900 Series HP 3000 Computer Systems

Mirrored Disk/iX User's Guide

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Printing History

The following table lists the printings of this document, together with the respective release dates for each edition. The software version indicates the version of the software product at the time this document was issued. Many product releases do not require changes to the document. Therefore, do not expect a one-to-one correspondence between product releases and document editions.

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First Edition	April 1990	A.40.00
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Preface

MPE/iX, Multiprogramming Executive with Integrated POSIX, is the latest in a series of forward-compatible operating systems for the HP 3000 line of computers.

In HP documentation and in talking with HP 3000 users, you will encounter references to MPE XL, the direct predecessor of MPE/iX. MPE/iX is a superset of MPE XL. All programs written for MPE XL will run without change under MPE/iX. You can continue to use MPE XL system documentation, although it may not refer to features added to the operating system to support POSIX (for example, hierarchical directories).

Finally, you may encounter references to MPE V, which is the operating system for HP 3000s not based on PA-RISC architecture. MPE V software can be run on the PA-RISC (Series 900) HP 3000s in what is known as *compatibility mode*.

The *Mirrored Disk/iX User's Guide* describes how to install and maintain mirrored disks with split-volume backup.

It is written for the system manager who is familiar with volume management. The manual contains information that is subject to change without notice.

The manual is divided into five chapters, two appendices and a glossary.

Chapter 1	Introducing Mirrored Disks With Split-volume Backup introduces mirrored disks and split-volume backup including features and product environment and manual overview.
Chapter 2	Installing Mirrored Disks describes how to install and set up mirrored disks.
Chapter 3	Performing Split-Volume Backup describes how to perform a split-volume backup.
Chapter 4	Troubleshooting describes disk repair and what to do in the event of a disk failure.
Chapter 5	Referencing Commands describes all of the VOLUTIL and system commands used with mirrored disks.
Appendix A	Quick Start Procedures describes in minimum detail basic mirrored disk tasks.
Glossary	Defines the terms introduced with mirrored disks.

Conventions

`UPPERCASE` In a syntax statement, commands and keywords are shown in uppercase characters. The characters must be entered in the order shown; however, you can enter the characters in either uppercase or lowercase. For example:

```
COMMAND
```

can be entered as any of the following:

```
command     Command     COMMAND
```

It cannot, however, be entered as:

```
comm        com_mand    comamnd
```

italics In a syntax statement or an example, a word in italics represents a parameter or argument that you must replace with the actual value. In the following example, you must replace *filename* with the name of the file:

`COMMAND` *filename*

bold italics In a syntax statement, a word in bold italics represents a parameter that you must replace with the actual value. In the following example, you must replace ***filename*** with the name of the file:

`COMMAND(`***filename***`)`

punctuation In a syntax statement, punctuation characters (other than brackets, braces, vertical bars, and ellipses) must be entered exactly as shown. In the following example, the parentheses and colon must be entered:

(*filename*):(*filename*)

underlining Within an example that contains interactive dialog, user input and user responses to prompts are indicated by underlining. In the following example, yes is the user's response to the prompt:

```
Do you want to continue? >>  yes
```

`{ }` In a syntax statement, braces enclose required elements. When several elements are stacked within braces, you must select one. In the following example, you must select either `ON` or `OFF`:

`COMMAND` { `ON` / `OFF` }

`[ ]` In a syntax statement, brackets enclose optional elements. In the following example, `OPTION` can be omitted:

`COMMAND` *filename* `[OPTION]`

When several elements are stacked within brackets, you can select one or none of the elements. In the following example, you can select `OPTION` or *parameter* or neither. The elements cannot be repeated.

`COMMAND` *filename* [`OPTION` / *parameter*]

Conventions (continued)

`[ ... ]`

In a syntax statement, horizontal ellipses enclosed in brackets indicate that you can repeatedly select the element(s) that appear within the immediately preceding pair of brackets or braces. In the example below, you can select *parameter* zero or more times. Each instance of *parameter* must be preceded by a comma:

`[,`*parameter*`][...]`

In the example below, you only use the comma as a delimiter if *parameter* is repeated; no comma is used before the first occurrence of *parameter*:

`[`*parameter*`][,...]`

`| ... |`

In a syntax statement, horizontal ellipses enclosed in vertical bars indicate that you can select more than one element within the immediately preceding pair of brackets or braces. However, each particular element can only be selected once. In the following example, you must select **`A`**, **`AB`**, **`BA`**, or **`B`**. The elements cannot be repeated.

$$\left\{ \begin{matrix} \texttt{A} \\ \texttt{B} \end{matrix} \right\} \texttt{| ... |}$$

`...`

In an example, horizontal or vertical ellipses indicate where portions of an example have been omitted.

`Δ`

In a syntax statement, the space symbol `Δ` shows a required blank. In the following example, *parameter* and *parameter* must be separated with a blank:

`(`*parameter*`)Δ(`*parameter*`)`

The symbol indicates a key on the keyboard. For example, RETURN represents the carriage return key or Shift represents the shift key.

CTRL*character*

CTRL*character* indicates a control character. For example, CTRL**`Y`** means that you press the control key and the Y key simultaneously.

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Introducing Mirrored Disks with Split-Volume Backup

This manual is intended for users with volume management experience to provide them with the information necessary to install and maintain Hewlett-Packard Mirrored Disk/iX. Refer to the *Volume Management Reference Manual* (32650-90045) for additional information on volume management.

What are mirrored disks?

Mirrored disks are designed to provide high data availability by automatically maintaining identical information on two partner disks. When an application writes to a disk, disk mirroring causes the information to be written to both drive partners. Applications running on the system are unaware that disk mirroring is present.

Once disk mirroring has been installed using the VOLUTIL utility, a mirrored disk acts just like any other disk connected to the system, until a disk failure occurs. If either disk of any pair fails, normal system operation continues. When the partner is ready to resume operation, the system copies data from the good disk, bringing the pair to a consistent state, and normal mirroring resumes. Refer to Figure 1-1.

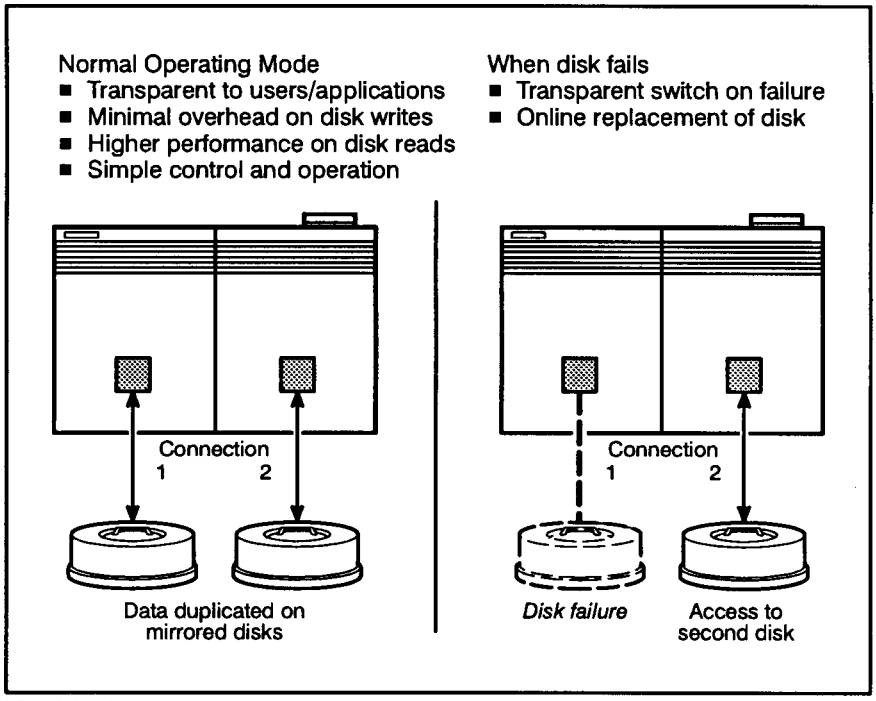

Figure 1-1. Mirrored Disks

What is split-volume backup?

Split-volume or *online* backup uses mirrored disks to perform file backup while allowing users to continue accessing those same files. A mirrored volume set is "split" into two identical sets of data. One of the sets is used for normal access and operation, while the other is used exclusively for backup. When the backup is complete, the backup volumes are overwritten with the contents of the user volumes (which may have undergone modifications). Normal disk mirroring resumes after this point. Refer to Figure 1-2.

The volume set is continuously available except during the time it takes to close the volume set, split it, and open it. Only mirrored volume sets may be backed up using this method.

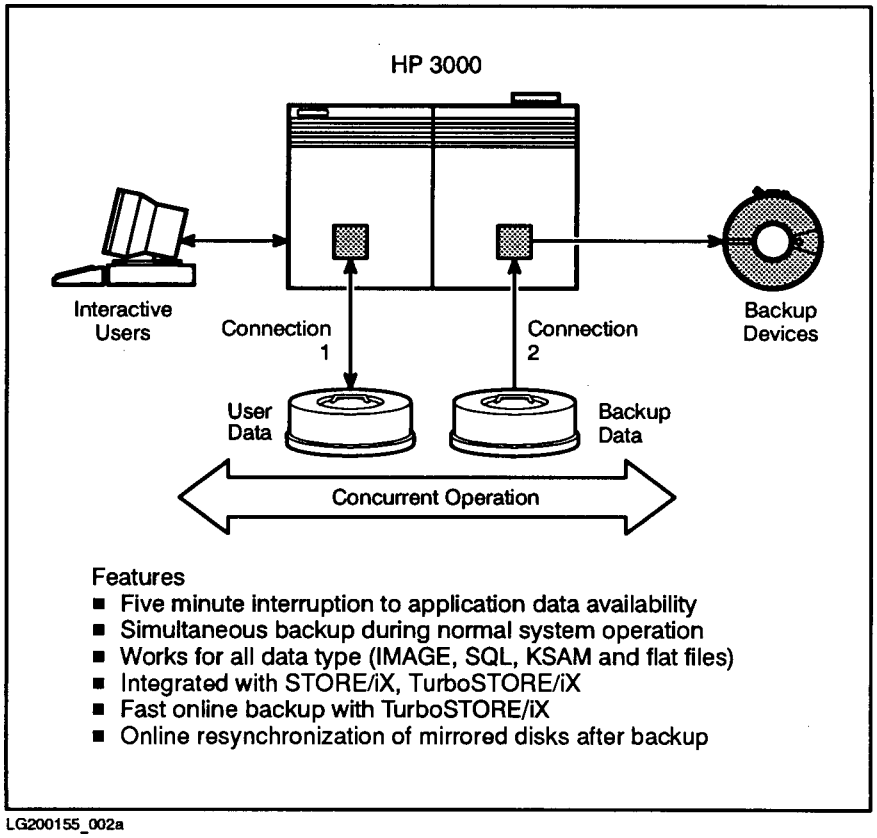

Figure 1-2. Split-Volume Backup

Product features

Mirrored Disk/iX supports the following features:

High data availability	System automatically maintains identical information on two partner disks. Users continue to access data if either disk of any pair is disabled or under repair.
Reduced downtime	Users continue to access data while system performs file backup.
Disk failure recovery	System detects failed drive, continues to run application, and discontinues mirroring until drive is repaired.
Resume mirroring	System allows for the removal of the failed drive from pair, the mounting of another drive in its place while the system is running, then copies data to the new drive, and resumes disk mirroring.
Data consistency	System writes data to both partners of a mirrored pair, data is always consistent, even during the repair process.

Product specifications

This section describes what environment and capability is needed to use mirrored disks.

Product environment

Mirrored Disk/iX is designed to work with nonsystem volumes on Hewlett-Packard 900 Series systems with the following restrictions:

- MPE software release A.30.00 or greater.
- Disk drives that do *not* use HP-IB.
- Mirrored partners must be the same model of disk drive.
- Mirrored partners should be connected to different device adapter cards.
- Mirrored Disk/iX does not support mirroring system volumes.

User capabilities

Create volumes (CV) capability is required to use VOLUTIL to initilialize mirrored volumes and to input system commands from the system console to perform split-volume backup.

Installation overview

Before you can use mirrored disks, you must perform the following procedures:

- Use the SYSGEN utility to configure the disks into the system.
- Install the disk hardware.
- Boot the system with the new configuration.
- Use the AUTOINST utility to install the mirrored disk software.
- Use the VOLUTIL utility to create a mirrored volume set.
- Move files, if necessary.
- Set up accounts and groups.

Operation overview

Once mirrored disks have been installed, you can use them like any other disks connected to the system. Additionally, you can perform split-volume backup of mirrored disk data while still accessing the data.

2

Installing Mirrored Disks

This chapter describes what you must do before you can use Mirrored Disk/iX. In particular, it describes how to install mirrored disks and create a mirrored volume set.

Mirrored disk installation

Installing mirrored disks consists of the following procedures:

- Configuring the disks into the system.
- Installing the disks.
- Booting the system with the mirrored disk configuration.
- Installing the mirrored disk software with the AUTOINST utility.

System configuration

Use SYSGEN to configure the mirrored disks into the system. Refer to the *System Startup, Configuration, and Shutdown Reference Manual* (32650-90042) for more information.

Disk installation

Install the disks according to the appropriate disk installation manual. Use the following guidelines:

- The system must have at least two non-HP-IB device adapter cards. Make sure that mirrored pairs are not connected to the same device adapter card. This ensures that if a device adapter card fails, it does not affect both partners of a mirrored pair.
- Install mirrored partners next to each other, so that you can see the status lights of both partners of a pair.
- Label each mirrored disk pair. If a disk fails, you can easily determine which disk partner to replace.

Figure 2-1 shows how mirrored disks can be connected to the system.

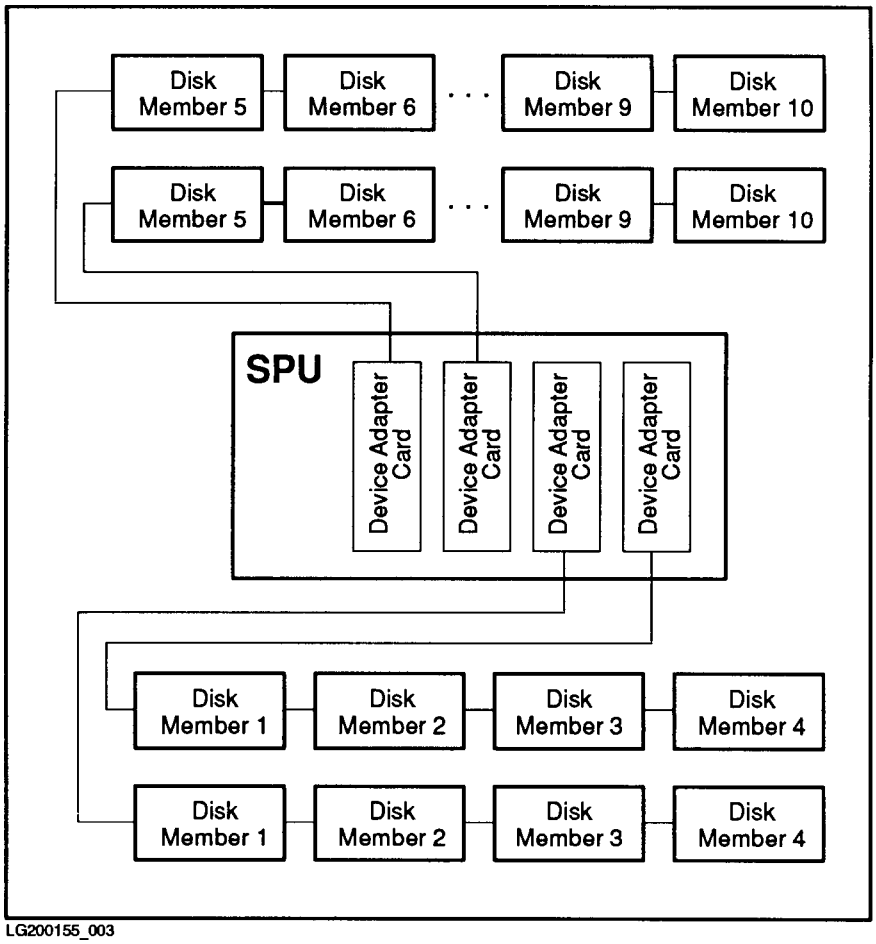

Figure 2-1. Sample Mirrored Disk Configuration

The above example shows four device adapter cards connected to twenty disks (ten mirrored pairs).

Figure 2-2 shows how twenty disks can be installed next to their partners in eight pack cabinets. Refer to the appropriate disk operating and installation manual for any disk cabling restrictions.

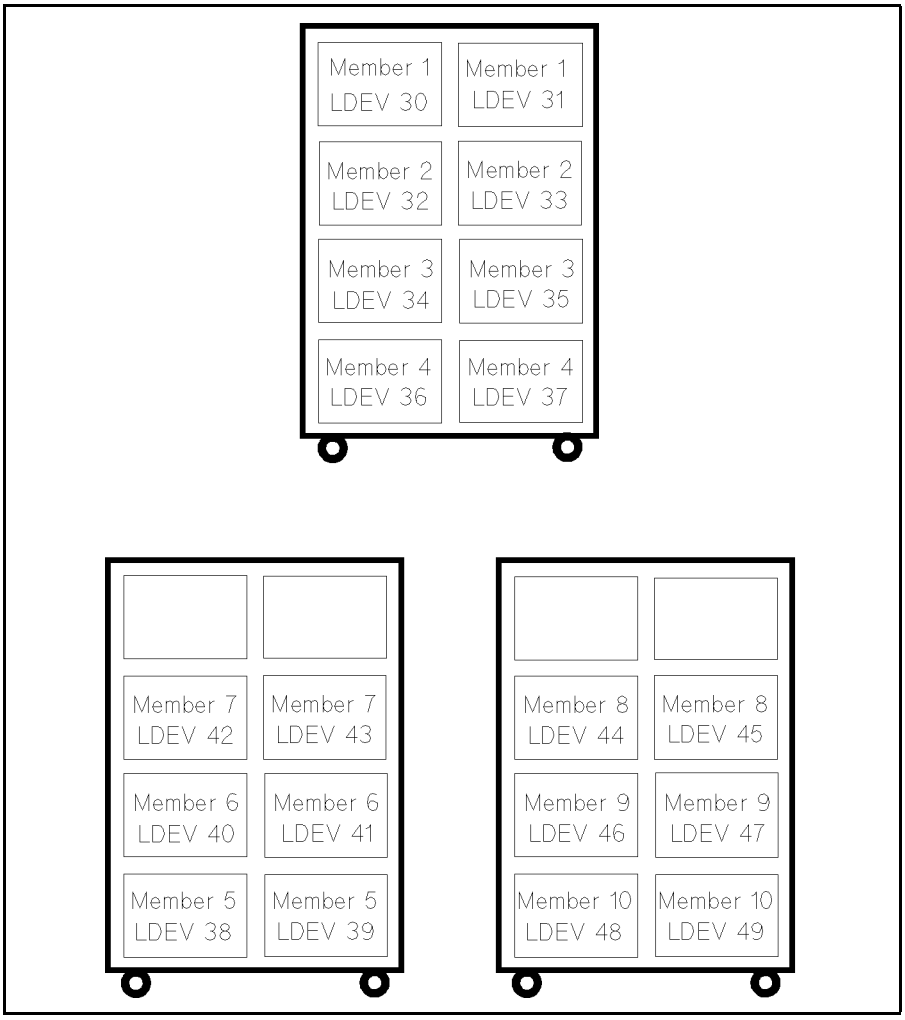

Figure 2-2. Sample Cabinet Installation

LDEVs 30, 31, 32, and 33 are the disks directly connected to device adapter cards. All of the other disks are chained off those disks.

Note

For quick reference, it is a good idea to draw a map of the mirrored disks with member names and LDEV numbers and to mark which disks are connected to the device adapter cards. This map helps to easily identify the location of each disk.

System boot

Boot the system with the mirrored disk configuration group. Refer to the *System Startup, Configuration, and Shutdown Reference Manual* (32650-90042) for more information about booting the system.

Mirrored disk software

The mirrored disk product is distributed on a magnetic tape. Install the tape using the AUTOINST utility described in the *HP3000 MPE/iX Installation and Update Manual* (36123-90001).

Setting up the mirrored volume set

After you have installed the mirrored disk hardware and software, you need to set up the mirrored volume set by performing the following procedures:

- Initialize the mirrored volume set.
- Add members to the mirrored volume set, if necessary.
- Move files, if necessary.
- Set up accounts and groups.

Initializing a mirrored volume set

A mirrored volume set is created by using the VOLUTIL `NEWMIRRSET` command to initialize the master volume of the set. Refer to the *Volume Management Reference Manual* (32650-90045) for more information on using the VOLUTIL utility.

This example shows how to create a mirrored volume set. You need create volumes (CV) capability to create a mirrored set.

1. Use the `DSTAT` command to display which disks can be initialized.

Note

The new volume must be mounted in the `SCRATCH` or `UNKNOWN` state.

```
:DSTAT

LDEV-TYPE  STATUS   VOLUME  (VOLUME SET - GEN)
 - - - - - - - - - - - - - - - - - - - - - - -
30- 079370  SCRATCH
31- 079370  SCRATCH
32- 079370  SCRATCH
33- 079370  SCRATCH
```

LDEVs 30, 31, 32, and 33 are mounted in the `SCRATCH` state and are available to be initialized.

2. Start the VOLUTIL utility.
3. Use the NEWMIRRSET command to initialize the mirrored volume set PROD_SET with the master name MEMBER1 for LDEVs 30 and 31.

```
:VOLUTIL

Mirvutil A.00.00, (C) Hewlett-Packard Co., 1989. All Rights Reserved.

volutil: NEWMIRRSET PROD_SET MEMBER1 (30,31)

*Verify: Initialize new volume set PROD_SET on ldev 30 and ldev 31 [Y/N]? Y

*Note: New master volume has been initialized for ldev 30 and ldev 31.
```

The header "Mirvutil" tells you that mirrored disk software has been installed and that VOLUTIL has been changed to accommodate mirrored disks.

The system responds with a question asking you to verify whether the information that you input was correct. When you respond (Y) followed by (RETURN), the system displays process information.

Caution

Make sure that you see the message verifying that the volumes were initialized. Any error that occurs during initialization means that the volumes must be reinitialized.

4. After you create a mirrored volume set, use the DSTAT command to verify that the volume set was initialized.

```
volutil: :DSTAT

LDEV-TYPE  STATUS   VOLUME  (VOLUME SET - GEN)
- - - - - - - - - - - - - - - - - - - - - - - - -
30- 079370  MASTER-MD   MEMBER1 (PROD_SET-0)
31- 079370  MASTER-MD   MEMBER1 (PROD_SET-0)
32- 079370  SCRATCH
33- 079370  SCRATCH
```

The "MD" in the previous screen designates a mirrored disk volume.

Adding volumes to a mirrored set

To add a volume to a mirrored volume set, use the VOLUTIL NEWMIRRVOL command.

Note

The new volume must be mounted in the SCRATCH or UNKNOWN state.

This example shows how to add a volume to a mirrored volume set.

1. Use the NEWMIRRVOL command to add the volume MEMBER2 to the mirrored volume set PROD_SET for LDEVs 32 and 33. If you do not specify a volume class, the default volume class DISC is added to the volume.

Note

Remember to include the colon (:) in the command between the set name and the volume name.

```
volutil: NEWMIRRVOL PROD_SET:MEMBER2 (32,33)

*Verify: Initialize new member volume on ldev 32 and ldev 33 [Y/N]?Y

*Note: New member volume has been initialized for ldev 32 and ldev 33.
```

The system responds with a question asking you to verify whether the information you input was correct. When you respond (Y) followed by (RETURN), the system displays process information.

Caution

Make sure that you see the message verifying that the volumes were initialized. Any error that occurs during initialization means that the volumes must be reinitialized.

2. Use the DSTAT command to verify that the volumes were added correctly to the volume set.

```
volutil: :DSTAT

LDEV-TYPE  STATUS      VOLUME  (VOLUME SET - GEN)
- - - - - - - - - - - - - - - - - - - - - - - - -
30- 079370  MASTER-MD   MEMBER1 (PROD_SET-0)
31- 079370  MASTER-MD   MEMBER1 (PROD_SET-0)
32- 079370  MEMBER-MD   MEMBER2 (PROD_SET-0)
33- 079370  MEMBER-MD   MEMBER2 (PROD_SET-0)
```

3. Use the VOLUTIL `SHOWSET` command with the new `MIRROR` option to display and verify volume information.

```
volutil:SHOWSET PROD_SET MIRROR

Volume Name  Vol Status  Mirr Status  Ldev  Mirr ldev
- - - - - - - - - - - -  - - - - - -  - - - - - - - -
MEMBER1      MASTER      NORMAL       30    31
MEMBER1      MASTER      NORMAL       31    30
MEMBER2      MEMBER      NORMAL       32    33
MEMBER2      MEMBER      NORMAL       33    32
```

This screen shows that there are four mirrored disks operating normally.

4. Additional pairs can be added to the mirrored volume set using the `NEWMIRRVOL` command.

Setting up accounts and groups

Once the mirrored volume set has been created, set up accounts and groups on the system volume set and the mirrored volume set. For more information on setting up accounts and groups on nonsystem volume sets, refer to the *Volume Management Reference Manual* (32650-90045).

The BULDACCT utility can be used to set up accounts and groups. Information on using this utility is described in the *MPE/iX Utilities Manual* (32650-90081).

Moving files

Now that the mirrored volume set has been created and contains accounts and groups, you can move files to that set. Since the system volume set cannot be mirrored, data on the system volume set that is to be mirrored must be moved to a mirrored volume set. Use the `STORE` command to move files from the system volume set to the mirrored volume set. Refer to the *MPE/iX Commands Reference Manual Volumes 1 and 2* (32650-90003 and 32650-90364) for more information on moving files.

Using mirrored disks

Once mirrored disks have been installed and set up, they operate just like any other disks connected to the system.

The system automatically recognizes the mirrored volume set after the volumes have been added to a mirrored volume set, upon the power on of the disk drive or the boot of the system.

Note

In order to access mirrored volumes, the `MASTER` volumes of the mirrored volume set must be mounted.

3

Performing Split-Volume Backup

This chapter describes how to use mirrored disks to perform split-volume backup.

Split-Volume backup requirements

Split-volume backup can proceed only if all of the following requirements are met:

- The volume set must have been previously initialized as a mirrored volume set through the VOLUTIL utility.
- The volume set must be a nonsystem volume set. Currently, only nonsystem volume sets can be mirrored.
- All members of the volume set and both partners of each pair must be present at the time of the split. None of the volumes may be disabled or suspended, or undergoing a repair.

Once the above requirements have been met, you can proceed to back up the mirrored disk data.

Backing up a mirrored set

Backing up a mirrored volume set consists of the following steps:

1. Splitting the mirrored volume set.
2. Using the `STORE` command to back up the files.
3. Joining the volume set and starting a repair.

Splitting a mirrored set

This example shows how to perform step 1 of split-volume backup, splitting a mirrored set.

1. All users of the volume set must initially be logged off before a split-volume backup can be performed. Notify users of the volume set that they need to log off.

Note

If you do not want to log off the system, make sure that you are not logged on to the mirrored volume set that you want to back up. You can use the CHGROUP command to switch to another volume set.

```
:TELL @ LOGOFF FOR BACKUP
```

2. Use the VSCLOSE command with the SPLIT option to split the volume set into user volumes and backup volumes.

Note

The VSCLOSE command with the SPLIT option can only proceed if the files in the volume set are not being accessed.

The NOW option of the VSCLOSE command cannot be used with the SPLIT option.

3. You can use the DSTAT command to display the split-volume set.

```
:VSCLOSE PROD_SET; SPLIT
:DSTAT

LDEV-TYPE  STATUS      VOLUME  (VOLUME SET - GEN)

- - - - - - - - - - - - - - - - - - - - - - - - -
30- 079370  LONER-SU    MEMBER1 (PROD_SET-0)
31- 079370  LONER-SB    MEMBER1 (PROD_SET-0)
32- 079370  LONER-SU    MEMBER2 (PROD_SET-0)
33- 079370  LONER-SB    MEMBER2 (PROD_SET-0)
```

Data is unavailable from the time it that takes to complete the VSCLOSE and VSOPEN. Other than this interval, the files are continuously accessible to users.

Since the disks are in the LONER state after the VSCLOSE, either volume set half may be taken offline and used independently of the other half.

4. Use the `VSOPEN` command to make the volume set available. Both user volumes and backup volumes will attempt to be mounted.

Note

If either of them has been taken offline, the command only mounts the available volume set half.

```
:VSOPEN PROD_SET

PROD_SET SPLIT USER VOLUME MOUNTED ON LDEV 32
(AVR 23)

PROD_SET SPLIT BACKUP VOLUME MOUNTED ON LDEV 33
(AVR 24)
```

After the volume set is placed online using the VSOPEN command, it is mounted and available for use.

Note

Once a volume set has been taken offline with a VSCLOSE command, it can only be mounted with a VSOPEN command, not by bringing it online.

5. Notify users that the volume set is available.
6. You can use the DSTAT command to display the user volumes (-SU) and the backup volumes (-SB).

```
:TELL @ SYSTEM IS AVAILABLE NOW
:DSTAT

LDEV-TYPE  STATUS   VOLUME  (VOLUME SET - GEN)
- - - - - - - - - - - - - - - - - - - - - - - - -
30- 079370  MASTER-SU   MEMBER1 (PROD_SET-0)
31- 079370  MASTER-SB   MEMBER1 (PROD_SET-0)
32- 079370  MEMBER-SU   MEMBER2 (PROD_SET-0)
33- 079370  MEMBER-SB   MEMBER2 (PROD_SET-0)
```

Backing up disk files to tape

This example shows how to perform step 2 of split-volume backup, using the STORE command to back up mirrored disk files to magnetic tape.

1. Use the FILE command to specify that a tape drive will be used as the output device.
2. Use the STORE command with SPLITVS to start storing the files. The SHOW option is used to display the files that have been stored to tape.

```
:FILE T; DEV=TAPE
:STORE @.@.@; *T; SPLITVS=PROD_SET; SHOW
```

The tape produced by a split-volume STORE command is fully compatible with tapes produced from a normal STORE command.

Since the files being backed up are distinct from files on the user volumes, users can continue to create, modify, or purge files on the user volumes while the backup is in progress.

The files being backed up remain in the same file state present at the time the volume set was split.

Joining the volume set

This example shows how to perform step 3 of split-volume backup, joining the volume set.

1. Use the new VOLUTIL command `JOINMIRRSET` to join the user and backup halves of a split volume set to make them mirrored again. After the volume set is joined, a repair starts using the volumes that were specified by the source parameter as the source volumes.

Note

The `SOURCE=USER` option is specified so users can continue accessing the volume set while the join is initiated and the repair takes place.

```
:VOLUTIL

Mirvutil A.00.00, (C) Hewlett-Packard Co., 1990.
All Rights Reserved.

volutil:JOINMIRRSET PROD_SET SOURCE=USER
```

Ideally, all members and partners should be present at the time of the join. If any of the volumes are unavailable (due to disk or other errors), some amount of recoverability can be done depending on the situation. Refer to the "Troubleshooting" chapter in this manual for more information.

2. Once the volume set has been rejoined a repair, starts to bring both pairs to a consistent state. You can use the `SHOWSET` command to display the disks being repaired.

```
volutil:SHOWSET PROD_SET MIRROR

Volume Name  Vol Status   Mirr Status  Ldev  Mirr ldev
- - - - - -  - - - - - -  - - - - - - - - -  - - - - -
MEMBER1      MASTER       REPAIR-SRCE  30    31
MEMBER1      MASTER       REPAIR-DEST  31    30
MEMBER2      MEMBER       REPAIR-SRCE  32    33
MEMBER2      MEMBER       REPAIR-DEST  33    32
```

Note

A maximum of six mirrored pairs can be repaired simultaneously. If there are more than six mirrored pairs to be repaired, the repairs are staged. This means that when one of the six repairs finishes, another begins.

Restoring files from a backup tape

Since the tape produced by a split-volume backup is identical in format to that of a normal `STORE` command, no changes in operation are required to restore the files from tape. Follow the procedures for restoring files from a backup tape as described in the *Performing System Operating Tasks* (32650-90137) manual.

4

Troubleshooting

This chapter describes disk repair, how to recover from disk failures, nonrecoverable conditions, and troubleshooting procedures.

Disk repair

Disk repair is a mirrored disk operation that copies data from the good drive to the bad drive to bring a mirrored pair to a consistent state without interrupting applications accessing the volume set. After the repair operation is completed, normal mirroring resumes.

The system starts repairing a disk when one of the following occurs:

Operator starts repair	Operator issues the `REPLACEMIRRVOL` command to start repair.
System automatically starts repair	Upon volume mount, the system checks to make sure both partner disks contain the same information. If partner disks do not contain the same information, the good disk and the bad disk are identified and the repair begins.

All mirrored pairs on the system cannot be repaired at once. There is a limit of six repair operations taking place at the same time. This is to limit the performance impact of repairing on the system. The repairs are staged, such that when one of the six repairs finishes, another begins.

Note

If a system crash occurs and the system is restarted, the mirrored disk system always performs a disk repair on all of the mirrored disk partners. The repairs are staged.

Drives that are staged (awaiting repair) transition to the repair state in order of mounting. If the maximum number of repairs is taking place, subsequent pairs that mount and get staged are serviced in the order that they are mounted.

Note

Any disk pair that has one partner go DISABLED, (and has a `REPLACEMIRRVOL` command issued), always begins an immediate repair and is not staged.

You can use the VOLUTIL `SHOWSET` command to display volumes involved in the repair process.

```
:VOLUTIL

Mirvutil A.00.00, (C) Hewlett-Packard Co., 1990.
All Rights Reserved.

volutil:SHOWSET PROD_SET MIRROR

Volume Name  Vol Status   Mirr Status  Ldev  Mirr ldev
- - - - - -  - - - - - -  - - - - - - - - -  - - - - -
MEMBER1      MASTER       NORMAL       30    31
MEMBER1      MASTER       NORMAL       31    30
MEMBER2      MEMBER       REPAIR-DEST  32    33
MEMBER2      MEMBER       REPAIR-SRCE  33    32
```

The above screen shows that LDEV 32 (REPAIR-DEST) is being repaired by LDEV 33 (REPAIR-SRCE). The repair process takes about twenty minutes to complete. The time is an only an estimate and can take up to an hour and a half. Programs and data residing on `MEMBER2` are available while repairs are taking place.

Disk failures

The following disk failures will now be described along with their recovery procedures:

- Drives that do not mount at system start.
- Drives that are disabled after they have mounted.

Disk mounting failure

The system automatically mounts a mirrored volume set after volumes have been added to a mirrored volume set, upon power on of the disk drive or the boot of the system.

When a mirrored volume set is mounted, it is possible that one or more mirrored partners may be missing or not responding.

Example: If a disk does not mount

This example shows how to recover from a disk that did not mount.

1. If LDEV 32's partner did not mount, LDEV 32 is placed in the `PENDING` state and a console message is displayed to alert you of this condition.

   If the partner of LDEV 32 comes online, it is recognized; otherwise, the message displays every thirty seconds.

2. Reply to the `(Y/N)?` question to stop it from repeating.

```
?09:09/12/MIRRORED PARTNER MISSING FOR LDEV# 32

?09:09/22/ACKNOWLEDGE MIRRORED PARTNER MISSING FOR LDEV# 32(Y/N)?

:REPLY 22,Y
```

3. You will not be able to access `MEMBER2` due to the `PENDING` state of one of its disks until you do one of the following:

   a. Power on the missing partner (if the drive had previously been powered off).

   b. Issue the `SUSPENDMIRRVOL` command to place the `PENDING` disk in the `SUSPEND-MIRR` state and make it accessible without mirroring.

Note

Issuing the `SUSPENDMIRRVOL` command does not stop the repeating message. Your reply stops the message.

4. Use the DSTAT command to verify that LDEV 32's partner did not mount.

```
:DSTAT

LDEV-TYPE   STATUS       VOLUME  (VOLUME SET - GEN)
- - - - - - - - - - -    - - - - - - - - - - - - -
30- 079370   MASTER-MD     MEMBER1     (PROD_SET-0)
31- 079370   MASTER-MD     MEMBER1     (PROD_SET-0)
32- 079370 *PENDING-MD     MEMBER2     (PROD_SET-0)
```

The previous screen shows that MEMBER2 is waiting (PENDING) for the mount of its partner (which is not even listed). The MEMBER2 volume remains in the PENDING state and remains unavailable until you issue the SUSPENDMIRRVOL command to override and tell the system to proceed without mirroring on that volume.

Note

The SUSPENDMIRRVOL command can only be issued on a disk in the PENDING state.

5. Use the VOLUTIL SUSPENDMIRRVOL command to access the MEMBER2 volume without mirroring.

```
:VOLUTIL

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volutil:SUSPENDMIRRVOL PROD_SET:MEMBER2 32

*Verify:SUSPEND THE MIRROR PENDING VOLUME ON LDEV 32 [Y/N]?Y
```

Caution

Care must be taken when using SUSPENDMIRRVOL to ensure that the PENDING disk is good. This command forces the system to mount and use this drive. Because of drive errors, it may not have been possible to mark the drive as bad. The drive could contain data that has not been updated. This could lead to application errors and force a reload of the volume set.

6. After you have suspended a mirrored volume, use the SHOWSET command with the MIRROR parameter to verify that the volume can be accessed and is in the SUSPEND-MIRR state.

```
volutil:SHOWSET PROD_SET MIRROR

Volume Name  Vol Status   Mirr Status  Ldev  Mirr ldev
- - - - - -  - - - - - -  - - - - - - - - - - - - - - -
MEMBER1      MASTER       NORMAL       30    31
MEMBER1      MASTER       NORMAL       31    30
MEMBER2      MEMBER       SUSPEND-MIRR 32    *
```

   The previous screen shows that the MEMBER2 volume is available and does not have a mirrored partner.

7. Check the disk that did not mount to see if it was powered on. Once the disk has been repaired by either physically replacing the drive or fixing the disk problem, power on the disk.

Example: Replacing a disk that did not mount

This example shows how to replace a disk that did not mount at system start.

1. Use the DSTAT command to verify that the new volume can be initialized (SCRATCH or UNKNOWN status). If you need to scratch the volume and it does not contain any data that you want to save, use the SCRATCHVOL command.

Note

The new volume must be mounted in the SCRATCH or UNKNOWN state. It does not need to have the same LDEV or I/O path as the disk that did not mount.

```
volutil: :DSTAT

LDEV-TYPE   STATUS       VOLUME  (VOLUME SET - GEN)
- - - - - - - - - - -    - - - - - - - - - - - - - -
30- 079370   MASTER-MD     MEMBER1 (PROD_SET-0)
31- 079370   MASTER-MD     MEMBER1 (PROD_SET-0)
32- 079370   MEMBER-MD     MEMBER2 (PROD_SET-0)
33- 079370   SCRATCH
```

Note

If the new volume mounts in the PENDING state, do not issue the SUSPENDMIRRVOL command on the new volume. Disk mirroring cannot work properly if both partners of a mirrored pair are placed in the SUSPEND-MIRR state.

2. Use the REPLACEMIRRVOL command to initialize LDEV 33 as the new mirrored disk partner of LDEV 32.

```
volutil: REPLACEMIRRVOL PROD_SET:MEMBER2 33
```

The system now recognizes (mounts) the replaced volume, resumes disk mirroring, and starts the repair process.

3. Use the SHOWSET command to verify that MEMBER2 is under repair.

```
volutil: SHOWSET PROD_SET MIRROR

Volume Name  Vol Status  Mirr Status  Ldev  Mirr ldev
- - - - - -  - - - - - - - - - - - - - -  - - - - -
MEMBER1      MASTER      NORMAL       30    31
MEMBER1      MASTER      NORMAL       31    30
MEMBER2      MEMBER      REPAIR-SRCE  32    33
MEMBER2      MEMBER      REPAIR-DEST  33    32
```

The above screen shows that LDEV 33 (REPAIR-DEST) is being repaired by LDEV 32 (REPAIR-SRCE). Programs and data residing on MEMBER2 are available while repairs are taking place.

Disk failure after mounting

The system automatically recovers from a failure of a single disk that is a partner of a mirrored pair during normal mirrored operation. Normal mirrored operation means that both partners are fully mounted and no repair operation is taking place.

A drive can fail and be marked DISABLED in the following ways:

Errors being returned	The drive is marked as having failed (DISABLED) immediately, and the application continues to use the remaining drive in the NON-MIRROR state.
Drive not responding	There is a slight delay (less than two minutes) while the system waits for the drive to respond. During this waiting period, processes performing I/O will be suspended. If the drive responds before the timeout, normal mirroring resumes. If the drive does not respond, the drive is marked as having failed (DISABLED), and the application continues to use the remaining drive in the NON-MIRROR state.

Example: If a disk fails after mounting

This example shows how to recover from a disk that failed after mounting.

1. If LDEV 32 fails, a console message alerts you of this condition.

```
?09:09/12/MIRRORED VOLUME DISABLED ON LDEV# 32
```

   The system automatically continues the application without mirroring and places the good disk in the NON-MIRROR state. The following message displays every thirty seconds, asking you to acknowledge this condition.

2. Your reply stops the repeating message on the console. It causes no other action to take place.

```
?09:09/22/ACKNOWLEDGE MIRRORED VOLUME DISABLED ON LDEV# 32 [Y/N]?
:REPLY 22,Y
```

Note

The repeating message continues until a reply is given - even if the drive is replaced.

3. Use the DSTAT command to show that LDEV 32 has failed and is no longer available.

```
:DSTAT

LDEV-TYPE   STATUS       VOLUME  (VOLUME SET - GEN)
- - - - - - - - - - -    - - - - - - - - - - - - - -
30- 079370   MASTER-MD     MEMBER1 (PROD_SET-0)
31- 079370   MASTER-MD     MEMBER1 (PROD_SET-0)
32- 079370  *DISABLED-MD   MEMBER2 (PROD_SET-0)
33- 079370   MEMBER-MD     MEMBER2 (PROD_SET-0)
```

4. Use the SHOWSET command to confirm that LDEV 32 is disabled and that LDEV 33 is functioning in a NON-MIRROR state.

```
:VOLUTIL

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volutil:SHOWSET PROD_SET MIRROR

Volume Name  Vol Status  Mirr Status  Ldev  Mirr ldev
- - - - - -  - - - - - - - - - - - - - -  - - - - -
MEMBER1      MASTER      NORMAL       30    31
MEMBER1      MASTER      NORMAL       31    30
MEMBER2      MEMBER      DISABLED     32    33
MEMBER2      MEMBER      NON-MIRROR   33    32
```

Example: Replacing a disabled disk

This example shows how to replace a disk in the DISABLED state.

1. Use the DSTAT command to verify that the new volume mounts in the DISABLED state and has the same LDEV as the previous volume that was disabled.

```
:VOLUTIL

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volutil:SHOWSET PROD_SET MIRROR

Volume Name  Vol Status  Mirr Status  Ldev  Mirr ldev
- - - - - -  - - - - - - - - - - - - - -  - - - - -
MEMBER1      MASTER      NORMAL       30    31
MEMBER1      MASTER      NORMAL       31    30
MEMBER2      MEMBER      DISABLED     32    33
MEMBER2      MEMBER      NON-MIRROR   33    32
```

Note

When replacing a volume in the DISABLED state, you must use the same LDEV number and I/O path as the failed disk. Any volume mounted on that LDEV mounts in the DISABLED state and is available as the target of the REPLACEMIRRVOL command.

2. Use the REPLACEMIRRVOL command to replace LDEV 32 and resume mirroring (after the repair).

```
volutil: REPLACEMIRRVOL PROD_SET:MEMBER2 32
```

The system now recognizes (mounts) the replaced volume, resumes disk mirroring, and starts the repair process. The replacement volume has the same characteristics specified when the disabled volume was first initialized using the NEWMIRRVOL or NEWMIRRSET commands.

Note

REPLACEMIRRVOL always initiates an immediate repair (no staging), even if the maximum number of repairs is already taking place.

If the destination drive fails or is not responding during a repair operation, it is marked DISABLED, and the source drive returns to the NON-MIRROR state.

3. You can use the SHOWSET command to verify that MEMBER2 is under repair.

```
volutil: SHOWSET PROD_SET MIRROR

Volume Name  Vol Status   Mirr Status  Ldev  Mirr ldev
- - - - - -  - - - - - -  - - - - - - - - -  - - - - -
MEMBER1      MASTER       NORMAL       30    31
MEMBER1      MASTER       NORMAL       31    30
MEMBER2      MEMBER       REPAIR-SRCE  32    33
MEMBER2      MEMBER       REPAIR-DEST  33    32
```

Troubleshooting

This section describes troubleshooting information for the following conditions:

- Device adapter card drive failure.
- Disabled drive.
- Data recovery using DISCUTIL.
- System abort.
- JOINMIRRSET aborted.
- Drive fails when volume set is split.
- System abort while volume set is being split.
- Missing volumes during JOINMIRRSET.

If a device adapter card's drive fails

If a disk drive is directly connected to the device adapter card and that drive fails, the remaining drives connected to that device adapter card may not be available for use, depending on the type of drive failure. If power is lost to the drive, all disks chained off that drive go DISABLED, and a REPLACEMIRRVOL command is required for each drive on the chain to resume disk mirroring.

If a drive is DISABLED

A drive could be marked `DISABLED` simply because of a time out (over two minutes) due to loss of power to the drive, or a read/write error that is correctable by sparing (recovering defective disk sectors). Before replacing the drive, issue a `REPLACEMIRRVOL` command on the disabled drive, assuming that it is powered on and responding. If it again goes `DISABLED`, contact your support personnel.

If DISCUTIL is needed

Use the DISCUTIL utility to save and recover data from disk drives when MPE/iX is not available.

Note

When using DISCUTIL, you must power off one partner of each mirrored disk pair before DISCUTIL will work properly.

For more information on DISCUTIL, use the *Volume Management Reference Manual* (32650-90045).

If the system aborts

In the event of a system abort, use the DUMP utility to save the current state of system memory and secondary storage to tape for later analysis.

For more information on DUMP, use the *System Startup, Configuration, and Shutdown Reference Manual* (32650-90042).

If JOINMIRRSET is aborted

A volume join is aborted if one of the following conditions occur:

- A source volume is missing.
- Your negative reply when prompted for verification.
- A source volume fails.
- System aborts during `JOINMIRRSET`.
- If `SOURCE=USER` is requested, and a split-volume backup is taking place.
- If `SOURCE=BACKUP` is requested, and there are files opened on the user volumes.

If a source volume is missing

The join can be retried later with either volume set half as the source. You will have an opportunity to correct the error that resulted in missing volumes. If the situation cannot be rectified, the alternate volume set half can be used as the source. If neither volume set half is complete, a reload of the entire volume set is necessary.

If a source volume fails

After the `JOINMIRRSET` command has proceeded to the point of starting repairs, if any of the source volumes incur a disk failure before the repair completes, the entire volume set must be reloaded. This situation can be noted by the occurrence of a disk failure on a volume for which VOLUTIL did not print an "absent" message. The join cannot be retried with the other volume set half as the source volumes since they have already been used as the destination volumes.

If the system aborts during JOINMIRRSET

If a `JOINMIRRSET` command is interrupted by a system abort, the volume set may be partly split. The master volume is the first to be joined, and its state determines if the entire set is split or joined; therefore if the master is joined, all the members in the set are joined. The join is completed during reboot, and the repair process starts; otherwise, the volume set mounts as a split-volume set and the `JOINMIRRSET` command processing must be retried.

If a drive fails when volume set is split

While a volume set is split, if it fails, it is identical to a disk failure on a non-mirrored volume set. The application accessing the failed drive hangs or causes a system abort; however, the data on the failed drive can be recovered at the time of the join as long as the split-volume set still includes a complete volume set half (user or backup volumes).

If the failed drive is a backup volume, the latest copy of the data is available from the user volume. If the failed drive is a user volume and data is recovered from the backup volumes, changes made to the user volumes after the split are lost.

If the system aborts while volume set is being split

If a volume set split or join is interrupted by a system abort, the volume set may only be partially split. Upon remount, a partly split-volume set is always automatically joined.

Interrupted join	Results in a successful join.
Interrupted split	Returns the volume set to a joined state. The volume set split has to be redone after the repair (activated by the join) is complete.

If the volumes are unavailable during JOINMIRRSET

The JOINMIRRSET command matches volumes from user and backup split-volume sets that were previously mirrored partners, and starts a repair in the direction specified by the SOURCE parameter. Ideally, all user volumes and backup volumes belonging to the original volume set are mounted; however, volumes may be unavailable for a variety of reasons: disk error, power failure, user error. The possible combinations of volume states and their resulting actions are described in the following table.

Table 4-1. JOINMIRRSET Options

SOURCE=	Description

SOURCE=USER (No volumes missing)	All volumes in the set can be joined. Only the messages pertaining to the join itself are printed:
	`*Note: Volume MEMBER1 on ldev 34 and ldev 36 will be joined.`
	`*Note: Volume MEMBER2 on ldev 35 and ldev 370will be joined.`

SOURCE=USER (One or more backup volumes missing)	The partnerless user volumes are automatically suspended (the equivalent of SUSPENDMIRRVOL commands). The user volumes are continuously available for use. You can later resume mirroring by adding partners through the REPLACEMIRRVOL command.
	`*Warning: Backup volume MEMBER2 is absent.`
	`*Note: Volume MEMBER2 on ldev 37 will be suspended.`
	`*Note: Volume MEMBER1 on ldev 34 and ldev 36 will be joined.`

SOURCE=USER (All backup volumes missing)	All user volumes are suspended.
	`*Note: No backup volumes are mounted.`
	`*Note: Volume MEMBER1 on ldev 34 will be suspended.`
	`*Note: Volume MEMBER2 on ldev 37 will be suspended.`

SOURCE=USER (One or more user volumes missing)	If any of the source volumes are missing, the join cannot proceed and is aborted.
	`*Warning: User volume MEMBER1 is absent.`
	`*Error: User volumes incomplete, cannot use as repair source.`

SOURCE=BACKUP (No volumes missing)	Since this repair results in changes being made to the user volumes since the split has been lost, verification is requested before the command proceeds. All users of the volume set must be logged off.
	`*Verify: User volume set changes will be lost, continue [Y/N]?`
	`*Note: Volume MEMBER1 on ldev 34 and ldev 36 will be joined.`
	`*Note: Volume MEMBER2 on ldev 35 and ldev 37 will be joined.`

Table 4-1. JOINMIRRSET Options (continued)

SOURCE=	Description

`SOURCE=BACKUP` (One or more user volumes missing)	All users of the volume set must be logged off. Volumes with partners start repairing, and backup volumes with missing partners go mirror `PENDING`. Verification is requested.
	
	`*Warning: User volume MEMBER2 is absent.`
	`*Verify: User volume set changes will be lost, continue [Y/N]?`
	`*Note: Volume MEMBER1 on ldev 34 and ldev 36 will be joined.`
	`*Note: Use the SUSPENDMIRRVOL command for volume MEMBER2 on ldev 35.`

`SOURCE=BACKUP` (All user volumes missing)	All backup volumes become mirror `PENDING`.
	
	`*Note: No user volumes are mounted.`
	`*Verify: User volume set changes will be lost, continue [Y/N]?`
	`*Note: Use the SUSPENDMIRRVOL command for MEMBER1 on ldev 36.`
	`*Note: Use the SUSPENDMIRRVOL command for MEMBER1 on ldev 35.`

`SOURCE=BACKUP` (One or more backup volumes missing)	Since some of the source volumes are missing, the join cannot proceed and is aborted.
	
	`*Warning: Backup volume MEMBER1 is absent.`
	`*Error: Backup volumes incomplete, cannot use as repair source.`

Example: Repairing from backup volumes

This example shows how to perform a backup from the backup volumes when the user volume set is incomplete or data on the volume set is known to be corrupt.

1. Use the `DSTAT` command to find out if all of the volumes mounted. The user volume LDEV 33 did not mount. Since all of the user volumes did not mount (and all of the backup volumes did mount), the backup volumes can be used as the source of the join and the repair.

```
:DSTAT

LDEV-TYPE   STATUS       VOLUME  (VOLUME SET - GEN)
- - - - - - - - - - -    - - - - - - - - - - - - -
30- 079370   MASTER-SU     MEMBER1     (PROD_SET-0)
31- 079370   MASTER-SB     MEMBER1     (PROD_SET-0)
32- 079370   MEMBER-SB     MEMBER2     (PROD_SET-0)
```

Note

When you use backup volumes as the source of the join and repair, the changes that were made to the user volumes during the backup are lost. For example, a file that was created after the volume set was split, does not exist on the volume set after the join.

2. Inform users that they must be logged off the volume set before this type of join can be requested.

```
: TELL @ LOGOFF NOW FOR JOIN
```

3. Invoke VOLUTIL.
4. Use the JOINMIRRSET command with SOURCE=BACKUP.

```
:VOLUTIL

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volutil:JOINMIRRSET PROD_SET SOURCE=BACKUP
volutil:EXIT
```

If any user volumes are missing, the partner backup volumes are not automatically suspended by the JOINMIRRSET command; however, they are placed in the PENDING state after the join.

5. Exit VOLUTIL.
6. Notify users that the volume set is available.
7. Use the DSTAT command to find out which volumes are pending.

```
: TELL @ SYSTEM IS AVAILABLE NOW
: DSTAT

LDEV-TYPE   STATUS       VOLUME  (VOLUME SET - GEN)
- - - - - - - - - - -    - - - - - - - - - - - - -
30- 079370   MASTER-MD     MEMBER1     (PROD_SET-0)
31- 079370   MASTER-MD     MEMBER1     (PROD_SET-0)
32- 079370 *PENDING-MD     MEMBER2     (PROD_SET-0)
```

8. Use the VOLUTIL SHOWSET command with the MIRROR option to display the state of the volumes in the mirrored set.

```
:VOLUTIL

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volutil:SHOWSET PROD_SET MIRROR

Volume Name  Vol Status   Mirr Status  Ldev  Mirr ldev
- - - - - -  - - - - - -  - - - - - - - - - -  - - - - -
MEMBER1      MASTER       REPAIR-DEST  30    31
MEMBER1      MASTER       REPAIR-SRCE  31    30
MEMBER2      MEMBER       PENDING      32    *
```

9. Since the user volume LDEV 33 was missing, its partner is placed in the PENDING state after the join. To place MEMBER2 in non-mirroring operation, use the SUSPENDMIRRVOL command for LDEV 32 or use the REPLACEMIRRVOL command for a new partner for LDEV 32.

Nonrecoverable conditions

The following error conditions are nonrecoverable:

- Failure of both mirrored drives.
- Failure of both split-volume set halves.
- Failure of the source drive during the repair operation.
- Drive failure during join.

If both mirrored drives fail

When a single drive of a pair fails, a period of time exists while the drive is replaced and the new one is repaired. If the remaining drive fails during this time, the failure is identical to a disk drive failure on a non-mirrored system.

If both split volume set halves fail

If both the user volumes and backup volumes suffer a disk failure, the situation is nonrecoverable. This applies even if the volumes were not previously mirrored partners (same copies), but different members of the volume set. Either the user volumes or backup volumes must be complete in order for the volume set to return to a known consistent point. User volumes and backup volumes may not be mixed to create a volume set. The split-volume set cannot be joined, and must be recreated.

If a drive fails during the repair operation

Whenever there is an unexpected failure that necessitates a rebooting of the system, or when a split-volume set is joined into a mirrored volume set, all mirrored pairs undergo a repair process. This is necessary to guarantee the consistency of the disks. During the repair operation, one disk is copied to the other. If the source disk fails during this period, there is no way to recover from it without restoring the files from tape.

If the source drive of a staged or repairing volume pair becomes unresponsive (due to loss of power, for example) or suffers a hard error, the system behaves just as if there were no mirroring present. If the destination drive of a repairing volume pair becomes unresponsive or suffers a hard error, it is marked `DISABLED`. If the destination drive of a staged volume pair becomes unresponsive after being staged, but before transitioning to be repaired, it is marked `DISABLED` at repair time.

If a drive fails during the join operation

This is a more specific case of a failure during repair. If a `JOINMIRRSET` completes and during the repair one of the `REPAIR-SRCE` disks becomes disbaled, the volume set cannot be recovered and has to be reloaded.

Additionally, the system cannot recover from the following user errors:

- Improper use of the `SUSPENDMIRRVOL` command.
- Software errors.
- Direct modification of disk.

If you misuse the SUSPENDMIRRVOL command

It is possible through the use of the `SUSPENDMIRRVOL` command to force the system to mount and use a drive that is bad. Because of drive errors, it may not have been possible to mark the drive itself as bad when the errors occurred. Now if the volume set is remounted without the good partner, there may be no way for the system to know that the drive is bad. In this case the use of the `SUSPENDMIRRVOL` command could force the mounting of the bad drive, which may contain data that has not been updated. While this situation is highly unlikely, care must be taken when using this command to ensure that the disk in question is good.

If you create a software error

A mirrored disk system offers no protection against software errors that mistakenly write bad data to disk. The bad data is mirrored just as any other writing to disk.

If you modify a disk

Privileged mode users could, through DEBUG, make modification to one partner of a mirrored pair without notifying the mirrored disk system. This causes the partner disks to be inconsistent and could lead to unpredictable results.

5

Mirrored Disk Commands

Disk mirroring uses two types of commands: VOLUTIL utility commands and system commands. All of the VOLUTIL and system commands used with mirrored disks are described in this chapter. The VOLUTIL commands are described first, followed by the system commands. The VOLUTIL and system commands can be input in uppercase or lowercase.

VOLUTIL command summary

The following table lists all of the VOLUTIL commands used with mirrored disks.

Table 5-1. VOLUTIL Commands

Command	Task
`JOINMIRRSET`	Rejoins a previously split mirrored volume set.
`NEWMIRRVOL`	Adds a volume to a mirrored volume set.
`NEWMIRRSET`	Creates a mirrored volume set.
`REPLACEMIRRVOL`	Replaces a previously disabled volume.
`SHOWSET`	Displays volume set information.
`SUSPENDMIRRVOL`	Suspends mirroring on a volume which is in the `PENDING` state.

JOINMIRRSET

The new VOLUTIL `JOINMIRRSET` command joins a mirrored volume set that was previously split through the `VSCLOSE ;SPLIT` command. It also starts a repair in the direction specified by the `SOURCE` parameter. Ideally, all user volumes and backup volumes belonging to the original volume set are mounted; however, volumes may be unavailable for a variety of reasons: disk error, power failure, operator error. Refer to "Troubleshooting," in chapter 4 of this manual.

The user volumes should typically be selected as the source volumes since they contain the most recent copy of the data; however, the volumes chosen as the source volumes must be complete (that is, there can be no disabled or missing volumes). If the user volumes are incomplete and cannot be used as the source, the backup volumes can alternatively be chosen; however, this results in losing any changes made to the user volumes since the split.

This command is part of the VOLUTIL utility program. Pressing CTRL Y or Break has no effect on this command.

Task

Rejoins a previously split mirrored volume set and starts repairs.

Syntax

`JOINMIRRSET` [`SNAME=`] *volumesetname* { `SOURCE=` { `USER` / `BACKUP` } }

Parameters

volumeset-name — The volume set name of the split-volume set to be joined. **Required.**

`SOURCE` — The volume set half to be used as the source volumes for the repair. **Required.**

- `USER` — Use user volumes as source, backup volumes as destination.
- `BACKUP` — Use backup volumes as source, user volumes as destination.

The volume set half specified as the source must be complete, or the join fails. If any of the destination volumes are missing, the partner source volume is suspended (if `SOURCE=USER`), and no repair is done for the pair.

If `SOURCE=USER` is specified, users can continue to access the volume set while the join is initiated and the repair takes place.

If `SOURCE=BACKUP` is specified, all users must be logged off the volume set prior to executing this command so that the user volumes can be implicitly closed during the join.

Example This example shows how to use the VOLUTIL `JOINMIRRSET` command.

```
volutil:JOINMIRRSET PROD_SET SOURCE=USER
```

NEWMIRRSET

The NEWMIRRSET command creates a new mirrored volume set by initializing the master of the volume set.

The volume that will be initialized as the new volume master must be mounted in the SCRATCH or UNKNOWN state.

Task

Creates a mirrored volume set.

Syntax

```
volutil: NEWMIRRSET [SNAME=]sname
                    [MASTER=]master
                    [LDEVS=](ldev,ldev)
                    [ [PERM=]percent_perm][ [TRANS=]percent_trans]
                    [ [GEN=]gen_number]
                    [ [CLASSES=](cname[ [,cname]...])]
```

Parameters

sname — The name that you assign to the new volume set. It is used to reference and identify the set. It must be a unique name at the time of initialization. No other volume set with the same name can be mounted on the system. **Required**.

master — The name that you assign to the master volume of the set. This name need not be the same as the name assigned to the volume set. **Required**.

ldev,ldev — Two numbers from 1 to 999 that specify the logical devices that are to become the mirrored master volumes of the volume set. They must identify two different devices configured into the device class DISC. The volumes must be mounted in the SCRATCH or UNKNOWN state. **Required**.

percent_perm — A number between 0 and 100 that specifies the maximum percentage of disk space that can be allocated to permanent data (files, databases). Default is 100. **Optional**.

percent_trans — A number between 0 and 100 that specifies the maximum percentage of disk space that can be allocated to transient data (process stacks, virtual objects). Default is 100. **Optional**.

gen_number A number from 0 to 32,767 that specifies the generation of the new volume set. Default is 0. **Optional**.

cname The names of volume classes to be initially created in the volume set. The `MASTER` volume (volume being initialized) is assigned to these classes. If this parameter is omitted, the volume class `DISC` is created and the `MASTER` volume is assigned to it. **Optional**.

Example

This example shows how to use the VOLUTIL `NEWMIRRSET` command. If you do not specify a volume class, the default volume class `DISC` is added to the mirrored volume set.

```
volutil: NEWMIRRSET PROD_SET MEMBER1 (30,31)

*Verify: Initialize new volume set PROD_SET on ldev 30 and ldev 31 [Y/N]? Y

*Note: New master volume has been initialized for ldev 30 and ldev 31.
```

Note

After executing the `NEWMIRRSET` command, you should execute a `:VSCLOSE` *volsetname* and a `:VSOPEN` *volsetname* to ensure that the volume set information has been posted to the disk.

NEWMIRRVOL

The NEWMIRRVOL command adds a new member volume to an existing mirrored volume set.

The volume that will be initialized as the new volume member must be mounted in the SCRATCH or UNKNOWN state.

Task

Adds volumes to a mirrored volume set.

Syntax

```
NEWMIRRVOL [VNAME=]sname:vname
           [LDEVS=](ldev,ldev)
           [ [PERM=]percent_perm ][ [TRANS=]percent_trans]
           [ [CLASSES=](cname[ [,cname]...])]
```

Parameters

sname — The name assigned to the mirrored volume set. **Required**.

vname — The name that you assign to the new volume. It is used to reference and identify the volume. It must be a unique name at the time of initialization. No other volume with the same name can be mounted on the system. **Required**.

ldev,ldev — Two numbers from 1 to 999 that specify the logical devices that are to become the mirrored master volumes of the volume set. They must identify two different devices configured into the device class DISC. The volumes must be mounted in the SCRATCH or UNKNOWN state. **Required**.

percent_perm — A number between 0 and 100 that specifies the maximum percentage of disk space that can be allocated to permanent data (files, databases). Default is 100. **Optional**.

percent_trans — A number between 0 and 100 that specifies the maximum percentage of disk space that can be allocated to transient data (process stacks, virtual objects). Default is 100. **Optional**.

cname — The names of volume classes to be initially created in the volume set. The MASTER volume (volume being initialized) will be assigned to these classes. If this parameter is omitted the volume class DISC is created, and the MASTER volume is assigned. **Optional**.

Example This example shows how to use the VOLUTIL `NEWMIRRVOL` command. If you do not specify a volume class, the default volume class `DISC` is added to the volume.

Note The ":" needs to be specified in this command.

```
volutil: NEWMIRRVOL PROD_SET:MEMBER2 (32,33)

*Verify: Initialize new member volume on ldev 32 and ldev 33 [Y/N]? Y

*Note: New member volume has been initialized for ldev 32 and ldev 33.
```

Note After executing the `NEWMIRRVOL` command, you should execute a `:VSCLOSE` *volsetname* and a `:VSOPEN` *volsetname* to ensure that the volume set information has been posted to the disk.

REPLACEMIRRVOL

The REPLACEMIRRVOL command is used when a partner of a mirrored pair has suffered a failure and mirroring has been disabled. This command is also used to add a partner to a drive that is in the SUSPENDMIRR state because the operator issued a SUSPENDMIRRVOL command. This command initializes the new partner volume and begins the repair process on it. This process takes place without interruption to applications accessing the volume set. The replacement volume has the same characteristics that were specified in the NEWMIRRVOL or NEWMIRRSET command when the volume was first initialized.

When using this command, the replacement drive must be mounted on the same LDEV as the one that failed. The volume must be in the DISABLED state as shown in the DSTAT display.

Note

Any volume mounted on an LDEV on which a volume has been disabled, mounts in the DISABLED state.

Task

Replaces a previously disabled volume.

Syntax

```
REPLACEMIRRVOL [VNAME=] sname:vname
               [LDEV=] ldev
```

Parameters

sname	The name assigned to the mirrored volume set. **Required**.
vname	The name assigned to the volume. **Required**.
ldev	One number from 1 to 999 that specifies the logical device that is to be replaced. It must identify one unique device configured into the device class DISC. **Required**.

Example

This example shows how to use the REPLACEMIRRVOL command.

LDEV 33 did not mount. LDEV 32 mounted in the PENDING state because its partner was missing. The drive that did not mount has been fixed (or replaced), mounted, and placed online (in the DISABLED state). The drive can now be initialized as the new LDEV 33.

To initialize LDEV 33 as the new mirrored disk partner of LDEV 32, use the following command:

```
volutil: REPLACEMIRRVOL PROD_SET:MEMBER2 33
```

The system now recognizes (mounts) the replaced volume, resumes disk mirroring, and starts the repair process.

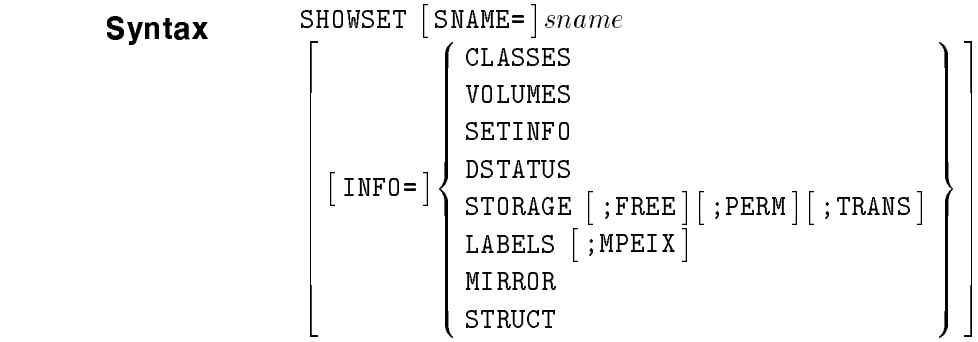
SHOWSET

The VOLUTIL SHOWSET command is used to display information about a particular volume set. The master volume of the volume set must be mounted in the MASTER state as displayed by the DSTAT command.

Task

Displays volume set information.

Syntax



Parameter

sname — The name assigned to the mirrored volume set. **Required**.

MIRROR — Include mirrored volume set information in the display. **Optional.**

None of the other SHOWSET options are affected by mirrored disks. For a detailed account of the other options, refer to the *Volume Management Reference Manual* (32650-90045).

Example This example shows how to use the VOLUTIL SHOWSET command.

```
volutil:SHOWSET ADMIN_SET MIRROR

Volume Name  Vol Status  Mirr Status  Ldev  Mirr ldev
- - - - - - - - - - - -  - - - - - -  - - - - - - - -
MEMBER1      MASTER      USER         30    *
MEMBER1      MASTER      BACKUP       31    *
```

Since the volume set is split, the "Mirr Ldev" field is not valid and displays "*"s. The previous partner volume may or may not be mounted on the system. If the volume set names and volume names match, the LDEVs can be assumed to have been mirrored partners.

```
volutil:SHOWSET PROD_SET MIRROR

Volume Name  Vol Status  Mirr Status  Ldev  Mirr ldev
- - - - - - - - - - - -  - - - - - -  - - - - - - - -
MEMBER1      MASTER      NORMAL       30    31
MEMBER1      MASTER      NORMAL       31    30
MEMBER2      MEMBER      DISABLED     32    33
MEMBER2      MEMBER      NON-MIRROR   33    32
MEMBER3      MEMBER      REPAIR-DEST  34    35
MEMBER3      MEMBER      REPAIR-SRCE  35    34
MEMBER4      MEMBER      STAGED-DEST  36    37
MEMBER4      MEMBER      STAGED-SRCE  37    36
MEMBER5      MEMBER      PENDING      38    *
MEMBER6      MEMBER      SUSPEND_MIRR 39    *
```

Table 5-2. SHOWSET Mirrored Disk States

States	Description	Volume Available?
NORMAL	Disks being mirrored.	Yes
PENDING	Partner did not mount upon system startup or VSOPEN.	No
DISABLED	Disk failure after volume mounted.	No, but partner is.
NON-MIRROR	Disk does not have mirrored partner. Partner went disabled after mounting.	Yes
SUSPEND-MIRROR	Disk does not have mirrored partner because partner did not mount and operator issued a SUSPENDMIRRVOL command.	Yes
REPAIR-DEST	Disk being repaired (copied to).	Yes
REPAIR-SRCE	Disk initiating repair (copied from).	Yes
STAGED-DEST	Disk awaiting repair as a REPAIR-DEST.	No, but partner is.
STAGED-SRCE	Disk awaiting repair as a REPAIR-SRCE.	Yes

SUSPENDMIRRVOL

The SUSPENDMIRRVOL command is used when one partner of a mirrored pair is not mounted and access to the mounted volume is desired anyway. This command tells the system to proceed without mirroring on the mounted volume.

Caution

Care must be taken when using SUSPENDMIRRVOL to ensure that the PENDING disk is good. This command forces the system to mount and use this drive. Because of drive errors, it may not have been possible to mark the drive as bad. The drive could contain data that has not been updated. This could lead to application errors and force a reload of the volume set.

Task

Suspends mirroring on a volume whose partner is in the PENDING state.

Syntax

```
SUSPENDMIRRVOL [VNAME=] sname:vname
               [LDEV=] ldev
```

Parameters

sname	The name assigned to the mirrored volume set. **Required**.
vname	The name assigned to the volume. **Required**.
ldev	One number from 1 to 999 that specifies the logical device that is to be suspended. It must identify one unique device configured into the device class DISC. **Required**.

Example This example shows how to use the SUSPENDMIRRVOL command.

1. Use the DSTAT command to find out which volumes are mounted. LDEV 32 mounted in the PENDING state because its partner did not mount.

```
:DSTAT

LDEV-TYPE  STATUS      VOLUME  (VOLUME SET - GEN)
- - - - - - - - - - - - - - - - - - - - - - - - -
30- 079370   MASTER-MD   MEMBER1 (PROD_SET-0)
31- 079370   MASTER-MD   MEMBER1 (PROD_SET-0)
32- 079370 *PENDING-MD   MEMBER2 (PROD_SET-0)
```

2. Use the VOLUTIL SUSPENDMIRRVOL command to access MEMBER2 without mirroring.

Note The SUSPENDMIRRVOL command can only be issued on a disk in the PENDING state.

```
: VOLUTIL

Mirvutil A.01.01, (C) Hewlett-Packard Co., 1990.
All Rights Reserved.

volutil: SUSPENDMIRRVOL PROD_SET:MEMBER2 32

*Verify: SUSPEND THE MIRROR PENDING VOLUME ON LDEV 32 [Y/N]? Y

volutil: :DSTAT

LDEV-TYPE  STATUS      VOLUME  (VOLUME SET - GEN)
- - - - - - - - - - - - - - - - - - - - - - - - -
30- 079370   MASTER-MD   MEMBER1 (PROD_SET-0)
31- 079370   MASTER-MD   MEMBER1 (PROD_SET-0)
32- 079370   MEMBER      MEMBER2 (PROD_SET-0)
```

System command summary

The following system commands have been changed to include mirrored disks. They are described in this section.

Table 5-3. System Commands

Command	Task
DSTAT	Displays disk information.
STORE	Backs up disk files to tape.
VSCLOSE	Closes a volume set and takes it offline.
VSOPEN	Opens a volume set and makes it available for use.

DSTAT

The DSTAT command displays the current status of the disk drives on the system.

Syntax

DSTAT [*ldev* | ALL]

Parameter

ldev — One number from 1 to 999 that specifies the logical device that is to be displayed. It must identify one unique device configured into the device class DISC. **Optional**.

ALL — Lists all of the disks connected to the system including the system volumes. **Optional.**

Example

This example shows the disk states that can be displayed in the DSTAT command when using mirrored disks.

```
:DSTAT ALL

LDEV-TYPE  STATUS      VOLUME  (VOLUME SET - GEN)
- - - - - - - - - - - - - - - - - - - - - - - - - -
 1- 079350   MASTER      MEMBER1 (MPEIX_SYSTEM_VOLUME_SET-0)
 2- 079350   MEMBER      MEMBER2 (MPEIX_SYSTEM_VOLUME_SET-0)
30- 079350   MASTER      MEMBER1 (CUST_SET-0)
31- 079350   MEMBER      MEMBER2 (CUST_SET-0)
32- 079370   MASTER-MD   MEMBER1 (PROD_SET-0)
33- 079370   MASTER-MD   MEMBER1 (PROD_SET-0)
34- 079370   MEMBER-MD   MEMBER2 (PROD_SET-0)
35- 079370  *DISABLED-MD MEMBER2 (PROD_SET-0)
36- 079370   LONER-SU    MEMBER1 (ADM_SET-0)
37- 079370   LONER-SB    MEMBER1 (ADM_SET-0)
38- 079370   LONER-SU    MEMBER2 (ADM_SET-0)
39- 079370   LONER-SB    MEMBER2 (ADM_SET-0)
40- 079370   MASTER-SU   MEMBER1 (PAYROLL_SET-0)
41- 079370   MASTER-SB   MEMBER1 (PAYROLL_SET-0)
42- 079370   MEMBER-SU   MEMBER2 (PAYROLL_SET-0)
43- 079370   MEMBER-SB   MEMBER2 (PAYROLL_SET-0)
44- 079350   LONER
45- 079350   SCRATCH
46- 079350   UNKNOWN
```

The following table describes DSTAT disk states and whether data can be accessed on a volume in that state.

Table 5-4. DSTAT Disk States

State	Description	Accessible?
MASTER	A volume in this state is the master volume of a volume set. In order for the system to recognize the volume set, the master volume must be mounted.	Yes
MEMBER	A volume in this state belongs to a volume set whose master is mounted. If the master is not mounted, the volume is in the LONER state.	Yes
MASTER-MD	A volume in this state is the master volume of a mirrored volume set. In order for the system to recognize the volume set, the master volume must be mounted.	Yes
MEMBER-MD	A volume in this state belongs to a mirrored volume set whose master is mounted. If the master is not mounted, the volume would be in the LONER state.	Yes
MASTER-SU	A volume in this state is the master volume of a user volume set. In order for the system to recognize the volume set, the master volume must be mounted.	Yes
MASTER-SB	A volume in this state is the master volume of a backup volume set. In order for the system to recognize the volume set, the master volume must be mounted.	No
MEMBER-SU	A volume in this state belongs to a user volume set whose master is mounted.	Yes
MEMBER-SB	A volume in this state belongs to a backup volume set whose master is mounted.	No
DISABLED-MD	A volume in this state failed after it was mounted.	No
LONER-SU	A volume is in the LONER-SU state when the volume set is closed by the VSCLOSE command. This volume is marked as the user half of the pair.	No
LONER-SB	A volume is in the LONER-SB state when the volume set is closed by the VSCLOSE command. This volume is marked as the backup half of the pair.	No

Table 5-4. DSTAT Disk States (continued)

State	Description	Accessible?
LONER	A volume is in the LONER state when its master is not mounted, or when the volume set is closed by the VSCLOSE command.	No
SCRATCH	A volume in the SCRATCH state can be initialized. It may contain data, but by scratching the volume, the user has indicated that the data is no longer needed.	No
UNKNOWN	A volume in the UNKNOWN state does not have a label that the system can recognize. The volume may be from another system, it may be a new disk pack, or it may be a volume that has been formatted. An UNKNOWN volume is available for initialization.	No

STORE

The STORE command is the MPE system backup utility. The SPLITVS option can be used to concurrently back up the files on a mirrored volume set onto a magnetic tape.

The STORE command accesses one part of the split set called the *backup part*, while the user part is still available for general usage. Users can read, write, create, or delete files on the user half of the volume set while the backup media is concurrently produced from the backup half. The media produced is a valid snapshot of the volume set at split time. The backup time can additionally be reduced by using the INTER and STORESET options.

Note that if the wildcard (@) file set specification is used for a split-volume set, different files may be stored depending on whether SPLITVS or ONVS is used. This is because files may have been created or purged on the user volumes after the volume set was split. The new state of the file set is stored if ONVS is used, and the old state if SPLITVS is used.

This command can be issued from a session, a job, or a program but not in BREAK. Pressing CTRL Y suspends execution of this command.

Task

Stores disk files to tape.

Syntax

```
STORE [filesetlist] [;[storefile] [;option[;...]]]
      [;SPLITVS=split_setname[,split_setname]]
      [;ONVS=volumesetname[,volumesetname]]
      [;DIRECTORY]
      [;TRANSPORT]
      [;PURGE]
      [;INTER]
      [;MAXTAPEBUF]
      [;STORESET=(device[,...])[,(device[,...])[,...]]
      [;FCRANGE=filecode/filecode[,...]]
      [;ONERROR=recoverytype]
      [;SHOW[=showparist]]
      [;PROGRESS[=#minutes]]
      [; DATE[S]<=accdate]
      [; DATE[S]>=ddate]
      [;FILES=xfiles]
      [;RENAME]
```

Parameters

filesetlist Specifies a list or set of files to be stored. Default is @. The syntax is:

filesetitem[,*filesetitem*] [...] [,*filesetitem*]

filesetitem A file set or an indirect file name. An indirect filename is a file name that may be backreferenced to a disk file. This file can include both the file sets and options for the STORE command.

fileset Specifies a set of files to be stored. All files that match *filestostore* are stored unless the file also matches a *filesnottostore* set. The syntax is:

filestostore [-*filesnottostore* [...] [-*filesnottostore*]]

where *filestostore* and *filesnottostore* are file designators. The maximum depth of negative file sets (*filesnottostore*) is nine.

filedesignator Describes one or many files. Wildcards are permitted for any of the three parts. The syntax is:

filedesig[.*groupdesig*[.*acctdesig*]]

A lockword may also be provided for the *filestostore*. The syntax is:

filedesig[/*lockword*][.*groupdesig*[.*acctdesig*]]

storefile Name of destination tape file onto which the stored files are to be written.

If *storefile* is not supplied and the STORESET option is not used, STORE creates a default file name. The default file name is the user's logon user name. No file equation is used.

SPLITVS Split volume set. Specifies that only files in the *filesetlist* that reside on the backup volumes belonging to the specified split-volume set are to be stored. The files may be concurrently in use while they are being stored, since users can only access files on the user volumes. The syntax is:

; SPLITVS = *split_setname*[,*split_setname*...]

A set name included for the ONVS option can not be specified for the SPLITVS option; however, SPLITVS and ONVS both can be used in the same STORE command with different volume set names. The SPLITVS option also provides the ability to restrict or enhance the creation of directory information on the STORE tape. If the DIRECTORY option is specified in conjunction with the SPLITVS option, only the accounting structures on the specified split-volume sets are stored.

The STORE command's syntax supports up to twenty volume sets.

split_setname A split-volume set name specified for the SPLITVS volume set can be mounted on the system at any time.

split_setname A split-volume set name specified for the SPLITVS option. This volume set must be a mirrored volume set that was split through VSCLOSE; SPLIT.

ONVS On volume set. Specifies that only files in the *filesetlist* that reside on the volume specified are to be stored. The syntax is:

;ONVS = *volumesetname*[,*volumesetname*...]

A set name included for the SPLITVS option cannot be specified for the ONVS option; however, ONVS and SPLITVS both can be used in the same STORE command with different volume set names. The ONVS option also provides the ability to restrict or enhance the creation of directory information on the store tape. If the DIRECTORY option is specified in conjunction with the ONVS option, only those accounting structures on the specified volume sets are stored.

Up to twenty volume sets may be specified.

volumeset-name A volume set name specified for the ONVS option. This volume set may be a split-volume set; however, the files are stored from the user volumes, not the backup volumes. If the files are in use for writing, they are not stored.

`DIRECTORY` Specifies that the file system directory is to be stored. Requires OP or SM capability. If the `ONVS` or `SPLITVS` option is not specified, then `DIRECTORY` defaults to dumping the system directory; otherwise, directories of the specified volume sets are dumped. This provides operators and system managers with a method of completely dumping or copying the account structure of nonsystem volume sets.

This option overrides default file sets.

```
STORE; *TAPE; DIRECTORY
```

only stores the directory account structure; it does not default to:

```
STORE @; *TAPE; DIRECTORY
```

Also, the error reporting for directories occurs as follows:

If the accounting structure cannot be imaged for a particular volume set, the `STORE` fails immediately. If the accounting structure image is successfully created, that image is treated as a file except for summary accounting information. That is, if `STORE` incurs a disk read error on that image, the `STORE` continues, but that image is noted as having incurred an error.

Note that the directory image file is always created in temporary domain on the system volume set.

`TRANSPORT` Specifies that an MPE V/E-compatible store tape is to be produced. This option is not valid with the `SPLITVS`, `DYNAMIC`, `LOGONLY`, `STORESET`, `INTER`, `FCRANGE`, or `DIRECTORY` options.

`PURGE` The `PURGE` option deletes the file set specified in *filesetlist* after `STORE` completes. This option is not valid with the `SPLITVS` option.

Other Options

None of the other options are affected by `SPLITVS`. For a detailed account of the other options, read the *MPE/iX Commands Reference Manual Volumes 1 and 2* (32650-90003 and 32650-90364).

STORE Tape Compatibility

The `STORE` tape format used by split-volume backup is identical with current `STORE` tapes. The tape may be interleaved (as generated by the `INTER` option) or noninterleaved. Consecutive tape drives may also be used.

Note

Since the STORE TRANSPORT option is not supported, a split-volume backup tape can only be restored on a Series 900 system.

SPLITVS Example

This example shows how to store the files on a split-volume set called SPLIT_SET_A:

```
:STORE @.@.@; *TAPE; SPLITVS=SPLIT_SET_A
```

ONVS Example

This example shows how to store the files on VOLUME_SET_A.

```
:STORE @.@.@; *TAPE; ONVS=VOLUME_SET_A
```

STORE Example

This example shows how to back up all of the files on a split-volume set along with the correct directory account structure.

A mirrored volume set MIRROR_SET is closed, split, and then mounted in a split state. The following command backs up all of the files on a split-volume set, along with its directory account structure:

```
:STORE @.@.@;*TAPE;SPLITVS=MIRROR_SET;DIRECTORY;SHOW
```

VSCLOSE

The VSCLOSE command closes the specified volume set and takes it offline. The PARTVS parameter and the SPLIT option have been added to support split-volume backup.

In order to close a volume set, all users must have stopped accessing files on that volume set.

Note

The NOW option cannot be specified with the SPLIT option. The VSCLOSE command with the SPLIT option proceeds only if the files on the volume set are not being accessed.

If there are open files, the volume set cannot be split. Note that a volume set is not placed in the CLOSE PENDING state if SPLIT was specified.

A default VSCLOSE of a split-volume set attempts to close both volume set halves. If it finds that only one of the halves is present, it closes it and returns no warning for the absent volume set half.

If the system fails while a VSCLOSE SPLIT is in progress, only part of the volume set may be split. The master volume is the last to be split, and its state determines if the entire set is split or joined; therefore, if the master is still joined, all the members in the set must be joined. The next time that this partially split-volume set is mounted, an automatic join takes place. A repair starts for the volumes that were split. The user must wait for the repair to complete before another split can be initiated.

This command may be issued from a session, a job, or in BREAK, but not from a program. Pressing CTRL Y has no effect on this command. This command may be issued only from the system console.

Task

Closes a volume set and takes it offline.

Syntax

```
VSCLOSE volumesetname [ [ ;PARTVS= ] { USER   } ]  [ ;NOW   ]
                                     { BACKUP }    [ ;SPLIT ]
```

Parameters

volumeset-name

The name of the volume set to be closed. Any user who is accessing a file at the time is allowed to finish access; however, users who are not accessing files at the time are unable to open files on the volume set, and VSRESERVE and MOUNT requests are denied. **Required.**

PARTVS — This parameter is only applicable to a previously split-volume set. It notifies the system which split-volume set half is to be closed.

- USER — Close only the user volumes.
- BACKUP — Close only the backup volumes.

If PARTVS is not specified, both volume set halves are closed. If PARTVS is specified for a nonsplit-volume set, an error is returned, and the volume set is not closed.

NOW — This option cannot be used with the SPLIT option. This option instructs the system to abort any job or session using a file on the volume set.

SPLIT — This option splits the volume set into user volumes and backup volumes if it is a mirrored volume set and is in the proper state. All members of the volume set and both members of each pair must be present. There can be no repair taking place. Both partners of each volume pair must be identical at the time of the split.

There can be no users logged on to the volume set when the split is processed. If there are files open on the volume set, the VSCLOSE fails and the volume set remains united.

For each mirrored pair, the system assigns a backup volume and user volume. The volume with the greater path number is selected as the backup volume.

If SPLIT is specified for a non-mirrored volume set, an error is returned and the volume set is not closed.

Example

This example shows how to use the VSCLOSE command with the SPLIT option.

```
:VSCLOSE PROD_SET; SPLIT
```

VSOPEN

The VSOPEN command tells the system to open the specified volume set. The volume set becomes available for use again. Since bringing a volume set online opens the set (by default), this command is needed only for a volume set for which a VSCLOSE command has been issued. The PARTVS parameter has been added to support split-volume backup.

A default VSOPEN of a split-volume set attempts to open both volume set halves. If it finds that only one of the halves is present, it opens it and returns no warning for the absent volume set half.

This command may be issued from a session, a job, or in break, but not from a program. Pressing CTRL Y has no effect on this command. This command may be issued only from the system console.

Task

Opens a volume set and brings it online.

Syntax

VSOPEN *volumesetname* [[;PARTVS=] { USER / BACKUP }]

volumeset-name — The volume set that is to be opened. The name must be unambiguous; that is, MPE does not accept part of a *volumesetname* and default the remainder of the name. **Required.**

PARTVS — This parameter is only applicable to a previously split-volume set. It tells the system which split-volume set half is to be opened.

- USER — Open only the user volumes.
- BACKUP — Open only the backup volumes.

If PARTVS is not specified, both volume set halves are opened. If PARTVS is specified for a nonsplit-volume set, an error is returned and the volume set is not opened.

Example

This example shows how to use the VSOPEN command with the PARTVS parameter:

```
:VSOPEN PROD_SET; PARTVS=USER
```

A

Quick Start Procedures

This appendix shows in minimum detail how to perform the following procedures:

- Create a mirrored volume set.
- Add members to a mirrored volume set.
- Back up files.
- Suspend mirroring on a pending volume.
- Replace a disk that did not mount.
- Replace a disk that failed after mounting.

Create a mirrored volume set

1. Invoke VOLUTIL.
2. Initialize a `SCRATCH` or `UNKNOWN` volume as `MEMBER1` of the mirrored volume set `PROD_SET` for LDEVS 30 and 31:

```
:VOLUTIL

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All Rights Reserved.

volutil: NEWMIRRSET PROD_SET MEMBER1 (30,31)

*Verify: Initialize new volume set PROD_SET on ldev 30 and ldev 31 [Y/N]? Y

Note*: New master volume has been initialized for ldev 30 and ldev 31.
```

Note

After executing the `NEWMIRRSET` command, you should execute a `:VSCLOSE` *volsetname* and a `:VSOPEN` *volsetname* to ensure that the volume set information has been posted to the disk.

Add members to a mirrored volume set

1. Add a SCRATCH or UNKNOWN volume as MEMBER2 to the mirrored volume set PROD_SET for LDEVS 32 and 33 using a ":" between the set and volume name:

```
volutil: NEWMIRRVOL PROD_SET:MEMBER2 (32,33)

*Verify: Initialize new member volume on ldev 32 and ldev 33 [Y/N]? Y

*Note: New member volume has been initialized for ldev 32 and ldev 33.

volutil:EXIT
```

Note

After executing the NEWMIRRVOL command, you should execute a :VSCLOSE *volsetname* and a :VSOPEN *volsetname* to ensure that the volume set information has been posted to the disk.

2. Add remaining members to the mirrored volume set as needed.

Back up files

1. All users of the volume set must be initially logged off before an split-volume backup of that set can be performed.

   Use the VSCLOSE command with the SPLIT option to split the volume set into user volumes and backup volumes:

```
:TELL @ LOGOFF FOR BACKUP
:VSCLOSE PROD_SET; SPLIT
```

2. Use the VSOPEN command to make the volume set available. Both user volumes and backup volumes attempt to be mounted. If either of them has been taken offline, the command only mounts the available volume set half. After the volume set is placed split-volume using the VSOPEN command, it is mounted.

3. Notify users that the volume set is available for use:

```
:VSOPEN PROD_SET

PROD_SET SPLIT USER VOLUME MOUNTED ON LDEV 32
(AVR 23)

PROD_SET SPLIT BACKUP VOLUME MOUNTED ON LDEV 33
(AVR 24)

:TELL @ SYSTEM IS AVAILABLE NOW
```

Note

Once a volume set has been taken offline with a `VSCLOSE` command, it can only be mounted with a `VSOPEN` command, not by bringing it online.

4. Use the `STORE` command with the `SPLITVS` parameter to back up the volume set. The tape produced by a split volume `STORE` command is fully compatible with that from a normal `STORE` command:

```
:FILE T; DEV=TAPE
:STORE @.@.@; *T; SPLITVS=PROD_SET; SHOW
.
.
```

5. Invoke VOLUTIL.

6. Use the JOINMIRRSET command to join the user and backup halves of a split volume set to make them mirrored again. After the volume set is joined, a repair starts using the volumes that were specified by the source parameter as the source volumes.

```
:VOLUTIL

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volutil:JOINMIRRSET PROD_SET SOURCE=USER
```

The SOURCE=USER option is specified so that users can continue accessing the volume set while the join is initiated and the repair takes place.

Suspend mirroring on a PENDING volume

1. Reply to the console message.
2. Invoke VOLUTIL:

```
?09:09/22/ACKNOWLEDGE MIRRORED PARTNER MISSING FOR LDEV# 32[Y/N]?

:REPLY 22,Y

:VOLUTIL

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volutil:
```

3. Use the VOLUTIL `SUSPENDMIRRVOL` command to suspend mirroring on LDEV 32 for `MEMBER2` of the mirrored volume set `PROD_SET`.
4. Reply to the verify message:

```
volutil: SUSPENDMIRRVOL PROD_SET:MEMBER2 32

*Verify: SUSPEND THE MIRROR PENDING VOLUME ON LDEV 32 [Y/N]? Y
```

Replace a disk that did not mount

1. Physically replace the drive that did not mount.
2. Use the VOLUTIL `REPLACEMIRRVOL` command to resume mirroring on LDEV 32 for `MEMBER2` of the mirrored volume set `PROD_SET` and the new drive with any LDEV:

```
volutil: REPLACEMIRRVOL PROD_SET:MEMBER2 55
```

Replace a disk that failed after mounting

1. Reply to the console message.
2. Invoke VOLUTIL:

```
?09:09/22/ACKNOWLEDGE MIRRORED PARTNER DISABLED ON LDEV# 32[Y/N]?

:REPLY 22,Y

:VOLUTIL

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volutil:
```

3. Physically replace the drive that failed.
4. Use the VOLUTIL `REPLACEMIRRVOL` command to resume mirroring on LDEV 32 for `MEMBER2` of the mirrored volume set `PROD_SET` and the new drive with the original LDEV 32:

```
volutil: REPLACEMIRRVOL PROD_SET:MEMBER2 32
```

Glossary

account
A collection of users and groups. Each account has a unique name on the system. It is the method used to organize a system's users and files and to allocate use of system resources such as central processor time, online connect time, and file space. Accounts are the principal billing entity for the use of these resources. Every user must specify an account to access the system.

backup
The process that duplicates computer data to offline media, such as magnetic tape. Backups protect data if a system problem occurs.

bad drive
The single drive that is a partner of a mirrored pair that has been marked bad by the system because of a disk-related failure. In the repair process, the bad drive is the destination of the copy.

batch processing
A method of submitting a job for processing. A job, which is submitted as a single entity, can consist of multiple commands such as program compilation and execution, file manipulation, or utility functions. Once submitted, no further interaction between the user and the job is necessary.

boot
The process of leading, initializing, and running an operating system. The term "booting" is derived from the phrase "pulling yourself up by your bootstraps."

crash
1) The unexpected shutdown of a program or system. If the operating system crashes, it is called a "system crash" and requires the system to be rebooted.

2) A head crash or disk crash. This occurs when the read/write heads on a disk drive (that normally ride on a thin cushion of air above the disk) make physical contact with the disk surface, destroying data and the disk track. The extent of damage to the system depends on which disk crashed and how much of the disk was corrupted. A crash of the system disk is serious, since it contains the directory of user files as well as operating system programs, the I/O configuration, and the accounting structure.

data recovery
The process of using DISCUTIL to recover data from disks that cannot be used by the operating system.

DISABLED
A mirrored disk state where a disk has failed and is no longer being used. When this occurs, the operator is notified by a console message.

disk repair
In mirrored disks, disk repair refers to the copying of data from one good disk to its partner (bad disk). This operation takes about twenty minutes and does not interfere with applications running on the system or accessing the volume set.

DISCUTIL utility
An MPE utility that is used primarily to recover data from disks that cannot be used by the operating system.

disk
A circular plate of magnetically coated material used to store computer data. A disk may be fixed, removable, hard, or flexible.

disk drive
A peripheral device that reads information from and writes information to the disk.

disk failure
A disk-related problem that causes a disk to be unavailable for use.

disk pack
A set of one or more disk platters stacked inside a plastic cylindrical container.

GEN
Generation number. A number between 0 and 32,767 used to distinguish different versions of a volume set.

good drive
The single drive that is a partner of a mirrored pair that has been marked good by the system when compared to its partner. In the repair process, the good drive is the source of the copy.

group
A group is part of an account that is used to organize the account's files. All files must be assigned to a group; and, within an account, each group has a unique name. Groups are the smallest entity for which use of system resources is reported. A `PUB` group is designated for each account when it is created. Additional groups are created within the account, as needed, by the account manager.

logical device number (LDEV)
An LDEV number is assigned to all hardware components of a computer system and is used for identification purposes.

LONER
A duplicate of a member volume currently online or a volume recognized by MPE as a member volume but without a master volume online. The `VSCLOSE` command puts all master and member volumes of a set in the `LONER` state.

master volume
A master volume is the only volume needed to define a volume set. It contains the configuration data, the root directory, a free space map, file label table, and a volume label with a unique volume set ID for the volume set.

MASTER
The state of a disk recognized by the system as a master volume.

member volume
A volume containing a volume label indicating that it belongs to an MPE volume set. It may be used by one or more volume classes.

MEMBER
The state of a disk recognized by the system as a member volume.

mirrored disks
Two partner disks that contain exactly the same information. When a write is issued, the write is performed on both disks.

mirrored disk states
A mirrored disk exists in one of the following states: `NORMAL`, `PENDING`, `DISABLED`, `NON-MIRROR`, `SUSPEND-MIRR`, `REPAIR-DEST`, `REPAIR-SRCE`, `USER`, and `BACKUP`.

mountable volumes
See nonsystem volumes.

mounting
The act of making a data storage device accessible. To physically mount the device, you load the media onto the device. To logically mount the device, you tell the operating system which device you want to use, and it allows you access to that resource.

NON-MIRROR
A mirrored disk state where a disk does not have a partner and is not functioning as a mirrored disk.

nonremovable disks
Disks that cannot be removed from the disk drive.

nonsystem volumes
Nonsystem or mountable volumes are member volumes of a volumes set. They do not need to be mounted for the operating system to run.

NORMAL
A mirrored disk state where two mirrored partner disks are operating, and one is not being repaired.

online
A system state that means the system is available for use. A split-volume backup occurs while the system is available.

PENDING
A mirrored disk state where one partner of a mirrored pair is not mounted and the other partner that did mount is not available for use.

private volumes
See nonsystem volumes.

recognizing a disk
See mounting.

removable disk
Disks that can be removed from disk drives and transported to another disk drive.

REPAIR-DEST
A mirrored disk state that shows which partner is the destination (being copied to) of a repair.

REPAIR-SRCE
A mirrored disk state that shows which partner is the source (being copied from) of the repair.

SCRATCH volume
A volume whose data is no longer needed that has been marked as available for a new volume or volume set. The `SCRATCHVOL` command marks the volume. The `UNSCRATCHVOL` unmarks the volume without losing any data or label information, provided that the disk has not been written to.

split-volume backup
The process that duplicates computer data to offline media while the operating system is running.

split-volume set
A mirrored volume set that has been "split" into user volumes and backup volumes by the `VSOPEN` command to prepare for online backup.

SUSPEND-MIRR
A mirrored disk state where a disk does not have a partner and is not functioning as a mirrored disk.

system abort
See crash.

system disk
The disk volume, mounted as logical device 1. It contains MPE, I/O configuration information, the accounting structure and file directory, and utilities and subsystems. It also contains an area reserved for virtual memory and may be used to store user files.

system master volume
The volume of a system volume set that is always named `MPEXL_SYSTEM_MASTER`. This volume must be mounted for an MPE operating system to be booted and is always mounted on LDEV 1.

system volume
An MPE system volume set. It contains a bootable system image of the operating system and system configuration on its master volume. It is the only volume needed to load and start the system. It is always mounted and named `MPEXL_SYSTEM_VOLUME_SET`.

UNKNOWN
A disk pack without a volume label recognized by MPE/iX.

unscratch a volume
To make data available on a previously "scratched" volume. See SCRATCH volume.

volume
A volume is one-disk pack. Each volume is assigned a name for identification and reference. This name must be unique within its volume set. A volume may be a member of one or more classes.

volume class
A volume class is used to allocate and limit disk space. A volume class is a logical subset or partition within a volume set and can bridge more than one member volume. A volume class is assigned a unique name within the volume set. No more than 255 different classes can exist in a single volume set. A volume can be partitioned by one or more volume classes.

volume failure
See disk failure.

volume management
A facility of MPE used to manage disk storage using volumes, volume sets, and volume classes.

volume set
A set of volumes containing one master volume and up to 255 member volumes.

volume states
The states that a volume can exist on a system. Accessible: `MASTER` and `MEMBER`. Inaccessible: `LONER`, `UNKNOWN`, and `SCRATCH`.

VOLUTIL utility
The MPE volume utility that provides volume initialization and maintenance, volume label and membership inquiries, and volume space/sector status.

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