/ctl0d0> exit

# print stat | uma -ioctl /dev/rac/ctl0d0 -tty -barcode| grep -i full
      20 X1   Full   "DF3500" ""
       1 D1   Full   "DF3501" "" from S4
      31 S1   Full   "CLN904" ""

xxxxxx xx x
```

Notes

Exercising the Media Changer

Once again, OmniBack provides similar capabilities to the “mc” utility. The ability to relocate tapes within the library is very essential to remote management of such a device. OmniBack also provides a graphical user interface called the “Library Manager” that mirrors this functionality.

The “stat” command within “uma” provides the same report as we previously saw with “mc.” Notice that “uma” requires the –barcode option in order to display the barcode labels for tapes.

19. SLIDE: Checking Drive Status

Checking Drive Status (m t)

```
# mt -f /dev/rmt/1mnb status
Drive: QUANTUM DLT8000
Format:
Status: [0]          (empty tape device)
File: 0
Block: 0
# mc -s S4 -d D1
# mt -f /dev/rmt/1mnb status
Drive: QUANTUM DLT8000
Format:
Status: [41118985] BOT online compression immediate-report-
mode
File: 0
Block: 0
```

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Notes

In most cases, when backup applications are finished with their activities, they automatically put tapes back to their starting positions. A typical backup should include the following basic processes or tape controls:

- select and load a tape from a repository slot into the tape drive
- write data to the tape (perform the backup)
- rewind the tape to the beginning
- eject the tape from the drive back to the repository slot

When all is working perfectly, the above scenario should be executed. However this is not always the case. What happens when a backup process stops in the middle? Does the application still clean it up? If the answer is no, then we would have to perform some of the steps of the cleanup manually.

In addition to the “mc” command for manually controlling the library operations, the “mt” command may be used to interact with a tape drive. The “mt” command gives us the ability to check status, rewind, fast-forward and test the tape drives operations.

The sample above demonstrates the kind of interaction that is very useful in determining the state of a DLT tape drive once a tape is loaded. The DLT mechanism, unlike DDS, has two

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states available while a tape is inserted into the drive. The states, offline and online indicate the readiness of the device to be used for writing. Mechanically, the DLT tape must be inserted into the unit and extended onto the pickup reel and positioned to the beginning of tape marker (BOT) to be considered online. If the tape drive is taken offline, the tape may then be ejected from the drive.

If a backup job were to fail, a tape may be “stuck” in the drive. The tape may or may not be offline and ready to be ejected. The “mt” command will allow us to effectively communicate with the tape drive to find out exactly what’s going on.

Note: Hardware failures are not addressed by this tutorial.

20. SLIDE: Testing the Tape Drive

Testing the Tape Drive (m t)

```
# export TAPE=/dev/rmt/c1t1d0BEST
# mt status
Drive:QUANTUM DLT7000
Format: DLT 85937 bpi 52 quad-tracks compressed (70GB)
Status: [41118585] EOD online compression immediate-
report-mode
File: -1
Block: 0
# mt offl
# mt -f /dev/rmt/1mnb status
tape hardware path 56/48.1.0.0 not online during open
# mc -s D1 -d S1
```

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Notes

The “mt” command allows for manipulation of the tape within the drive. In addition to querying the status of the device it is possible to move the tape forward and reverse. It is also possible to put the tape offline. The offline mode is more useful for DLT tapes than for DDS due to the fact the DLT tapes require two operations to remove a tape. The first step in removing a tape is to take the drive offline, and then the tape may be ejected.

The procedure listed above could be executed to cleanup after a failed backup job. First the drive used for the failed backup is checked, and found to contain a tape that is still in the online state. The “offl” command within “mt” rewinds the tape to the beginning, then takes the drive offline. The status is again checked to confirm the offline state. (This query can take some time to return the status, such as 30 or more seconds.) The tape is moved back to a repository slot once taken offline.

It is worth mentioning that the “mc” command is able to perform the offline function automatically when we request that a tape is moved from a drive to a storage slot. By interacting with the tape device we can confirm that it is responding correctly to the SCSI commands.

Effective troubleshooting usually involves testing multiple components to find where a problem exists. The commands covered here allow us to exercise mechanically the loading and unloading of tapes, as well as the reading of the tape marks if forward or reverse movement commands are used.

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This testing does not guarantee that the drive will write data onto the tape. That is best accomplished by utilizing commands associated with backup software. Media protection from overwrites, and data protection in general must be considered before any write operation is executed outside the realm of application controlled backup operations. In order to completely test a tape drive a scratch tape will likely be needed, at least one that can be overwritten without regard to any data loss.

21. SLIDE: Check Shared Device Status

Check Shared Device Status (st)

```
# ll /dev/scsi_spt (st command requires a sctl device file)
crw-r--r--  1 root  sys  203 0x010000 May 31 10:22
/dev/scsi_spt/lib1

# st -f $PWD/lib1 -s (check status of a shared fiber
channel device)
Device is reserved by another host
# st -f $PWD/lib1 -r (reset the device to reclaim a reserved
device)

# st -f $PWD/lib1 -s (status while the bus is resetting)
Device unit attention

# st -f $PWD/lib1 -s (verify status after the reset operation)
Device is OK and available
```

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Notes

One final aspect of tape library management deals with device sharing. It is increasingly common to have multiple hosts connected to the library via Fibre Channel. While it is not the intention of this tutorial to address all of the issues related to that technology, it is necessary to mention an additional possible cause of backup failure. SCSI devices today, by way of their drivers and commands that access them, allow for a reserve and release operation.

Tape devices may be reserved by one of the hosts that are connected to the device, thus preventing another open or access to the device by another connected host. All of the commands previously mentioned such as mc, mt, and uma are all able to access the reserve and release command to control access to a library or tape device. The reserve/release is not meaningful for locally attached SCSI devices.

Many backup applications provide the reserve/release option for their device configuration if they support Fibre Channel.

The trouble with the reserve/release function is that if one system issues the reserve, and then fails, the other system will not have access to the devices. Locally “mt” is able to release the previously reserved device, but the release must come from the same system that issued the reserve. The “st” command can remedy this situation.

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The “st” command is able to release a previously reserved device, even if the system issuing the release did not reserve it. Caution must be exercised here so that accidental releases are not issued for active devices, and thus requires root access for execution. Data loss may result if a device is released during a backup operation.

The “st” command is able to check the status on a library controller as well as the tape devices, and is able to issue the reclaim (release) for both as well.

The SCSI pass-through device driver (sctl) must be used with “st”. Therefore, the mknod commands covered previously in this tutorial become essential.

22. SLIDE: Summary

Summary

- Tape libraries are relatively easy to manage once fully understood
- Creation of a device file to control the library may be required
- HP-UX provides sufficient commands to control and troubleshoot library operations
- mt, mc, and st may need to be installed from a patch if your system does not have them already

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Notes

Thank you for attending “Managing and Configuring Tape Libraries on HP-UX.”