

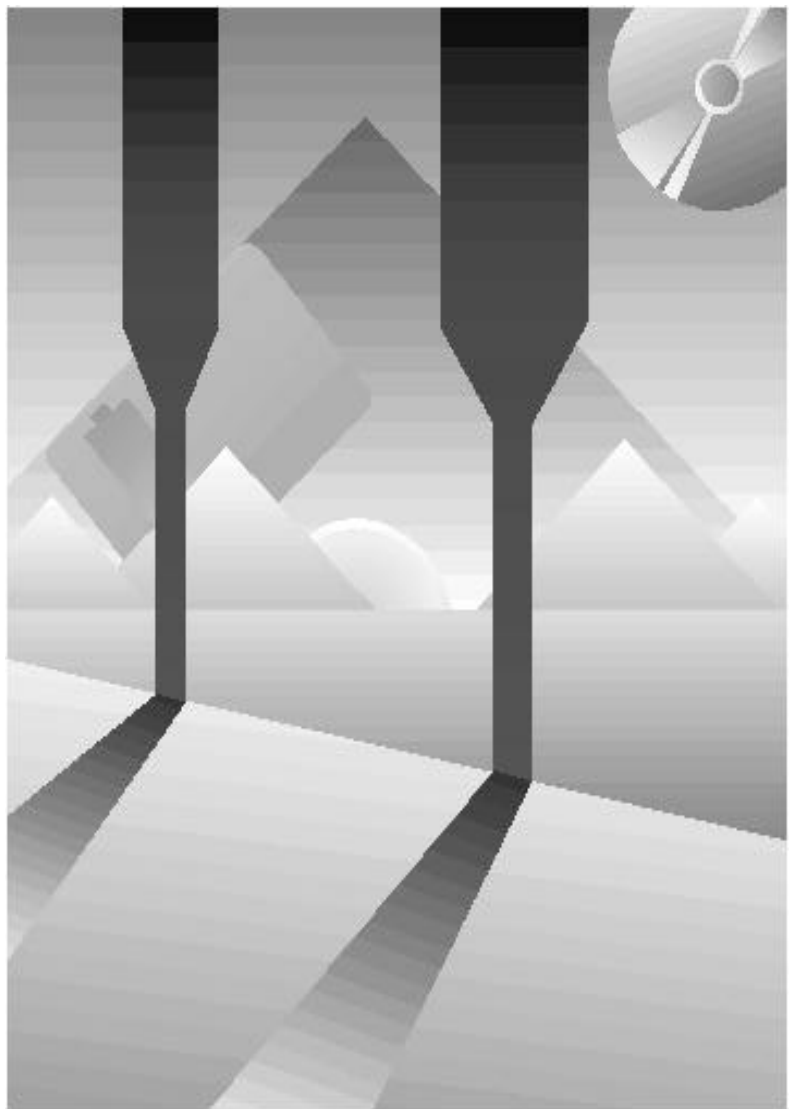
COMPAQ

Disk Mirroring with VERITAS VxMirror

Compaq TechNote

Includes information on:

- Software installation
- Configuring disk mirroring
- Recovering from disk failures



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COMPAQ TECHNOTE FOR SCO UNIX

DISK MIRRORING WITH VERITAS VxMirror

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Chapter 1

INTRODUCTION

This TechNote focuses specifically on VERITAS VxMirror running under SCO UNIX V 3.2.4 on a Compaq ProSignia with two identical SCSI hard disks that have the SCSI IDs set to 0 and 1. Each drive is assumed to have a Compaq Configuration partition. This TechNote describes the process of installing and configuring VERITAS disk mirroring and the process of recovering from a hard disk failure. VxMirror is included with SCO UNIX Software from Compaq, version 2.0.

TECHNOTE FOCUS

This TechNote specifically addresses the replicated site environment, which includes terminal-based vertical applications used in businesses. The information in this document deals with inexpensive and reliable mirroring to ensure increased system uptime.

Use Table 1-1 to locate the information you want in this TechNote.

Table 1-1
TechNote Chapter Summary

Chapter 2 INSTALLING VERITAS VxMirror	Provides procedures for installing VERITAS VxMirror and setting up a second drive as a mirrored drive.
Chapter 3 RESTORING VERITAS MIRRORING ONTO A SECONDARY DRIVE	Provides the procedure for restoring a secondary drive using VERITAS VxMirror.
Chapter 4 RESTORING VERITAS MIRRORING ONTO A PRIMARY DRIVE	Provides the procedure for restoring a primary drive using VERITAS VxMirror.

Continued



Table 1-1 *Continued*

Appendix A MULTIVENDOR INTEGRATION FROM COMPAQ	Provides information on how to order Compaq TechNote subscriptions and individual Compaq TechNotes.
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VERITAS DISK-MANAGEMENT SOFTWARE PRODUCT SUMMARY

VERITAS disk-management software products are used in systems with multiple hard disk drives. They provide a number of features for improving both disk fault tolerance and disk management. Compaq currently offers four VERITAS disk-management software products that run under SCO UNIX. They can be classified as "middleware" software products because they are designed to improve the overall UNIX system function by increasing system availability and improving system performance.

Table 1-2 lists the four COMPAQ software products and their features.

Table 1-2
COMPAQ Product Summary

Product	Features
VERITAS VxMirror from Compaq (VERITAS VxMirror)	Provides disk mirroring.
VERITAS Enterprise Bundle from Compaq (VERITAS Volume Manager - VxVM)	Provides disk mirroring, disk striping, and character-based real-time disk administration for systems with a single processor.
(VERITAS Visual Administrator - VxVA)	Provides a graphical interface for real-time disk administration.

Continued

Table 1-2 Continued

Product	Features
VERITAS Multiprocessor Upgrade from Compaq (VERITAS Volume Manager with Multiprocessor Support - VxVM MPX)	Provides disk mirroring, disk striping, and character-based real-time disk administration for systems with multiple processors.

MARKETS FOR VERITAS DISK-MANAGEMENT PRODUCTS

VERITAS products can be used in multiple environments. Three of these environments are:

- replicated sites
- performance-driven sites
- downsizing sites

Replicated Sites

Replicated sites are small environments, such as fast-food outlets or video stores where there are many identical outlets that do not require large numbers of simultaneous users at each store. Typically, these sites do not require expensive high performance configurations. For replicated sites, VxMirror offers inexpensive disk mirroring.

Performance-Driven Sites

Performance-driven sites are mid-sized environments that require increased system performance with a larger number of users. These sites do not maintain a staff of data processing personnel to monitor system performance. For these sites, VxVM offers disk mirroring and disk striping.

Downsizing Sites

Downsizing sites are large corporate sites that have a staff of data processing personnel. These sites are looking for all of the features offered by VxVM: disk mirroring, disk striping, real-time data relocation, and online system administration.

VERITAS DISK-MANAGEMENT PRODUCT CONCEPTS

System availability or "uptime" is the amount of time the system is available for business data processing services. Two basic factors that can reduce uptime are hardware failures and system administration tasks. VxVM has features that improve uptime by minimizing the effects of disk failure and disk-related administration tasks.

Hard Disk Fault Tolerance - VERITAS Mirroring and Duplexing

Although any hardware component can fail, the most common hardware failure involves a hard disk drive. If the System Administrator has recent disk backups, the system must be taken offline to replace the drive and then a new drive must be rebuilt. This process can result in significant down-time and lost productivity.

VxVM and VxMirror dramatically reduces downtime due to disk failure by providing hard disk drive mirroring. Mirroring means maintaining multiple copies of a filesystem on different drives so that in the event of a hard disk failure, the system can continue to function using the "mirrored" filesystem.

To reduce exposure to hard disk drive controller failures, a second hard disk host controller may be used to control the secondary drive. This is often referred to as "controller duplexing." VERITAS can mirror across these controllers, so in the event that one of them fails, the system continues to run.

NOTE: There are situations where a bad controller must be removed in order for the system to continue functioning.



System Availability - VERITAS Real-Time System Administration

Some common system administration tasks are: performing system backups, changing the filesystem size, adding a new drive to the system, and moving data to other drives to reduce I/O bottlenecks. To perform each of these tasks, the System Administrator must take the system offline. This can result in significant downtime.

VERITAS Volume Manager dramatically reduces downtime for system administration because the System Administrator can perform most of these common tasks without taking the system offline. By using VxVM, the System Administrator can perform complete backups, expand filesystems, and move data between drives while business users continue working. Additionally, if the System Administrator installs a new drive in a mirrored configuration, VxVM automatically rebuilds the drive and re-establishes mirroring via a set of background operations.

The VERITAS Visual Administrator provides an easy to use graphical interface for real-time disk administration.

SYSTEM PERFORMANCE IMPROVEMENTS

Overall system performance is greatly affected by disk I/O. The System Administrator can improve system performance by distributing reads and writes across multiple hard disks.

Disks (especially those using the SCSI interface) can allow overlapped disk seeks providing that the controller was designed to support them. Thus, one disk can position its read/write heads at the same time that another disk is doing the same thing. This improves disk throughput. VERITAS exploits overlapped seeks via its disk mirroring, disk striping, and data relocation operation.

Disk Performance - Disk Striping

Disk striping refers to writing data across multiple hard disks using a specified stripe width. For example, if the stripe width is 32 Kbytes, then the first 32 Kbytes of data are written to the first disk. The second 32 Kbytes of data are written to the second disk, and so on. The host adapter can issue parallel requests to each of the participating disks. Parallel requests reduce single-drive bottlenecks and improve system performance.

VxVM supports disk striping across multiple disks with user-defined stripe widths. Multiple disks can be used simultaneously.

Disk Performance - Real-Time Data Relocation

I/O bottlenecks can significantly reduce system performance. However, the System Administrator must usually perform I/O load balancing with the system offline. This requires removing the system from business use.

VxVM supports data relocation in real time. It also provides the tools to measure I/O performance and to detect I/O bottlenecks. If the I/O load clusters on a single drive, VxVM allows the System Administrator to move portions of the data to other drives. The I/O requests are then distributed over multiple hard disks.

Disk Reliability - Disk Mirroring

Disk mirroring can improve system performance in read-intensive environments if the system can read from either the primary disk or the mirrored disk independently. One of the most time-consuming parts of a read operation is referred to as "hard disk seek time." This is the time required for the read/write heads to move to the next data location.

Accessing two copies of the data independently can reduce the time required to access the data. VxVM supports these independent reads in a mirrored environment.



VERITAS TECHNICAL CONCEPTS

In order to provide enhanced disk management, VERITAS implements several new disk structures called volumes, plexes, and subdisks.

A VERITAS "volume" is the equivalent of an SCO UNIX divvy division. It can contain either a filesystem or a raw division. The differences between an SCO UNIX divvy division and a VERITAS volume is that the VERITAS volume can contain multiple copies of a filesystem or raw division. This is how mirroring is established.

A VERITAS "plex" is configured inside a VERITAS volume and provides the mechanism by which mirroring is implemented. A single plex contains either a filesystem or raw space. Mirroring is established when more than one plex is associated with a single volume. Each plex within a volume maintains an identical copy of the data. Hence, two plexes provides two-way mirroring and three plexes provides three-way mirroring. These plexes can be removed or inserted into a volume dynamically. When a new plex is inserted into a VERITAS volume, it is "rebuilt" in the background and then functions as another mirror within the volume.

VERITAS "subdisks" are the building blocks of a plex and are used to distribute disk I/O activity across multiple hard drives. Each plex must contain at least one subdisk. When disk striping is desired, each plex must be configured with multiple subdisks that reside on different hard drives. Separated subdisks are then used to build a "striped" plex that has a filesystem that is distributed across multiple hard drives.

In this TechNote, we are focusing on disk mirroring but not disk striping. Hence, we are not configuring plexes from multiple subdisks. Refer to the VERITAS documentation for more information on the use of subdisks.

DOCUMENTATION CONVENTIONS

Table 1-3 lists the conventions this TechNote uses to distinguish elements of text.

Table 1-3
Documentation Conventions

Convention	Use
keys	Keys appear in boldface.
KEY+KEY	When you see a plus sign between two keys, hold down the first key while you press the second key. For example, "Press the CTRL+Z keys" means press and hold down the CTRL key while you press and release the Z key.
<i>filenames, directories, screen selections, variables</i>	These items always appear in italics.
"new terms," "prompts"	The first occurrence of a technical term, prompts, and references to a word rather than a command appears in quotes.
commands, options, programs, utilities	These items always appear in boldface.
user input, screen display	Information you type exactly as it appears and information displayed on the screen appears in a different type face.
! IMPORTANT	Presents clarifying information or specific instructions.
NOTE	Presents commentary, sidelights, or interesting points of information.

Continued

**Table 1-3** *Continued*

Convention	Use
ENTER, F1-F12	These items are keys on your keyboard, not a sequence of keys to press.
type	When instructed to type information, do so without pressing ENTER .
enter	When instructed to enter information, type the information and press the ENTER key.
Select <i>item</i> → <i>item</i> → <i>item</i>	Items separated by arrows indicate items you select in a sequence.



Chapter 2

INSTALLING VERITAS

VxMirror

This chapter provides you with procedures for installing VERITAS VxMirror and setting up a second drive as a mirror drive. In this specific case of installing VxMirror in a simple mirroring configuration, we configure the hard drive with both a root and /u filesystem. By doing this, we separate the user data from the operating system files. This simplifies administrative tasks such as installing upgrades and performing tape backups.

INSTALLING VERITAS VxMirror WHILE INSTALLING SCO UNIX FROM COMPAQ

NOTE: This procedure presumes that you are installing SCO UNIX software from Compaq from a CD-ROM or tape.

The installation of VxMirror occurs during the installation of SCO UNIX from Compaq. As you follow the UNIX installation prompts, answer the questions according to your system requirements.

Table 2-1 lists the SCO UNIX installation questions that precede the VERITAS installation questions.



Table 2-1
SCO UNIX Installation Questions

Prompt

Medium selection.

Are these your current hardware settings? (y/n)

Serialization Setup screen appears.

Product Confirmation screen appears.

Software Setup screen appears.

To view the list of time zones.

Highlight your time zone.

To view possible security level selections

Review screen. If everything is correct . .

Hardware Setup screen appears.

To view a list of mouse drivers.

Highlight your selection.

To view a list of video selections.

Highlight your selection.

To view a list of network selections.

Highlight your selection.

Disk Setup screen appears.

NOTE: Keep the root filesystem large enough to handle the operating system and the user applications. The remaining space should be allocated to the /u filesystem for user data. Adjust the partition sizes to meet your requirements.

Partition Initialization screen appears.

Edit the information as necessary and press enter.



To install VERITAS VxMirror, complete the following questions.

1. If you selected Open Server Enterprise, the following question appears, "Do you wish to add the VERITAS Enterprise Bundle product? (y/n)," enter
n
2. At the prompt, "Do you wish to add the VERITAS VxMirror product? (y/n)," enter
y
3. At the prompt, "Enter the VERITAS VxMirror serial number:" Enter your serial number.
4. At the prompt, "Enter the VERITAS VxMirror activation key:" Enter your activation key.
5. At the prompt, "Is the serial number/activation key correct? (y/n)," enter
y
6. The following messages display on the screen:

```
Volume Manager will take over and manage the available free disk space.  
You can also place under the Volume Manager control
```

- ```
 1) all filesystems and the primary swap device
 2) root filesystem and swap
 3) no filesystems or swap space
```

```
Select an option [default: 1]:
```

```
Select 1) all filesystems and the primary swap device by entering
```

```
1
```

```
Installation proceeds, which takes about 30 minutes.
```

7. At the prompt, "Asks you to choose a password:" Enter 1) *Pick a password*. Enter your password, then enter it again.  
The kernel is built now.

8. A message appears: "Installation and initial configuration of Release 3.0 of SCO Open Desktop/SCO Open Server is now complete. Remove the N1 floppy diskette from drive A. Press any key to reboot."

## **VERIFYING THAT VERITAS IS FUNCTIONING**

To verify that VERITAS is working properly, produce a report by completing this procedure:

1. Remove the Volume Manager diskette, and reboot the system to multi-user mode by pressing **ENTER** at the UNIX boot prompt.
2. The following message appears:

---

Type Control-D to proceed with normal startup.

Press **CTRL + D** for multi-user mode.

3. The current time and date displays. If this is correct, press **ENTER**.
4. At the UNIX login prompt, login as *root* by entering  
root
5. When prompted, enter your password.
6. Start the VERITAS Volume Configuration Utility by entering  
mkdev vol



7. The Volume Configuration menu display:

```
**** Volume Configuration ****
1. Create Volume
2. Create a file system
3. Remove a file system
4. Reconfigure a volume
5. Display Volume Manager Reports
6. Reclaim and Defragment Free Space
7. Create Recovery Floppies

Select an option or enter q to quit:
Select Display Volume Manager Reports by entering
5
```

8. The Volume Manager Reports menu displays:

```
**** Volume Manager Reports ****
1. Volume States (volinfo)
2. Volume Configuration (volprint)
3. Volume I/O Statistics (volstat)

Select an option or enter q to quit:
Select Volume Configuration (volprint) by entering
2
```

9. At the prompt, "Include all object types (volumes, mirrors, subdisks)? (y/n)," enter  
y

10. At the prompt, "List complete hierarchies below selected objects? (y/n)," enter  
n



11. At the prompt, "Display configuration summary information only?," enter  
n
12. The following message displays:

```
Indicate output formats to select:
Select type-specific one-line format (t) by entering
t
```

13. When prompted for the objects to display, select *all objects matching criteria entered above*, by pressing **ENTER**.
14. The report displays on the screen. The following ENABLE/ACTIVE portion of the Volume Manager Report shows only the portion of the report that concerns us here.

```
...
pl rootp-0128 root-vol ENABLED ACTIVE ...
pl swapp-0129 swap-vol ENABLED ACTIVE ...
pl up1 u ENABLED ACTIVE ...
v root-vol static ENABLED ACTIVE ...
v swap-vol static ENABLED ACTIVE ...
v u fsgen ENABLED - ...
```

Examine the table and verify that the plexes (pl) and volumes (v) are listed as ENABLED and ACTIVE. (The u volume shows a dash rather than the word ACTIVE.)

15. When prompted to continue, press **ENTER**.
16. At the options list, choose quit by entering  
q
17. Quit by again entering  
q



## INSTALLING A SECOND HARD DRIVE

To install a second hard drive, complete this procedure:

1. At the UNIX system prompt, start the **mkdev** utility by entering  
mkdev hd
2. At the prompt, "Do you want to add another SCSI disk? (y/n)," enter  
y
3. A prompt requests that you indicate the prefix of the SCSI host adapter that supports this device. Select the default SCSI host adapter "cha" (the Compaq Fast SCSI-2 Adapter) by pressing **ENTER**.
4. The following message appears:

---

Which SCSI host adapter supports this device?

Select 0 or 1, or 'h' for help, or 'q' to quit:

Select SCSI host adapter 0 by entering

0

5. At the prompt, "What is the Target ID for this device?" indicate the second drive by entering  
1
6. The following message appears:

---

What is the LUN (logical unit number) of this device?

Select 0-7, or 'h' for help, or 'q' to quit:

Select the default of 0 by pressing **ENTER**.



The screen displays the following:

| Host<br>Adapter<br>Type | Device | Adapter<br>Number | ID | LUN |
|-------------------------|--------|-------------------|----|-----|
| cha                     | Sdsk   | 0                 | 1  | 0   |

7. At the prompt, "Do you want to update the SCSI configuration? (y/n)," enter  
y
8. At the prompt, "Would you like to relink at this time? (y/n)," enter  
y
9. At the prompt, "Do you want this kernel to boot by default? (y/n)," enter  
y
10. At the prompt, "Do you want the kernel environment rebuilt? (y/n)," enter  
y
11. Reboot the system to multi-user mode for the changes to take effect. Enter  
reboot
12. The following message appear:

Type Control-D to proceed with normal startup.

Press **CTRL + D** for multi-user mode.

13. The current time and date displays. If correct, press **ENTER**.
14. At the UNIX login prompt, login as *root* by entering  
root
15. When prompted, enter your password.

---

## CONFIGURING THE SECOND HARD DRIVE

To configure the second hard drive as the mirror drive, complete this procedure:

1. At the system prompt, again start the **mkdev** utility by entering  
mkdev hd
2. Although you want to *configure* the second hard disk and *not add it*, at the prompt, "Do you want to add another SCSI disk? (y/n)," enter  
y
3. A prompt requests that you indicate the prefix of the SCSI host adapter that supports this device. Select the default SCSI host adapter "cha" (the Compaq Fast SCSI-2 Adapter) by pressing **ENTER**.
4. The following message appears:

```
Which SCSI host adapter supports this device?
```

```
Select 0 or 1, or 'h' for help, or 'q' to quit:
```

```
Select SCSI host adapter 0 by entering
```

```
0
```

5. At the prompt, "What is the Target ID for this device?" Select 1 by entering  
1
6. The following message appears:

```
What is the LUN (logical unit number) of this device?
```

```
Select 0-7, or 'h' for help, or 'q' to quit:
```

```
Select the default of 0 by pressing ENTER.
```



7. A screen message indicates that you may choose to overwrite all or part of your hard disk and asks if you wish to continue. Enter

y

8. For the VERITAS scripts to work properly, you must now create an active UNIX partition. The following message appears:

- 
1. Display Partition Table
  2. Use Entire Disk for UNIX
  3. Use Rest of Disk for UNIX
  4. Create UNIX Partition
  5. Activate Partition
  6. Delete Partition

Enter your choice or 'q' to quit:

Select *Use Rest of the Disk for UNIX* by entering

3

**NOTE:** This choice preserves the Compaq System Config partition.

9. When prompted to continue, press **ENTER**.
10. The following message appears:

- 
1. Display Partition Table
  2. Use Entire Disk for UNIX
  3. Use Rest of Disk for UNIX
  4. Create UNIX Partition
  5. Activate Partition
  6. Delete Partition

Enter your choice or 'q' to quit:

Select *Activate partition* by entering

5

At the prompt, "Enter the partition number you want to make active, or q to return," enter the UNIX partition number.





11. Enter **q** to quit.
12. At the prompt, "Would you rather run the original SCO divvy program? (y/n)," enter  
**n**
13. At the prompt, "Are you sure you want the division tables rewritten? (y/n)," enter  
**y**

A menu displays the choices for using the new drive.

14. The following message appears:

```
The new drive can be used in the following ways:
 1) use the whole drive for VxVM free space
 2) mirror a whole existing drive to this drive
 3) mirror ROOT and SWAP on this drive
Select an option or q to quit:
```

Select *Mirror a whole existing drive to this drive* by entering

**2**

15. VERITAS detects that *hd0* is eligible for mirroring and replication. This will be true only if the drives are identical. At the prompt, "Would you like to make the new device an exact replica of drive *hd0*? (y/n)," enter  
**y**

The system prompt displays. The mirroring operation takes place in the background over the next 15 to 30 minutes.

## VERIFYING THAT THE VERITAS MIRROR IS FUNCTIONING

To verify that the VERITAS mirror is working properly, produce a report by completing this procedure:

1. Start the VERITAS Volume Configuration Utility by entering  
mkdev vol
2. The Volume Configuration menu display:

---

```
**** Volume Configuration ****
```

1. Create Volume
2. Create a file system
3. Remove a file system
4. Reconfigure a volume
5. Display Volume Manager Reports
6. Reclaim and Defragment Free Space
7. Create Recovery Floppies

Select an option or enter q to quit:

Select *Display Volume Manager Reports* by entering

5

3. The Volume Manager Reports menu displays:

---

```
**** Volume Manager Reports ****
```

1. Volume States (volinfo)
2. Volume Configuration (volprint)
3. Volume I/O Statistics (volstat)

Select an option or enter q to quit:

Select *Volume Configuration (volprint)* by entering

2



4. At the prompt, "Include all object types (volumes, mirrors, subdisks)? (y/n)," enter  
y
5. At the prompt, "List complete hierarchies below selected objects? (y/n)," enter  
n
6. At the prompt, "Display configuration summary information only? (y/n)," enter  
n
7. The following message displays:  

Indicate output formats to select:  
Select *type-specific one-line format (t)* by entering  
t
8. When prompted for the objects to display, select *all objects matching criteria entered above*, by pressing **ENTER**.

9. The report displays on the screen. The following ENABLED/ACTIVE portion of the Volume Manager Report shows only the portion of the report that concerns us here.

|     |            |          |         |        |     |
|-----|------------|----------|---------|--------|-----|
| ... |            |          |         |        |     |
| pl  | rootp-0128 | root-vol | ENABLED | ACTIVE | ... |
| pl  | root-volp1 | root-vol | ENABLED | ACTIVE | ... |
| pl  | swapp-0129 | swap-vol | ENABLED | ACTIVE | ... |
| pl  | swap-volp1 | swap-vol | ENABLED | ACTIVE | ... |
| pl  | up1        | u        | ENABLED | ACTIVE | ... |
| pl  | up2        | u        | ENABLED | ACTIVE | ... |
| v   | root-vol   | static   | ENABLED | ACTIVE | ... |
| v   | swap-vol   | static   | ENABLED | ACTIVE | ... |
| v   | u          | fsgen    | ENABLED | -      | ... |

Examine the table and verify that there are two plexes (pl) for the *root*, *swap*, and *u* volumes and that they are listed as ENABLED and ACTIVE. (The *u* volume shows a dash rather than the word ACTIVE.) For details on this table, refer to the VERITAS documentation.

**NOTE:** The *root-volp1* and *swap-volp1* names are temporary. After you reboot the system, these names change to *rootp-0168* and *swapp-0169*, respectively.

10. When prompted to continue, press **ENTER**.
11. At the options list, choose quit by entering  
q
12. Quit by again entering  
q



## PREPARING FOR RECOVERY

The steps for recovering from a primary drive failure (SCSI ID 0) are more involved than are the steps for recovering from a secondary drive failure (SCSI ID 1). This is because the system does not reboot automatically when a new primary drive has been installed.

### Primary Drive Failure

When the system has either a failed primary drive or a new primary drive with SCSI ID 0, you must have a floppy boot procedure that allows you to "point" to the second drive for the booting process. We will use the Compaq Disaster Recovery System to create a boot floppy. To do this, complete this procedure:

1. To create the boot floppy, execute the following program:  
`/usr/bin/compaq/dis_recovery/cpqrec`
2. At the prompt, "Would you like to create a Compaq Disaster Recovery boot floppy? (y/n)," enter  
`y`
3. At the prompt, "Which 1.44 MB floppy device do you wish to use?" Select the correct one for your system.
4. At the prompt, "Please place a 1.44 MB diskette in device /dev/rfd0135ds18," place a diskette in drive A: and press **ENTER**.
5. At the prompt, "Would you like to create a Compaq Disaster Recovery tape? (y/n)," enter  
`n`

### Secondary Drive Failure

You do **not** need to use the floppy diskette created in the preceding steps when a secondary drive is replaced. This is because the system automatically reboots as long as the primary drive is working.



---

## *Chapter 3*

# **RESTORING VERITAS MIRRORING ONTO A SECONDARY DRIVE**

This chapter provides the procedure for restoring mirroring with VERITAS VxMirror in the event of a hard disk drive failure of the secondary drive (SCSI ID 1).

## **DETERMINING STALE PLEXES**

In order to replace a failed secondary drive with a new drive and re-establish mirroring, you must first remove all references to the stale plexes on the failed drive. The designation "stale" refers to a plex which no longer has current data and is not participating in the mirroring process. To determine which plexes are stale, we will produce a report by completing this procedure:

1. Bring the system down by entering  
`haltsys`
2. Turn off the power to the server.
3. Remove the bad drive, especially if it prevents booting.
4. Reboot the system to multiuser mode.

**NOTE:** Numerous error messages display during the booting process. These are not important at this time.

VERITAS continues to operate successfully.

5. Start the VERITAS Volume Configuration Utility by entering  
`mkdev vol`



6. The Volume Configuration menu displays:

```
**** Volume Configuration ****
1. Create Volume
2. Create a file system
3. Remove a file system
4. Reconfigure a volume
5. Display Volume Manager Reports
6. Reclaim and Defragment Free Space
7. Create Recovery Floppies

Select an option or enter q to quit:
Select Display Volume Manager Reports by entering
5
```

7. The Volume Manager Reports menu displays:

```
**** Volume Manager Reports ****
1. Volume States (volinfo)
2. Volume Configuration (volprint)
3. Volume I/O Statistics (volstat)

Select an option or enter q to quit:
Select Volume Configuration (volprint) by entering
2
8. At the prompt, "Include all object types (volumes, mirrors, subdisks)?
(y/n)," enter
y
9. At the prompt, "List complete hierarchies below selected objects? (y/n),"
enter
n
10. At the prompt, "Display configuration summary information only? (y/n),"
enter
n
```

11. The following message displays:

Indicate output formats to select:

Select *type-specific one-line format (t)* by entering

t

12. When prompted for the objects to display, select *all objects matching criteria entered above*, by pressing **ENTER**.
13. The report displays on the screen. The following ENABLED/ACTIVE portion of the Volume Manager Report shows only the portion of the report that concerns us here.

|     |            |          |          |        |     |
|-----|------------|----------|----------|--------|-----|
| ... |            |          |          |        |     |
| pl  | rootp-0128 | root-vol | ENABLED  | ACTIVE | ... |
| pl  | rootp-0168 | root-vol | DETACHED | STALE  | ... |
| pl  | swapp-0129 | swap-vol | ENABLED  | ACTIVE | ... |
| pl  | swapp-0169 | swap-vol | DISABLED | STALE  | ... |
| pl  | up1        | u        | ENABLED  | ACTIVE | ... |
| pl  | up2        | u        | DISABLED | STALE  | ... |
| v   | root-vol   | static   | ENABLED  | ACTIVE | ... |
| v   | swap-vol   | static   | ENABLED  | ACTIVE | ... |
| v   | u          | fsgen    | ENABLED  | -      | ... |

Examine the table and determine which plexes (pl) are stale.



14. Write down the stale plex names. In this case, they are:  
rootp-0168 (DETACHED STALE)  
swapp-0169 (DISABLED STALE)  
up1 (DISABLED STALE)
15. When prompted to continue, press **ENTER**.
16. At the options list, choose quit by entering  
q
17. Quit again by entering  
q

## **REPLACING THE SECONDARY DRIVE**

To replace the secondary drive, complete this procedure:

1. Bring the system down by entering  
haltsys
2. Turn off the power to the server.
3. Set the SCSI ID on the new drive to 1.  
**NOTE:** Refer to your hardware documentation.
4. Insert the new drive into the appropriate drive bay.
5. Plug in the power cable and the logic cable.
6. Reboot the system to multiuser mode by pressing **ENTER** at the UNIX "Boot:" prompt.



7. The following message appears:

Type Control-D to proceed with normal startup.

Press **CTRL + D** for multi-user mode.

The screen displays numerous VERITAS error messages. These are not important at this time.

8. The current time and date displays. If this is correct, press **ENTER**.
9. At the UNIX login prompt, login as *root* by entering  
root
10. At the password prompt, type your password.

## REMOVING REFERENCES TO STALE PLEXES

To remove references to stale plexes, complete this procedure:

1. Start the VERITAS Volume Configuration Utility by entering  
mkdev vol
2. The Volume Configuration menu displays:

\*\*\*\* Volume Configuration \*\*\*\*

1. Create Volume
2. Create a file system
3. Remove a file system
4. Reconfigure a volume
5. Display Volume Manager Reports
6. Reclaim and Defragment Free Space
7. Create Recovery Floppies

Select an option or enter q to quit:

Select *Reconfigure a Volume* by entering

4



3. The Volume available for reconfiguration menu displays:

```
**** Volume available for reconfiguration ****
1. root-vol
2. swap-vol
3. u
Select volume to reconfigure [1-3] or enter q to quit:
Select root-vol by entering
1
```

4. The following message appears:

```
How do you wish to change the volume root-vol?
1. Add a mirror to the volume
2. Remove a mirror from the volume
3. Increase the size of the volume and/or filesystem
4. Remove the volume entirely
Select an option or enter q to quit:
Select Remove a mirror from the volume by entering
2
```



5. The following message appears:

```
VOLUME
1. rootp-0168
2. rootp-0128
Select the volume to be removed [1-2] or enter q to quit:
```



**CAUTION:** You must select *rootp-0168*. Do *not* select the plex with real data - *rootp-0128*.

The screen displays numerous error messages. They are not important at this time.

6. The Volume available for reconfiguration menu displays:

```
**** Volume available for reconfiguration ****
1. root-vol
2. swap-vol
3. u
Select volume to reconfigure [1-3] or enter q to quit:
```

Select *swap-vol* by entering

2



7. The following message appears:

```
How do you wish to change the volume root-vol?
1. Add a mirror to the volume
2. Remove a mirror from the volume
3. Increase the size of the volume and/or filesystem
4. Remove the volume entirely
```

Select an option or enter q to quit:

Select *Remove a mirror from the volume* by entering

2

8. The following message appears:

```
MIRROR
```

- ```
1. swapp-0169
2. swapp-0129
```

Select the mirror to be removed [1-2] or enter q to quit:



CAUTION: You must select *swapp-0169*. Do *not* select the mirror with real data - *swapp-0129*.

The screen displays numerous error messages. They are not important at this time.



9. The Volume available for reconfiguration menu displays:


```
**** Volume available for reconfiguration ****
1. root-vol
2. swap-vol
3. u
Select volume to reconfigure [1-3] or enter q to quit:
Select u by entering
3
```

10. The following message appears:

```
How do you wish to change the volume root-vol?
1. Add a mirror to the volume
2. Remove a mirror from the volume
3. Increase the size of the volume and/or filesystem
4. Remove the volume entirely
Select an option or enter q to quit:
Select Remove a mirror from the volume by entering
2
```

11. The following message appears:

```
MIRROR
1. up2
2. up1
Select the mirror to be removed [1-2] or enter q to quit:
```

 **CAUTION:** You must choose *up2*. Do *not* select the mirror with real data - *up1*.

The screen displays numerous error messages. They are not important at this time.

12. At the options screen, quit by entering
q
13. Quit again by entering
q

REPLICATING THE MIRRORED DISK ONTO A NEW SECONDARY DISK

In the event of a drive failure, you need to replicate the mirrored disk. To replicate the mirrored disk onto a new secondary disk, complete this procedure.

1. At the UNIX system prompt, start the **mkdev** utility by entering
mkdev hd
2. At the prompt, "Do you want to add another SCSI disk? (y/n)," enter
y



3. A prompt requests that you indicate the prefix of the SCSI host adapter that supports this device. Select the default SCSI host adapter "cha" (Compaq Fast SCSI-2 Adapter), by pressing **ENTER**.
4. The following message appears:

```
Which SCSI host adapter supports this device?
```

```
Select 0 or 1, or 'h' for help, or 'q' to quit:
```

```
Select SCSI host adapter 0 by entering
```

```
0
```

5. At this prompt, "What is the Target ID for this device?" indicate the second drive by entering

```
1
```

6. The following message appears:

```
What is the LUN (logical unit number) of this device?
```

```
Select 0-7, or 'h' for help, or 'q' to quit:
```

```
Select the default of 0 by pressing ENTER.
```

7. At the prompt, "Do you wish to continue?" by entering

```
y
```


8. For VERITAS scripts to work properly, you must create an active UNIX partition at this point. The following message appears:

```
1. Display Partition Table
2. Use Entire Disk for UNIX
3. Use Rest of Disk for UNIX
4. Create UNIX Partition
5. Activate Partition
6. Delete Partition
```

Enter your choice or 'q' to quit:

Select 3) *Use rest of the disk for UNIX* by entering

3

NOTE: This choice preserves the Compaq System Configuration partition.

9. When prompted to continue, press **ENTER**.
10. The following message appears:

```
1. Display Partition Table
2. Use Entire Disk for UNIX
3. Use Rest of Disk for UNIX
4. Create UNIX Partition
5. Activate Partition
6. Delete Partition
```

Enter your choice or 'q' to quit:

Select 5) *Activate partition* by entering

5

11. At the prompt, "Enter partition number you want to make active, or Q to return," enter the UNIX partition number.
12. At the options list, choose quit by entering
- q



13. At the prompt, "Would you rather run original SCO divvy program?"
select the VERITAS divvy program by entering

n

14. At the prompt, "Are you sure you want the division tables rewritten?
(y/n)," enter

y

"CAUTION: The disk has already divvied using VERITAS divvy Do you
wish to continue (y/n)," enter

y

This is a chance to halt the installation script.

15. At the prompt, "Would you like to preserve exiting subdisk allocations?
(y/n)," enter

n

16. The following message appears:

The new drive can be used in the following ways:

- 1) use the whole drive for VxVM free space
- 2) mirror a whole existing drive to this drive
- 3) mirror ROOT and SWAP on to this drive

Select an option or q to quit:

Select 2) *Mirror a whole existing drive to this drive* by entering

2

17. At the prompt, "Would you like to make the new drive an exact replica of
drive hd0? (y/n)," enter

y

Attach operations are performed in the background, which takes about 15
to 30 minutes.

NOTE: If any error messages display and the drive activity light goes off
immediately, then run this procedure again.

VERIFYING THAT THE VERITAS MIRROR IS RE-ESTABLISHED

You must reboot the system and produce the following report to verify that the VERITAS mirror is re-established. To do this, complete this procedure:

1. Start the VERITAS Volume Configuration Utility by entering
mkdev vol
2. The Volume Configuration menu display:

**** Volume Configuration ****

1. Create Volume
2. Create a file system
3. Remove a file system
4. Reconfigure a volume
5. Display Volume Manager Reports
6. Reclaim and Defragment Free Space
7. Create Recovery Floppies

Select an option or enter q to quit:

Select *Display Volume Manager Reports* by entering

5

3. The Volume Manager Reports menu displays:

**** Volume Manager Reports ****

1. Volume States (volinfo)
2. Volume Configuration (volprint)
3. Volume I/O Statistics (volstat)

Select an option or enter q to quit:

Select *Volume Configuration (volprint)* by entering

2



4. At the prompt, "Include all object types (volumes, mirrors, subdisks)? (y/n)," enter
y
5. At the prompt, "List complete hierarchies below selected objects? (y/n)," enter
n
6. At the prompt, "Display configuration summary information only? (y/n)," enter
n
7. The following message displays:

Indicate output formats to select:
Select *type-specific one-line format (t)* by entering
t
8. When prompted for the objects to display, select *all objects matching criteria entered above*, by pressing **ENTER**.

9. The report displays on the screen. The following ENABLED/ACTIVE portion of the Volume Manager Report shows only the portion of the report that concerns us here.

...					
pl	rootp-0128	root-vol	ENABLED	ACTIVE	...
pl	rootp-volp1	root-vol	ENABLED	ACTIVE	...
pl	swapp-0128	swap-vol	ENABLED	ACTIVE	...
pl	swapp-volp1	swap-vol	ENABLED	ACTIVE	...
pl	up1	u	ENABLED	ACTIVE	...
pl	up2	u	ENABLED	ACTIVE	...
v	root-vol	static	ENABLED	ACTIVE	...
v	swap-vol	static	ENABLED	ACTIVE	...
v	u	fsgen	ENABLED	-	...

Examine the table and verify that the plexes (pl) and volumes (v) are listed as ENABLED and ACTIVE. (The u volume shows a dash rather than the word ACTIVE.)

NOTE: At first, the new root and swap divisions on the second drive (hd1) are given the temporary names root-volp1 and swap-volp1. When the system is rebooted these names will be changed to rootp-0168 and swapp-0169, respectively.

10. When prompted to continue, press **ENTER**.
11. At the options list, choose quit by entering
q
12. Quit again by entering
q
13. Relink the kernel to re-establish disk nodes for SCSI ID 1 by entering
/etc/conf/cf.d/link_unix -y



Chapter 4

RESTORING VERITAS MIRRORING ONTO A PRIMARY DRIVE

This chapter provides the procedure for restoring mirroring with VERITAS VxMirror in the event of a hard disk drive failure of the primary drive (SCSI ID 0).

DETERMINING STALE PLEXES

In order to replace a failed primary drive with a new drive and re-establish mirroring, you must first remove all references to the stale plexes on the failed drive. The designation "stale" refers to a plex which no longer has current data and is not participating in the mirroring process. To determine which plexes are stale, we will produce a report by completing this procedure:

1. Bring the system down by entering
`haltsys`
2. Turn off the power to the server.



IMPORTANT: Remove the bad primary drive, especially if it prevents booting.

3. Reboot the system to multiuser mode.

NOTE: Numerous error messages display during the booting process. These are not important at this time.

VERITAS continues to operate successfully.

4. Start the VERITAS Volume Configuration Utility by entering
`mkdev vol`

5. The Volume Configuration menu display:

```
**** Volume Configuration ****
1. Create Volume
2. Create a file system
3. Remove a file system
4. Reconfigure a volume
5. Display Volume Manager Reports
6. Reclaim and Defragment Free Space
7. Create Recovery Floppies

Select an option or enter q to quit:
Select Display Volume Manager Reports by entering
5
```

6. The Volume Manager Reports menu displays:

```
**** Volume Manager Reports ****
1. Volume States (volinfo)
2. Volume Configuration (volprint)
3. Volume I/O Statistics (volstat)

Select an option or enter q to quit:
Select Volume Configuration (volprint) by entering
2
7. At the prompt, "Include all object types (volumes, mirrors, subdisks)?
(y/n)," enter
y
8. At the prompt, "List complete hierarchies below selected objects? (y/n),"
enter
n
9. At the prompt, "Display configuration summary information only?," enter
n
```



10. The following message displays:

Indicate output formats to select:

Select *type-specific one-line format (t)* by entering

t

11. When prompted for the objects to display, select *all objects matching criteria entered above*, by pressing **ENTER**.
12. The report displays on the screen. The following ENABLED/ACTIVE portion of the Volume Manager Report shows only the portion of the report that concerns us here.

...					
pl	rootp-0128	root-vol	DETACHED	STALE	...
pl	rootp-0168	root-vol	ENABLED	ACTIVE	...
pl	swapp-0129	swap-vol	DISABLED	STALE	...
pl	swapp-0169	swap-vol	ENABLED	ACTIVE	...
pl	up1	u	DISABLED	STALE	...
pl	up2	u	ENABLED	ACTIVE	...
v	root-vol	static	ENABLED	ACTIVE	...
v	swap-vol	static	ENABLED	ACTIVE	...
v	u	fsgen	ENABLED	-	...

Examine the table and determine which plexes are stale.



13. Write down the stale plex names. In this case, they are:

rootp-0128 (DETACHED STALE)

swapp-0129 (DISABLED STALE)

up1 (DISABLED STALE)

NOTE: At first, if drive 0 is bad, then rootp-0128 is DETACHED STALE and swapp-0168 is DISABLED ACTIVE but later changes to DISABLED OFFLINE.

14. When prompted to continue, press **ENTER**.

15. At the options list, choose quit by entering

q

16. Quit again by entering

q

REPLACING THE PRIMARY DRIVE

To replace the primary drive, complete this procedure:

1. Bring the system down by entering

haltsys

2. Set the SCSI ID on the new drive to 0.

3. Insert the new drive into the appropriate drive bay.

4. Plug in the power cable and the logic cable.

5. Insert the Compaq Disaster Recovery Diskette in drive A: and turn on the power.



6. At the UNIX boot prompt, boot from the mirrored drive by entering the following boot string:

```
hd(104)unix kernel.root=vol(0) kernel.swap=vol(1) kernel.dump=vol(1)
```

NOTE: The new drive must be recognizable or the preceding boot string will not work.

7. The following message appears:

Type Control-D to proceed with normal startup.

Press **CTRL + D** for multi-user mode.

The screen displays numerous VERITAS error messages. These are not important at this time.

8. The current time and date displays. If this is correct, press **ENTER**.

9. At the UNIX login prompt, login as *root* by entering

```
root
```

10. At the password prompt, type your password.

NOTE: Now you must remove the subdisk allocations referring to Drive 0.

REMOVING REFERENCES TO STALE PLEXES

To remove references to stale plexes, complete this procedure:

1. Start the VERITAS Volume Configuration Utility by entering
mkdev vol
2. The Volume Configuration menu displays:

```
**** Volume Configuration ****
1. Create Volume
2. Create a file system
3. Remove a file system
4. Reconfigure a volume
5. Display Volume Manager Reports
6. Reclaim and Defragment Free Space
7. Create Recovery Floppies
```

Select an option or enter q to quit:

Select *Reconfigure a Volume* by entering

4

3. The Volume available for reconfiguration menu displays:

```
**** Volume available for reconfiguration ****
1. root-vol
2. swap-vol
3. u
```

Select volume to reconfigure [1-3] or enter q to quit:

Select *root-vol* by entering

1



4. The following message appears:

```
How do you wish to change the volume root-vol?

1. Add a mirror to the volume
2. Remove a mirror from the volume
3. Increase the size of the volume and/or filesystem
4. Remove the volume entirely
```

Select an option or enter q to quit:

Select *Remove a mirror from the volume* by entering

2

5. The following message appears:

```
VOLUME
```

- ```
1. rootp-0128
2. rootp-0168
```

Select the mirror to be removed [1-2] or enter q to quit:



**CAUTION:** You must select *rootp-0128*. Do *not* select the plex with real data - *rootp-0168*.

---

The screen displays numerous error messages. They are not important at this time.



6. The Volume available for reconfiguration menu displays:

```
**** Volume available for reconfiguration ****
1. root-vol
2. swap-vol
3. u
Select volume to reconfigure [1-3] or enter q to quit:
Select swap-vol by entering
2
```

7. The following message appears:

```
How do you wish to change the volume root-vol?
1. Add a mirror to the volume
2. Remove a mirror from the volume
3. Increase the size of the volume and/or filesystem
4. Remove the volume entirely
Select an option or enter q to quit:
Select Remove a mirror from the volume by entering
2
```



8. The following message appears:

```
MIRROR
1. swapp-0129
2. swapp-0169
Select the mirror to be removed [1-2] or enter q to quit:
```



**CAUTION:** You must select *swapp-0129*. Do *not* select the plex with real data - *swapp-0169*.

The screen displays numerous error messages. They are not important at this time.

9. The Volume available for reconfiguration menu displays:

```
**** Volume available for reconfiguration ****
1. root-vol
2. swap-vol
3. u
Select volume to reconfigure [1-3] or enter q to quit:
```

Select *u* by entering

3



10. The following message appears:

```
How do you wish to change the volume root-vol?

1. Add a mirror to the volume
2. Remove a mirror from the volume
3. Increase the size of the volume and/or filesystem
4. Remove the volume entirely
```

Select an option or enter q to quit:

Select *Remove a mirror from the volume* by entering

2

11. The following message appears:

```
MIRROR
```

- ```
1. up1
2. up2
```

Select the mirror to be removed [1-2] or enter q to quit:



CAUTION: You must select *up1*. Do *not* select the plex with real data - *up2*.

The screen displays numerous error messages. They are not important at this time.

12. At the options screen, quit by entering

q

13. Quit again by entering

q



REPLICATING THE MIRRORED DISK ONTO A NEW PRIMARY DISK

To replicate the mirrored disk onto a new primary disk, complete this procedure.

1. At the UNIX system prompt, start the **mkdev** utility by entering
mkdev hd
2. At the prompt, "Do you want to add another SCSI disk? (y/n)," enter
y
3. A prompt requests that you indicate the prefix of the SCSI host adapter that supports this device. Select the default SCSI host adapter "cha" (Compaq Fast SCSI-2 Adapter), by pressing **ENTER**.
4. The following message appears:

Which SCSI host adapter supports this device?

Select 0 or 1, or 'h' for help, or 'q' to quit:

Select SCSI host adapter 0 by entering

0

5. At this prompt, "What is the Target ID for this device?" indicate the second drive by entering
0
6. The following message appears:

What is the LUN (logical unit number) of this device?

Select 0-7, or 'h' for help, or 'q' to quit:

Select the default of 0 by pressing **ENTER**.



7. At the prompt, "Do you wish to continue?" by entering
y
8. For the VERITAS scripts to work properly, you must now create an active UNIX partition. The following message appears:

```
1. Display Partition Table
2. Use Entire Disk for UNIX
3. Use Rest of Disk for UNIX
4. Create UNIX Partition
5. Activate Partition
6. Delete Partition
Enter your choice or 'q' to quit:
```

Select *Use Rest of the Disk for UNIX* by entering

3

NOTE: This choice preserves the Compaq System Configuration partition.

9. When prompted to continue, press **ENTER**.
10. The following message appears:

```
1. Display Partition Table
2. Use Entire Disk for UNIX
3. Use Rest of Disk for UNIX
4. Create UNIX Partition
5. Activate Partition
6. Delete Partition
Enter your choice or 'q' to quit:
```

Select *Activate partition* by entering

5

At the prompt, "Enter the partition number you want to make active, or q to return," enter the UNIX partition number.



11. At the options list, choose quit by entering
q
12. At the prompt, "Would you rather run original SCO divvy program?"
Select the VERITAS divvy program by entering
n
13. At the prompt, "Are you sure you want the division tables rewritten?
(y/n)," enter
y

"CAUTION: The disk has already divvied using VERITAS divvy Do you
wish to continue (y/n), enter
y

This is a chance to halt the installation script.
14. At the prompt, "Would you like to preserve exiting subdisk allocations?
(y/n)," enter
n
15. The following message appears:

The new drive can be used in the following ways:

- 1) use the whole drive for VxVM free space
- 2) mirror a whole existing drive to this drive
- 3) mirror ROOT and SWAP on this drive

Select an option or q to quit:

Select *Mirror a whole existing drive to this drive* by entering

2

16. At the prompt, "Would you like to make the new drive an exact replica of
drive hd1? (y/n)," enter
y

Attach operations are performed in the background, which takes about 15 to 30
minutes.

NOTE: If any error messages display and the drive activity light goes off
immediately, then run this procedure again.

VERIFYING THAT THE VERITAS MIRROR IS RE-ESTABLISHED

You must reboot the system and complete this procedure to verify that the VERITAS mirror is re-established.

1. Start the VERITAS Volume Configuration Utility by entering
mkdev vol
2. The Volume Configuration menu display:

```
**** Volume Configuration ****
1. Create Volume
2. Create a file system
3. Remove a file system
4. Reconfigure a volume
5. Display Volume Manager Reports
6. Reclaim and Defragment Free Space
7. Create Recovery Floppies
```

Select an option or enter q to quit:

Select *Display Volume Manager Reports* by entering

5

3. The Volume Manager Reports menu displays:

```
**** Volume Manager Reports ****
1. Volume States (volinfo)
2. Volume Configuration (volprint)
3. Volume I/O Statistics (volstat)
```

Select an option or enter q to quit:

Select *Volume Configuration (volprint)* by entering

2



4. At the prompt, "Include all object types (volumes, mirrors, subdisks)? (y/n)," enter
y
5. At the prompt, "List complete hierarchies below selected objects? (y/n)," enter
n
6. At the prompt, "Display configuration summary information only? (y/n)," enter
n
7. The following message displays:

Indicate output formats to select:
Select *type-specific one-line format (t)* by entering
t
8. When prompted for the objects to display, select *all objects matching criteria entered above*, by pressing **ENTER**.

9. The report displays on the screen. The following ENABLED/ACTIVE portion of the Volume Manager Report shows only the portion of the report that concerns us here.

```

...
pl  rootp-volp1  root-vol  ENABLED  ACTIVE  ...
pl  rootp-0168  root-vol  ENABLED  ACTIVE  ...
pl  swapp-volp1  swap-vol  ENABLED  ACTIVE  ...
pl  swapp-0169  swap-vol  ENABLED  ACTIVE  ...
pl  up1          u          ENABLED  ACTIVE  ...
pl  up2          u          ENABLED  ACTIVE  ...
v   root-vol    static    ENABLED  ACTIVE  ...
v   swap-vol    static    ENABLED  ACTIVE  ...
v   u           fsgen     ENABLED  -        ...

```

Examine the table and verify that the plexes (pl) and volumes (v) are listed as ENABLED and ACTIVE. (The u volume shows a dash rather than the word ACTIVE.)

NOTE: At first, the new root and swap divisions on the second drive (hd1) are given the temporary names root-volp1 and swap-volp1. When the system is rebooted these names will be changed to rootp-0128 and swapp-0129, respectively.

10. When prompted to continue, press **ENTER**.
11. At the options list, choose quit by entering


```
q
```
12. Quit again by entering


```
q
```
13. Relink the kernel to re-establish disk nodes for drive id 0 by entering


```
/etc/conf/cf.d/link_unix -y
```



Appendix A

MULTIVENDOR INTEGRATION FROM COMPAQ

To help you successfully integrate and optimize your network or multivendor system, Compaq has developed a library of systems integration TechNotes for the SCO UNIX, NetWare, and Microsoft Windows NT operating system environments. TechNotes provide you with important information on topics such as network performance management, server management, and operating system interconnectivity.

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