

# DiskMaker for OpenVMS User's Guide

Order Number: AD-210-DM-UG

This manual describes the installation and proper operation of the DiskMaker for OpenVMS product.

**Revision/Update Information:** This is a revised manual

**Operating System and Version:** OpenVMS for VAX, Version 5.4 or later

**Operating System and Version:** OpenVMS for Alpha, Version 1.5 or later

**Software Version:** DiskMaker Version 1.5

**Advanced Systems Concepts  
Parsippany, New Jersey**

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## Preface

DiskMaker® for OpenVMS, engineered by Advanced Systems Concepts, Inc., is a layered product for Digital Equipment Corporation's OpenVMS Volume Shadowing facility. It extends OpenVMS Volume Shadowing's capability to include selective shadowing and heterogeneous disk shadowing. *DiskMaker for OpenVMS* uses technology found in ASCI's VIRTUOSO™ virtual disk system, however, please note that the licensed product VIRTUOSO is not DiskMaker, and DiskMaker is not VIRTUOSO.

DiskMaker supports OpenVMS Volume Shadowing *Phase II*. Phase II is available in VMS version 5.4-2 and later.

DiskMaker supports Digital's Disk Striping product and has been tested to V2.0.

This user manual describes DiskMaker's terms, concepts, and facilities and explains in detail the procedures for installing and using DiskMaker.

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## Intended Audience

The intended audience for this manual consists of the following:

- The VMS System Manager in charge of installing the software and setting up the DiskMaker environment
- The VMS Operators, responsible for the day-to-day operational maintenance of the DiskMaker volume sets

This manual assumes that the reader is familiar with Digital Equipment Corporation's OpenVMS Volume Shadowing product.

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## Document Structure

This User's Manual consists of 6 chapters, 1 appendix, a glossary, and an index, as follows:

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Section	Function
Chapter 1 OVERVIEW	Provides a summary of the product and its features and options
Chapter 2 INSTALLING DiskMaker	Provides a detailed explanation of the installation process as it relates to DiskMaker and its options. Several sample installations are also provided
Chapter 3 TERMS AND CONCEPTS	Explains and defines the terms and concepts that DiskMaker uses
Chapter 4 COMMANDS	This chapter provides the DiskMaker command reference
Chapter 5 CLUSTER CONSIDERATIONS	This chapter discusses the use of DiskMaker in a VMScluster

## Preface

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Section	Function
Chapter 6 SAMPLE APPLICATIONS	Provides practical applications and in-context examples of the features found in DiskMaker.
Appendix A MESSAGES	Lists all user-interface messages
GLOSSARY	Defines DiskMaker, VIRTUOSO and VMS terms

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## Conventions

This document uses the following conventions:

- Square brackets ( [ ] ) indicate the enclosed item is optional.
- Uppercase indicates that you type text exactly as shown.
- Text in lowercase consists of data that you must supply—a device name, for example.
- All prompts and messages that DiskMaker displays on your screen appear in small typewriter font, while all command syntaxes that you must enter appear in the same font, boldfaced, as follows:

```
This is a message or a prompt.  
$ This is what you must enter.
```

- A comma, followed by a horizontal ellipsis (...), indicates that you can supply more than one item, each separated by a comma.
- A vertical bar ( | ) indicates *one*, logical choice within a list, such as this *or* that.
- A `[ ]` indicates a key on your keyboard, for example, `[Return]`.
- A vertical ellipsis indicates the omission of system-supplied information, as in the following example:

```
%VMSINSTALL-W-NOTSYSTEM, You are not logged in to the SYSTEM account.  
%VMSINSTALL-W-DECNET, Your DECnet network is up and running.  
%VMSINSTALL-W-ACTIVE, The following processes are still active:  
.  
.  
.  
* Do you want to continue anyway? [NO] YES [Return]
```

---

## Associated Documents

For additional information consult the following documents:

- **Advanced Systems Concepts, Incorporated**

*Getting Started with DiskMaker®*

- **Digital Equipment Corporation**

*OpenVMS Volume Shadowing Manual*

*OpenVMS System Generation Utility Manual*

*OpenVMS License Management Utility Manual*

*VMS Disk Striping Guide to Operations Manual*

# 1

---

## OVERVIEW

The *DiskMaker for OpenVMS* (DiskMaker) system, engineered by Advanced Systems Concepts, Inc., is a layered product for Digital Equipment Corporation's OpenVMS Volume Shadow. It extends OpenVMS Volume Shadow's capability to include selective shadowing and heterogeneous disk shadowing. This is accomplished by the creation and use of *Virtual Disks* as shadow set members.

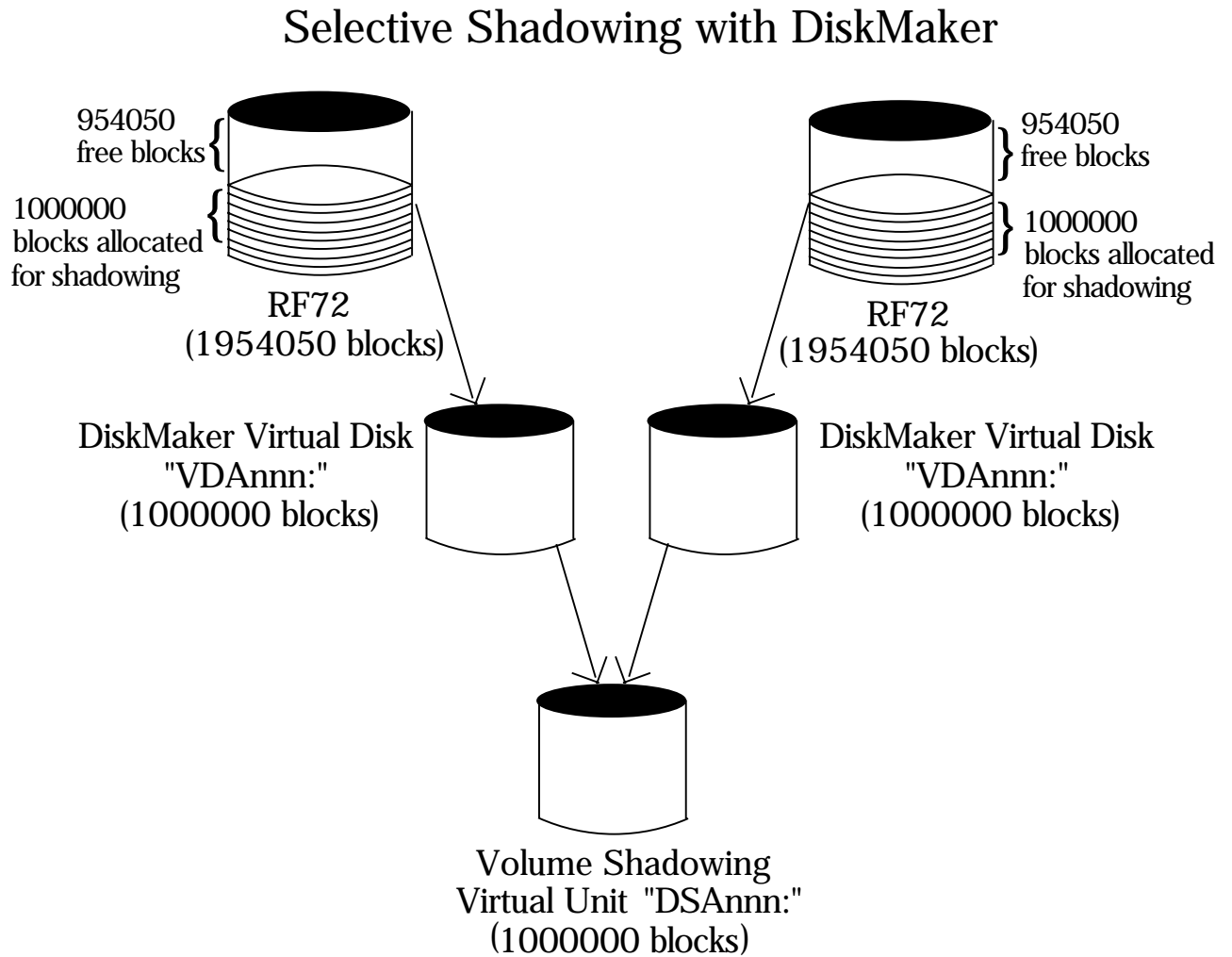
### 1.1

---

#### WHAT DOES DISKMAKER DO?

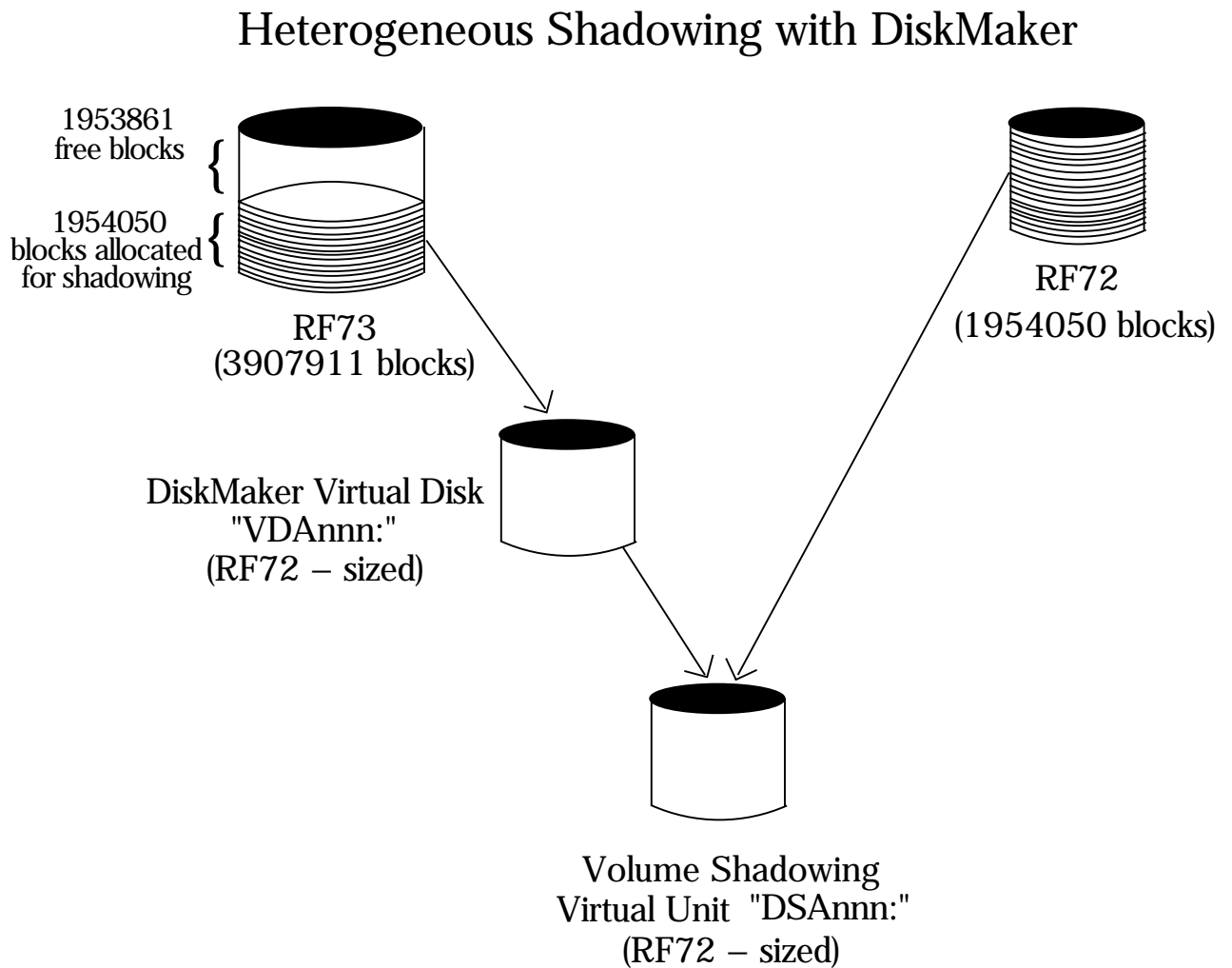
A limitation of OpenVMS Volume Shadowing is that all shadow set members must be the same type of physical disk device. DiskMaker adds the flexibility of *selective shadowing* and *heterogeneous disk shadowing*. *Selective shadowing* allows the shadowing of critical files, without the need to involve the entire disk device in shadow operations. *Heterogeneous disk shadowing* allows shadowing between dissimilar physical devices.

Figure 1-1 Selective Shadowing



*Shadow set consisting of 2 members.  
Each member is a 1,000,000 block portion of a RF72.  
The remaining 954,050 blocks on each RF72 are free for use.*

Figure 1–2 Heterogeneous Shadowing



*Shadow set consisting of 2 members: a full RF72, and a RF72–sized portion of a RF73.  
The remaining 1,953,861 blocks on the RF73 are free for use.*

### 1.2 **HOW DOES DISKMAKER WORK?**

---

OpenVMS Volume Shadowing requires its shadow set member disks to be identical in size and geometry; DiskMaker allows you to create virtual disks of any size and geometry you desire; these virtual disks then meet OpenVMS Volume Shadowing's needs.

Virtual disks are software generated and maintained devices that interact with OpenVMS to provide the same functions that real disks do. The only limitation on the creation of virtual disks is that they must be associated with the corresponding amount of blocks on a real physical disk. For example, a 1.0 million block virtual disk that used an RA90 (2.376 million blocks) for its storage space, would leave 1.376 million on the RA90 for other use.

After you generate virtual disks of the desired size, use them in a normal OpenVMS MOUNT command to create the shadow set.

## 1.3 DiskMaker COMPONENTS

---

The DiskMaker system consists of three major components:

- **DiskMaker Command programs (VIRTUOSO\_VCLI, VIRTUOSO\_SHR, VIRTUOSO\_PRVSHR)**
- **DiskMaker Device Driver (VDDDRIVER)**
- **DiskMaker Virtual-Disk Server (VIRTUOSO\_VDS)**

### DiskMaker Command Programs

This component is the user-interface program for the DiskMaker system. Using the DCL interface, it gives you the ability to perform the following functions:

- Activates or initializes a virtual disk
- Deactivates a virtual disk
- Modifies a virtual disk's attributes

### DiskMaker Device Driver

This VMS driver performs two major functions:

- Handles all I/O requests, made to a virtual disk  
(Depending upon the virtual disk type, the driver either performs the request or dispatches it to the Virtual Disk Server.)
- Contains a collection of kernel-mode routines, used by various DiskMaker components

### DiskMaker Virtual-Disk Server

This component (implemented as a detached process, one (1) per virtual disk) performs the following tasks:

- Activates or initializes a virtual disk and all the underlying-data structures
- Depending upon the virtual-disk type, takes an active role in handling I/O requests
- Deactivates a virtual disk

---

## 1.4

### HARDWARE AND SOFTWARE USED WITH THE DiskMaker SYSTEM

The DiskMaker system runs under the OpenVMS operating system on all standard VAX and AXP hardware configurations. Virtual disks require that the disks upon which they're based be OpenVMS-compatible. DiskMaker fully supports the VMScluster environment.

No special prerequisite software is required for using DiskMaker, however it is assumed that you are a user of Digital Equipment Corporation's OpenVMS Volume Shadowing facility, *Phase II*, (Phase II is available on VMS systems version 5.4-2 and above.) and/or Digital's Disk Striping product (V1.0 and later).

Please note that OpenVMS Volume Shadowing did not support SCSI disks until VMS V5.5. Therefore, you must be at that release to correctly shadow virtual disks based on SCSI disk drives.

If you do not own either Digital product (OpenVMS Volume Shadowing and/or VMS Disk Striping), you should STOP and contact ASCI or your local distributor. ASCI offers a complete line of shadowing and striping products for the entire VAX and Alpha AXP family of OpenVMS systems.

---

## 2 INSTALLING DiskMaker

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### 2.1 License Registration Instructions

Prior to using any ASCI product(s) you may have purchased or are about to evaluate, you must register your Product Authorization Key (PAK) with VMS. The ASCI PAK associated with the product is on a separate sheet of paper. ASCI highly recommends that you use the VMS license registration procedure `SYSSUPDATE:VMSLICENSE.COM` found on all VMS systems.

The following list will direct you to the appropriate section depending on whether this is the first product license registration or a succeeding registration.

- 1 If this is the first time you are registering this product license, read Section 2.1.1, *or*
- 2 If you are attempting to extend a product evaluation, read Section 2.1.2, *or*
- 3 If you have purchased the product after an evaluation, read Section 2.1.3.

If you do not possess an ASCI PAK for your evaluation or license purchase, please contact ASCI or your local distributor.

**Note: Execution of the VMSLICENSE command procedure and/or the LICENSE command require a privileged account.**

---

#### 2.1.1 First Time Registration

To begin your evaluation or use of this product, you must first register the product PAK with VMS through use of the VMSLICENSE procedure. This procedure will guide you in the registration and loading of the license.

- 1 At the VMS DCL prompt, enter `@SYSSUPDATE:VMSLICENSE`. You will be presented with a menu similar to the one below.

VMS License Management Utility Options:

1. Register a Product Authorization Key
2. Amend an existing Product Authorization Key
3. Cancel an existing Product Authorization Key
4. List Product Authorization Keys
5. Modify an existing Product Authorization Key
  
9. Exit this procedure

Type '?' at any prompt for a description of the information requested.

## INSTALLING DiskMaker

Enter one of the above choices [1]

- 2 Select the menu option "Register a Product Authorization Key", by entering a **1** or RETURN. The following prompt will appear:

Do you have your Product Authorization Key? [YES]

- 3 If you possess an ASCII PAK for the product you wish to register, you may enter **YES** or RETURN. The following message, similiar to the one below, will appear:

The REGISTER option allows you add a new license to a license database. A Product Authorization Key (PAK) provides the product name and information you need to register the license. You must enter all the information provided by your PAK exactly as specified.

- 4 The procedure will prompt you for the information shown on the PAK. At each prompt you must enter the information *exactly* as it appears on the PAK. If the PAK does not contain any information for a specific field, enter RETURN to advance to the next prompt. The information presented below in the example is not a valid PAK and should be used for illustrative purposes only.

```
PAK ID:
          Issuer [DEC] ASCII
          Authorization Number [] ASCII-90001-001

PRODUCT ID:
          Product Name [] EVALUATION
          Producer [DEC] ASCII

NUMBER OF UNITS:
          Number of Units [] 0

KEY LEVEL:
          Version []
          Product Release Date []

KEY TERMINATION DATE:
          Key Termination Date [] 1-JAN-1990

RATING:
          Availability Table Code [] F
          Activity Table Code []

MISCELLANEOUS:
          Key Options [] MOD_UNITS
          Product Token [] XCUSTOMER-NAME
          Hardware-Id [] XCUSTOMER-NAME
          Checksum [] 4-AAAA-BBBB-CCCC-DDDD
```

- 5 If this is an evaluation PAK, the product name may be EVALUATION rather than the actual product name you expect. This is normal and will allow you to evaluate all ASCII products using one (1) PAK. An evaluation PAK can also be noted by use of the *Key Termination Date* field. This field indicates the last day you will be able to use this product.

6 If this is a purchased license PAK, the *Product Release Date* field will be completed. In addition, the *Key Options* field will contain the option *NOSHARE*. This option means that you must designate which cluster member, by name, this PAK is meant for. If your system is not a VAXcluster member you won't be prompted for any other additional information concerning product to CPU binding.

7 When you have entered all the information requested by VMSLICENSE, the procedure will re-display the information entered and request confirmation to continue:

Is this information correct? [YES]

8 If the data is correct, type **YES** or RETURN. If any field has been entered incorrectly, type **NO**. The procedure will then re-prompt you for information in each field using your previous answer as the default. To cancel the default value without entering a new value, enter a backlash (/).

9 If you have correctly entered the PAK information you should see a message similar to the one below:

Registering EVALUATION license in SYS\$COMMON:[SYSEXE]LMF\$LICENSE.LDB...

10 This means your PAK has been successfully registered with VMS. The procedure will now give you an opportunity to load it. The product will not be usable unless the PAK can be successfully loaded.

Do you want to LOAD this license on this system? [YES]

11 To load the PAK enter **YES** or RETURN. The license will now be loaded and activated.

## 2.1.2 Extending an Evaluation

To extend an evaluation of this product, you will need to obtain a new PAK from ASCII or your local distributor. However, before you can register this new PAK with VMS you will first have to UNLOAD and DISABLE (and DELETE, if V5.5) the existing PAK. Please follow the steps below to UNLOAD and DISABLE the existing PAK.

1 Retrieve your existing paper PAK *or* issue a LICENSE LIST/FULL product\_name. Please jot down the "Authorization number" of the PAK. ASCII authorization numbers always begin with ASCII.

2 Issue the following VMS command:

```
$ LICENSE UNLOAD product_name/PRODUCER=ASCII
```

where "product\_name" represents the licensed product name.

## INSTALLING DiskMaker

- 3 Next, issue the following VMS command:

```
$ LICENSE DISABLE product_name/AUTHORIZATION=existing_pak_authorization
```

"existing\_pak\_authorization" represents the authorization number of the PAK as identified in item 1.

- 4 The previous two commands unloaded the license from active use, and disabled the license in the VMS license database. If you are using LMF V1.1 or VMS V5.5 (or later) you may optionally LICENSE DELETE the expired PAK from your license database. This avoids an unnecessary clutter of expired or otherwise useless PAKs in your database.
- 5 Continue the registration and loading process by following the directions in Section 2.1.1.

---

### 2.1.3 Registration of a Purchase License

Welcome to the family of satisfied ASCI customers! Since you evaluated this product, you will need to follow the steps as outlined in Section 2.1.2. This involves the unload and disabling of the evaluation PAK and the registration of the purchase license PAK.

If in the future you decide to upgrade your system or VMScluster please give us a call promptly. We will be able to give you a quotation for upgrading your license and ensure that you receive a PAK granting you additional units. If you do purchase an additional units PAK, the steps to register this PAK are outlined in Section 2.1.1. VMS will consolidate all your valid PAKs for a single product and add all the "units" required automatically.

DiskMaker can also be purchased on a *per-disk* basis. This means that rather than purchasing licenses for each node, you can license the product based on the number of virtual disks you wish to create.

---

## 2.2 PREPARING FOR INSTALLATION

The DiskMaker V1.3 system is a layered product for OpenVMS for VAX, Version 5.4 or later, or OpenVMS for AXP, Version 1.5 or later.

---

### 2.2.1 Release Notes

The DiskMaker system provides online release notes that you can display or print.

They are available from the VMSINSTAL procedure, if you use the N option. VMSINSTAL can print and/or display the release notes.

After installation the release notes are in the file, SYS\$HELP:DISKMAKER013.RELEASE\_NOTES. Example 2-1 illustrates how online help also provides the location of the release-notes file.

#### Example 2-1 Using Help to Find the DiskMaker Release Notes

---

```
$ HELP DISKMAKER RELEASE_NOTES
```

```
DiskMaker
```

```
Release_notes
```

```
    The release notes for DiskMaker V1.3 have been placed in the file  
    SYS$HELP:DISKMAKER013.RELEASE_NOTES.
```

---

### 2.2.2 Contents of the Distribution Kit

To determine if your distribution kit is complete, compare the contents with the following list:

#### **DiskMaker Product Checklist**

- *Getting Started with DiskMaker for OpenVMS*
- *DiskMaker for OpenVMS User's Guide*
- DiskMaker Distribution Media
- DiskMaker Product Information Sheet
- DiskMaker Software Product License Agreement
- DiskMaker Product Authorization Key (PAK for LMF)

If the contents of this kit are incomplete, please contact Advanced Systems Concepts, Inc., Hoboken, N.J.

## 2.2.3 Installation Checklist

---

Check each item in the following list before you start the installation:

- 1 A valid version of the VMS operating system (see Section 2.2.4)
- 2 A backup of your system disk (see Section 2.2.5)
- 3 Required privileges, quotas, disk space, and time (see Section 2.2.7)
- 4 A working familiarity with the VMSLICENSE procedure (see Section 2.1 and Section 2.2.6)
- 5 A working familiarity with the VMSINSTAL procedure (see Section 2.2.8)

## 2.2.4 Prerequisite Software

---

The DiskMaker system requires that a valid VMS operating system (at the proper version) be installed on your system before installing the DiskMaker system. To determine what version of VMS you have, type the following command:

```
$ SHOW SYSTEM
VAX/VMS V5.4-2 on node VAX_1 10-JAN-1993 11:33:54.06 Uptime 6 22:25:03
  Pid  Process Name  State  Pri  I/O  CPU  Page flts Ph.Mem
```

The first line of the displayed information shows the VMS Version.

VMSINSTAL checks for a valid version and aborts the procedure, if it does not find one.

## 2.2.5 System-Disk Backup

---

ASCI recommends that you take the precaution of backing up your system disk before any installation. For instructions on backing up your system disk, see the *VAX/VMS System Manager's Reference Manual*

### 2.2.6 License Requirements

The proper license PAK (Product Authorization Key) must be *registered* and *loaded* before DiskMaker can be used. The product name for DiskMaker for OpenVMS is DISKMAKER; for DiskMaker for OpenVMS with Striping it is DISKMAKER-STRIPING.

Use the DCL command SHOW LICENSE to check for loaded licenses. Obsolete licenses must be unloaded before new licenses can be loaded. Note: the VMSLICENSE procedure can optionally load the newly registered license, but will not inform you if an old license is already loaded.

## 2.2.7 VMSINSTAL Requirements

ASCI recommends that you run the VMSINSTAL procedure from the SYSTEM account.

The account you use for the installation must have the following privileges:

- CMKRNL
- TMPMBX

The account you use for the installation must have the following quotas:

- ASTLM = 24
- BIOLM = 18
- BYTLM = 18000
- DIOLM = 18
- ENQLM = 30
- FILLM = 20

The DiskMaker system requires at least 1,800 blocks on your system disk and will allocate a net amount of 1,050 blocks on your target device.

The installation takes about five (5) minutes from a magnetic tape, operating on a VAX 8250.

## 2.2.8 The VMSINSTAL Procedure

VMSINSTAL is a Digital-supplied, command procedure, used for installing software products from their distribution media to your system. To invoke the procedure, issue the following command:

```
$ @SYS$UPDATE:VMSINSTAL product device OPTIONS options_flag
```

You can invoke the command procedure, VMSINSTAL, without using any of the shown parameters (Table 2-1). If so, the procedure prompts you for the necessary information.

**Table 2-1 VMSINSTAL Parameters**

Parameter	Description
product	The product name and version—in this case, DISKMAKER021  This parameter is optional.
device	The device on which you mount the distribution volume  The format is ddcu; dd is the device code, c is the controller, and u is the unit number. You can use a logical name that translates to a valid-device specification. This parameter is optional.
OPTIONS	A keyword parameter that indicates, whether you have used the options_flag parameter to specify any options  This parameter is optional.
options_flag	A letter that specifies an option  The only valid option for this installation is N, which allows you to print and/or view the release notes before the installation continues. This parameter is optional and must follow the keyword, OPTIONS.

The DiskMaker-installation process uses the standard VMS-installation procedure, VMSINSTAL. The DiskMaker product is normally distributed on 9-track, 1600-bpi magtape in BACKUP format.

The next section documents the installation procedure, step by step. Future versions of VMSINSTAL might contain new prompts that are not documented here; however, the installation should proceed normally.

## 2.3 PERFORMING THE INSTALLATION

---

### Step 1: Log In

Log into the System Manager's account (SYSTEM) and use the operator's console terminal. Make sure that you do have all of the items, listed in the checklist in Section 2.2.3.

```
Username:  SYSTEM  
Password:  
```

### Step 2: Run VMSINSTAL

Invoke the installation-command procedure as follows:

```
$ @SYS$UPDATE:VMSINSTAL DISKMAKER013 $2$MUA0: OPTIONS N 
```

**DISKMAKER013** is the product name and version.

**\$2\$MUA0:** represents a valid device name on which you mount the distribution media. If the media is a disk, use the directory and device names.

**OPTIONS N** indicates that you want VMSINSTAL to prompt you for the release-notes options.

If you do not specify a product or device, the system prompts you for them.

If you do not want to type or print the release notes before the installation, omit **OPTIONS N**. After the installation you can find the release notes in the **SYSSHELP** directory.

To abort the installation, type **CTRL Y**. The installation procedure then deletes any files you have created up to that point and exits. To restart the installation, proceed with Step 2:.

## INSTALLING DiskMaker

### Step 3: Check Warnings

VMSINSTAL might display any or all of the following warning messages and ask if you want to continue.

```
%VMSINSTAL-W-NOTSYSTEM, You are not logged in to the SYSTEM account.  
%VMSINSTAL-W-DECNET, Your DECnet network is up and running.  
%VMSINSTAL-W-ACTIVE, The following processes are still active:  
. . .  
* Do you want to continue anyway? [NO]  YES  
```

If you choose not to continue, you return to the DCL level. Correct the warning condition, and restart with Step 2: above.

### Step 4: Create a Backup

If you have not backed up your system disk, do not continue with the installation. If you need to back up the system disk, type NO. VMSINSTAL exits and returns you to the DCL prompt. Backup your system disk and start VMSINSTAL at Step 2: above.

```
* Are you satisfied with the backup of your system disk? [YES]  
YES  
```

### Step 5: Load the Distribution Media

VMSINSTAL asks you to load the distribution media onto the device.

```
Please mount the first volume of the set on $2$MUA0:.  
* Are you ready? [YES]  YES    
%MOUNT-I-MOUNTED, DISKMAKER013 mounted on _$2$MUA0: (HSC000)
```

**Step 6: Select the Release Notes Option**

This step applies only if you specified the OPTIONS N in Step 2:.

Release Notes Options:

1. Display release notes
2. Print release notes
3. Both 1 and 2
4. Copy release notes to SYS\$HELP
5. Do not display, print or copy release notes

```
* Select option [2]: 2 
* Queue name [SYS$PRINT]: SYS$PRINT 
Job DISKMAKER021 (queue SYS$PRINT, entry 1117) started on SYS$PRINT
```

```
* Do you want to continue the installation? [YES]
YES 
```

Option 1 immediately displays the release notes at your terminal. Option 2 prompts you for a print queue and spools the release notes for printing. Option 3 does both. Option 4 copies the release notes to the SYS\$HELP directory, and Option 5 prevents VMSINSTAL from displaying, printing, or copying them.

```
* Queue name [SYS$PRINT]:
```

Then VMSINSTAL asks, if you want to continue the installation:

```
* Do you want to continue the installation? [YES]
```

**Step 7: Purge Existing Files**

The DiskMaker system creates a new generation of these system files during installation:

- SYS\$LIBRARY:DCLTABLES.EXE
- SYS\$STARTUP:DISKMAKER\_STARTUP.COM
- SYS\$STARTUP:DISKMAKER\_STARTUP\_LOCATION.COM
- SYS\$STARTUP:DISKMAKER\_SHUTDOWN.COM
- SYS\$STARTUP:VIRTUOSO\_STARTUP.COM
- SYS\$STARTUP:VIRTUOSO\_STARTUP\_LOCATION.COM
- SYS\$STARTUP:VIRTUOSO\_SHUTDOWN.COM

VMSINSTAL displays the following prompt, asking whether you want to purge old versions of these files:

## INSTALLING DiskMaker

```
* Do you want to purge files replaced by this installation? [YES]
YES 
```

### Step 8: Choose a Product Location

To store most of the DiskMaker product files you are prompted for a device and directory, which is created for you, if one does not already exist. The default location is SYSSYSDEVICE:[DISKMAKER].

DiskMaker requires a location for its files.

```
* Please enter a device/directory? SYSSYSDEVICE:[DISKMAKER] 
```

### Step 9: Allow the Installation to Complete

You will not be prompted again until the installation completes successfully. Then it displays the following messages:

```
Installation of DISKMAKER V1.3 completed at 12:20
```

```
VMSINSTAL procedure done at 12:20
```

### Step 10: Log out

Note that VMSINSTAL deletes or changes entries in the process-symbol tables during the installation. Therefore, if you continue to use the System Manager's account and want to restore those symbols, log out and log in again.

```
$ LOGOUT 
SYSTEM logged out at 10-JAN-1990 12:21:00.00
```

### Step 11: Install DCLTABLE

After a successful installation the DiskMaker command is available for execution. However, to allow *other cluster nodes with common system disks*, to use the DiskMaker command, enter the following command:

```
$ INSTALL REPLACE SYS$LIBRARY:DCLTABLES
```

## 2.3.1 Error Conditions

---

If the installation procedure fails for any reason, VMSINSTAL displays the following message:

```
%VMSINSTAL-F-UNEXPECTED, Installation terminated due to unexpected event.
```

This unexpected event can result from any of the following conditions:

- Insufficient disk space to complete the installation
- Insufficient AST quota
- Insufficient buffered-I/O-byte count
- Insufficient subprocess quota
- Insufficient open-file quota
- Insufficient process-paging-file quota
- Insufficient process-working-set quota
- Insufficient system-maximum-working set
- Incorrect version of VMS

For descriptions of the error messages, generated by these conditions, see the *VAX/VMS System Messages and Recovery Procedures Reference Manual* and the *Guide to VAX/VMS Software Installation*.

If you are notified that any of these conditions exist, take the appropriate action, as described in the message. You might need to change a system parameter (with SYSGEN) or increase an authorized-quota value (with AUTHORIZE). If the installation fails, restart the installation procedure from Step 2:.

### 2.3.2 Sample Installation

The following sample installation illustrates the sequence of the various VMSINSTAL prompts and queries, and their sample answers.

## Example 2-2 A Sample Installation

---

```

$ @SYS$UPDATE:VMSINSTAL

VAX/VMS Software Product Installation Procedure V5.5-2

It is 21-MAY-1993 at 16:37.

Enter a question mark (?) at any time for help.

* Are you satisfied with the backup of your system disk [YES]?
* Where will the distribution volumes be mounted: $2$MUA0:

Enter the products to be processed from the first distribution volume set.
* Products: DISKMAKER013
* Enter installation options you wish to use (none):

The following products will be processed:

    DISKMAKER V1.3

Beginning installation of DISKMAKER V1.3 at 16:37
%VMSINSTAL-I-RESTORE, Restoring product save set A ...
%VMSINSTAL-I-REMOVED, Product's release notes have been moved to SYS$HELP.

    DiskMaker for OpenVMS V013-000 Installation Procedure
    Copyright (C) 1993, Advanced Systems Concepts, Inc.

*****
Attention - System Manager / Installer:

1. Please remember to add SYS$STARTUP:DISKMAKER_STARTUP
   to your VMS Startup procedures.

2. DISKMAKER Release Notes can be found in SYS$HELP.

3. DISKMAKER DCL commands will be added to your DCL Tables on this node.
   For other cluster nodes, you must INSTALL/REPLACE DCL tables.

4. DISKMAKER Help will be added to your VMS Help library.

5. This product requires an ASCII Product Authorization Key (PAK)
   which is registered using Digital's License Management System.
   While you will be able to install the product without a PAK,
   you must register and load the license prior to using the product.
   ASCII suggests the use of the procedure SYS$UPDATE:VMSLICENSE.COM
   to accomplish this. After initial registration, LMF loads are
   automatically performed during subsequent system startups.
*****

* Do you want to purge files replaced by this installation [YES]?

DISKMAKER requires a location for its files.

* Please enter device/directory for DISKMAKER [SYS$SYSDEVICE:[DISKMAKER]]:
%VMSINSTAL-I-SYSDIR, This product creates system disk directory
                               SYS$SYSDEVICE:[DISKMAKER].
%VMSINSTAL-I-SYSDIR, This product creates system disk directory
                               SYS$SYSDEVICE:[DISKMAKER.EXAMPLES].
%FDL-I-CREATED, SYS$SYSDEVICE:[DISKMAKER]VIRTUOSO_DEPOSITORY.DAT;1 created
%VMSINSTAL-I-MOVEFILES, Files will now be moved to their target directories...

Installation of DISKMAKER V1.3 completed at 16:41

Enter the products to be processed from the next distribution volume set.
* Products:

VMSINSTAL procedure done at 16:42

```

---

### 2.3.3 Installation Messages

---

The messages that follow are DiskMaker product-specific messages, which can be displayed while you're installing the product. Any message not listed in this section should be investigated by examining the manual *VAX/VMS System Messages and Recovery Procedures Manual*.

DEVNOTAVL, Device *device-name* is not available

**Facility:** VMSINSTAL

**Severity:** Error

**Explanation:** The device you entered is not currently available.

**User Action:** Make the device available or choose another available device and rerun the installation procedure.

DEVNOTDISK, Device *device-name* is not a disk

**Facility:** VMSINSTAL

**Severity:** Error

**Explanation:** The device you entered is not a disk drive.

**User Action:** Select a disk drive and rerun the installation procedure.

DEVNOTEXIT, Device *device-name* does not exist

**Facility:** VMSINSTAL

**Severity:** Error

**Explanation:** The device you specified is unknown to the system.

**User Action:** Specify a legal-disk device and rerun the installation procedure.

DEVNOTMNT, device *device-name* is not mounted.

**Facility:** VMSINSTAL

**Severity:** Error

**Explanation:** The device you entered is not mounted or is not mounted Files-11.

**User Action:** Mount the disk as a Files-11 volume and rerun the installation procedure.

NOSPACE, device *device-name* contains only *nnn* free blocks. At least *nnn* blocks are required.

**Facility:** VMSINSTAL

**Severity:** Error

**Explanation:** The device you entered has insufficient free-disk space upon which to install the product.

**User Action:** Delete noncritical files to make room, or choose another disk device, and rerun the installation procedure.

## 2.4 STARTING DiskMaker

Normally, you load the DiskMaker system and have it ready for DiskMaker commands, when you bring up your system. A command procedure, named DISKMAKER\_STARTUP, found in the SYSSSTARTUP directory, initiates the system. To run successfully, DISKMAKER\_STARTUP requires several privileges (Table 2-2).

**Table 2-2 DISKMAKER\_STARTUP Privileges**

SETPRV	SYSNAM	CMEXEC
OPER	SYSPRV	CMKRNL

If you execute this command procedure within your VMS startup procedures, you should not have any problem with these privileges.

If you chose a disk device other than SYSSSYSDEVICE, you must) mount that disk system-wide prior to invoking this procedure.

DISKMAKER\_STARTUP performs several tasks:

- 1 Determines the location of the product
- 2 Loads the VIRTUAL DISK device driver and its template device
- 3 Uses the INSTALL utility to install these images:

VIRTUOSO\_PRVSHR.EXE (a privileged, shareable image)  
 VIRTUOSO\_VDS.EXE  
 VIRTUOSO\_SHR.EXE (a nonprivileged, shareable image)  
 VIRTUOSO\_VCLI.EXE

All DiskMaker executables are installed (via INSTALL) with the appropriate privileges necessary to run. All DiskMaker commands (except LIST and MONITOR) require the user to have PHY\_IO and OPER privilege. If you want to allow your general-user population to use DiskMaker, simply edit the startup procedure (VIRTUOSO STARTUP), and install VIRTUOSO\_VCLI.EXE with these additional privileges.

**Note: The device name VD cannot be changed due to the MSCP server and media-ID conventions, created by Digital.**

## 3 TERMS AND CONCEPTS

---

This chapter discusses terms and concepts regarding virtual disks and their usage in volume shadowing.

### 3.1 WHAT IS A VIRTUAL DISK?

---

A *Virtual Disk* is a software-generated and software-maintained representation of a disk device. A virtual disk interacts in the OpenVMS environment just like a real disk device: supports all standard disk QIO functions, is INITIALIZED and MOUNTed, contains a "home block", and the standard ODS system files (INDEXF.SYS, BITMAP.SYS, 000000.DIR, etc.). Virtual disks use blocks on real disks to store their data. Virtual disks of any size may be created, provided that an equal number of blocks are allocated on the corresponding real disk device(s).

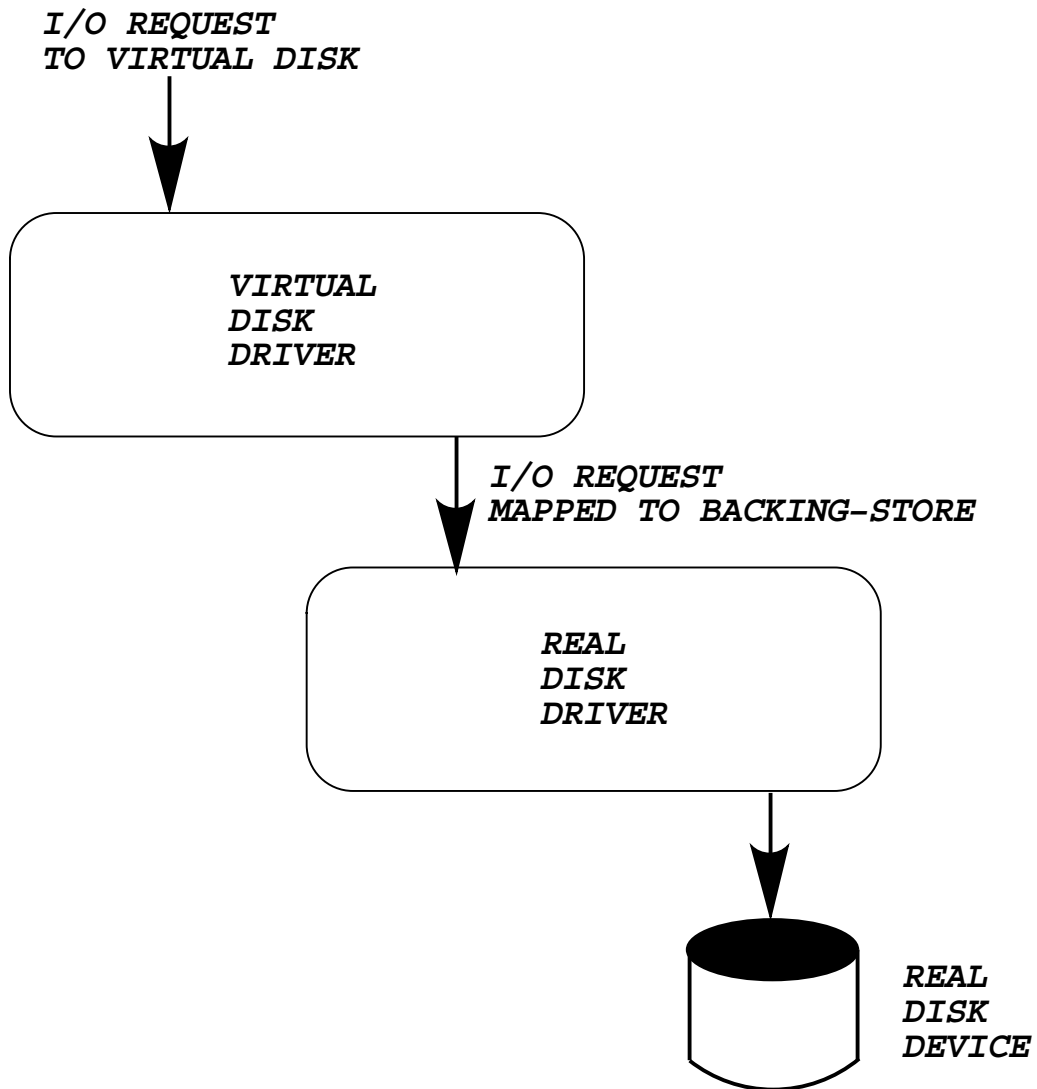
Virtual disks may be VMScLustered (either directly shared or through the MSCP server).

A *Backing-Store* is the collection of blocks, on a real disk, allocated for use by a virtual disk. A backing store may be a contiguous file on a Files-11 mounted disk, or all or part of a Foreign mounted disk.

# TERMS AND CONCEPTS

Figure 3-1 Virtual Disk I/O Flow

---



---

### 3.1.1 Backing-Stores

The DiskMaker definition of a backing store is a **nonvolatile** representation of the contents of a virtual disk. DiskMaker allows two types of backing-stores:

- Local File (contiguous or CBT)
- Local Volume (whole or partial)

---

#### 3.1.1.1 FILE Backing-Stores

A *File-Backed* virtual disk uses the blocks in a file to store the virtual disk's contents. Each LBN of the virtual disk is mapped to a VBN of the file. Backing-store files are **CREATED** by an initial activation of a virtual disk, and **OPENED** by subsequent virtual disk activation.

File backing stores can be either contiguous (the default) or contiguous-best-try. When contiguous files are used, the virtual disk I/O requests may be fully processed by the virtual disk driver. When non-contiguous files are used <sup>1</sup> then the driver must **WAKE** the server process for every I/O. Therefore, contiguous file virtual disks provide both better performance and reliability.

The real disk that contains the backing-store file is mounted with a normal Files-11 system-wide mount, and the space not allocation to the backing file is fully available to the file system. It is recommended that the real disks that contain backing files **NOT** be mounted with **MOUNT\_VERIFICATION** enabled.

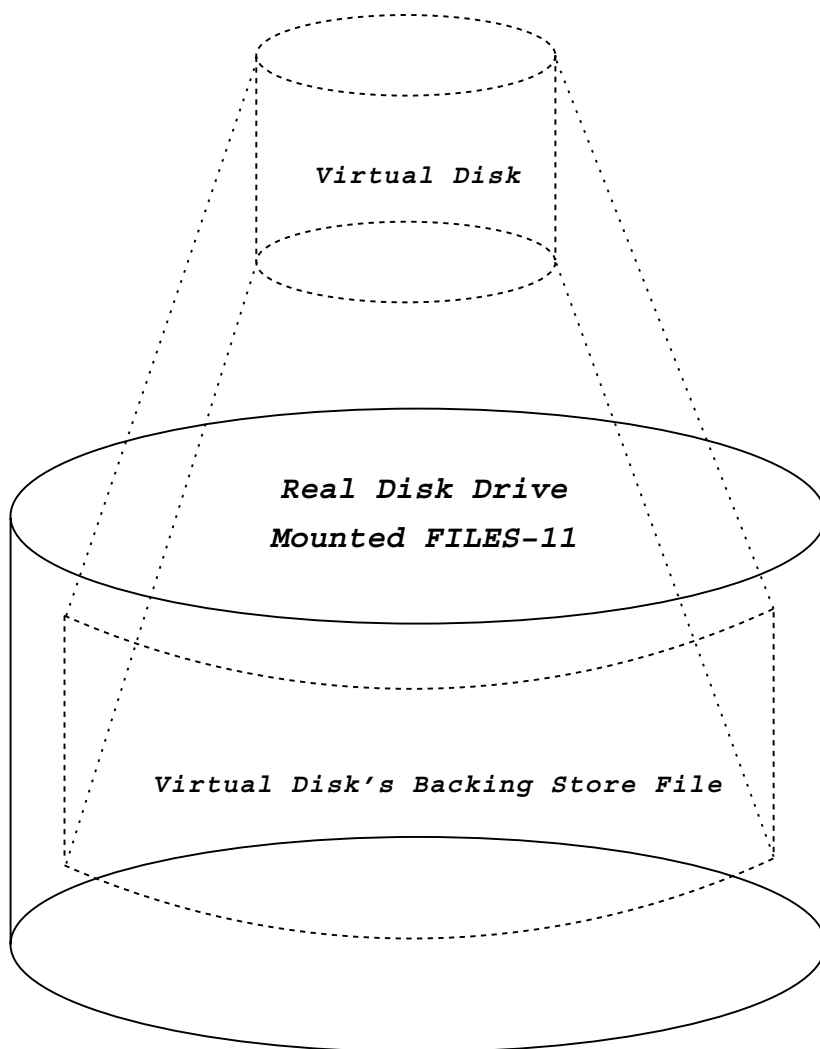
---

<sup>1</sup> CBT files are considered non-contiguous, even if the allocation is mapped to a single extent

## TERMS AND CONCEPTS

Figure 3-2 FILE Backing-Store Virtual Disk

---



---

**Helpful Hint:** To maximize contiguous space on a real disk, INITIALIZE the volume with the /INDEX=BEGIN qualifier

**Important Note:** Contiguous-best-try file backing stores are provided as a convenience for users who are evaluating the product, but ASCII does not recommend their use in production environments.

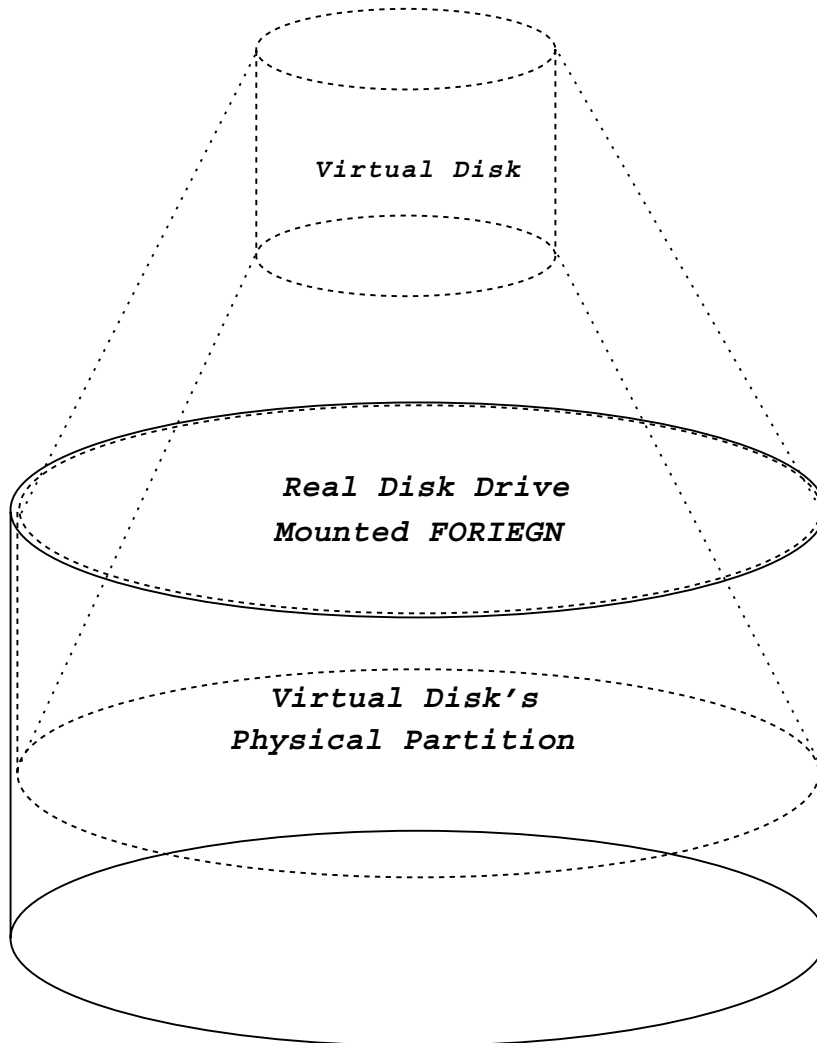
---

**3.1.1.2 VOLUME Backing-Stores**

A *Volume-Backed* virtual disk uses a range of blocks in a Foreign-mounted disk to store the virtual disk's contents. Each LBN of the virtual disk is mapped to a LBN of the real disk. The foreign disk is NOT file structured.

**Figure 3-3 VOLUME Partition Backing-Store Virtual Disk**

---



### 3.1.2        Volatile/Permanent Database

The DiskMaker system maintains a file, containing information on all known virtual disks. The information, stored in this file is similar to that requested by the ACTIVATE command. This file is referred to as the DiskMaker permanent (or nonvolatile) database. This database serves several purposes:

- 1 Allows simple, succeeding reactivations of a disk
- 2 Enforces a unique name for each virtual disk
- 3 Prevents inadvertant backing-store conflicts between virtual disks
- 4 Simplifies VMScluster operation by ensuring that all named disks are the same on all nodes

When a disk is activated, it becomes a part of the VMS system and internal VMS/DiskMaker-data structures are allocated. These data structures are collectively referred to as the *volatile* database. The volatility derives from the fact that those data structures are lost, when the system is rebooted.

Therefore, a virtual disk is considered *active*, when it appears in the volatile database and *known*, when it appears in the permanent database. On a VMScluster system, all nodes share the same permanent database.

The permanent database is located on the device and directory you chose during installation (the default is SYSSYSDEVICE:[VIRTUOSO]). The file specification is VIRTUOSO\_DEPOSITORY.DAT.

### 3.1.3 Virtual-Disk Names

When the DiskMaker system activates a virtual disk, a VMS device is dynamically created and named, in the format VDA $n$ : (for example, VDA1:). DiskMaker simply adds one (1) to the latest activated disk to determine the next unit number to use. This is quite similar to VMS mailboxes, DECnet-remote terminals, or LAT devices. However, since DiskMaker creates these devices dynamically, how can your applications know which disk device to access? Unlike a real disk with a unit-port plug (which usually doesn't change), the device names under DiskMaker can change quite often from activation to activation.

To get around this problem and also allow DiskMaker to identify a virtual disk, you must uniquely name the disk. The virtual *disk name* must be from one (1) to 31 characters long. DiskMaker uses this unique name to identify the virtual disk. DiskMaker also uses this name at activation time to create a system-wide logical name that refers to the dynamically created device. For example, the name, MYDISK, identifies the virtual disk in this command:

```
$ DISKMAKER ACTIVATE MYDISK
%VIRTUOSO-S-ACTVSUCC, virtual disk MYDISK (VDA10:) activated
$ SHOW LOGICAL MYDISK
"MYDISK" = "VDA10:" (LNM$SYSTEM_TABLE)
```

When DiskMaker activates MYDISK, it creates a new device, VDA10. DiskMaker assigns the logical name MYDISK to VDA10. Thus, the following command can successfully execute:

```
$ MOUNT/SYSTEM MYDISK TEST
%MOUNT-I-MOUNTED, TEST          mounted on _VDA10:
```

If a virtual disk is to be accessed by multiple nodes in a cluster, then you must control its unit number assignment. This is done by using the /DEVICE=VDA $n$ : qualifier of the activate command.

Please note that the label name of the device can be the same or different from its virtual-disk name.

### 3.1.4 Geometry, Size, and Device Type

When you create a virtual disk, DiskMaker requires topology information about the disk. The disk's size and its geometry constitute this topology. A disk's geometry is expressed by: cylinders per disk, tracks per cylinder, and sectors (blocks) per track. Generally, the size of a disk is equal to the product of the geometry ( $siz = cyl * trk * sect$ ). This might seem unnecessary for a virtual disk since no real physical geometry exists. However, certain software components, most importantly OpenVMS and VOLUME SHADOWING, require it, so you need to specify it.

DiskMaker has three (3) qualifiers that you can use to satisfy its topology information requirement. While you can specify all three, you usually need to use only one or none, if you use whole volume(s). The following rules apply:

- 1 If you are initializing a virtual disk with a volume-backing store, and you intend to use whole volume(s), you can omit all three (3) qualifiers. In that case this happens:
  - a. The *device type* is set from the volume-backing store.
  - b. The *size* is set from the smallest volume's size times the number of volumes specified.
  - c. The *geometry* is set from the volume-backing store with the number of cylinder's adjusted to reflect the actual size.
- 2 If you are initializing a virtual disk with either a partial volume- or file-backing store, you must specify at least one (1) qualifier.

If your virtual disk is to be joined in a shadow set where another member is a real disk (heterogeneous shadowing), then you should create the virtual disk with the exact same size and geometry as the real disk. If your virtual disk is to be joined in a shadow set only with other virtual disks (selective shadowing), then you should create each virtual disk, specifying the same geometries, with the size implied from the geometry - or use a pre-defined type from Table 3-1. If you create a virtual disk and specify only size, then different geometries may be calculated, depending on the under-lying backing-store disk.

These three (3) qualifiers observe the following rules of precedence: *size*, *geometry*, and *type*.

You can specify one of the device types in Table 3–1 below. If you omit both *size* and *geometry*, these values are retrieved from the table. If you require a device type that is not included in the table, please call customer ASCI customer support.

**Table 3–1 Table of Device Types**

Device Type	Size	Cylinder	Track	Sector
GENERIC_DU	1	1	1	1
GENERIC_DK	1	1	1	1
RX01	494	38	1	13
RX50	800	80	1	10
RX02	988	76	1	13
RX04	1,976	76	1	26
RX33	2,400	80	2	15
RL01	20,480	256	2	40
RK06	27,126	411	3	22
RL02	40,960	512	2	40
RC25	50,902	1,642	1	31
RK07	53,790	815	3	22
RZ22	102,432	388	8	33
RM03	131,680	823	5	32
RD53	138,672	1,020	8	17
RF30	151,734	1,331	3	38
RP04	171,798	411	1	22
RP05	171,798	411	19	22
RZ23	204,864	776	8	33
RA80	242,606	559	14	31
RB80	242,606	559	14	31
RM80	242,606	559	14	31
ESE20	245,757	480	128	4
RD54	311,200	1,221	15	17
RP06	340,670	815	19	22
RA60	400,176	1,600	6	42
RF71	404,624	1,331	8	38
RM05	500,384	823	19	32
RA70	547,041	1,507	11	33
RF31	744,400	1,861	8	50
RA81	891,072	1,248	14	51
RP07	1,008,000	630	32	50

## TERMS AND CONCEPTS

**Table 3-1 (Cont.) Table of Device Types**

<b>Device Type</b>	<b>Size</b>	<b>Cylinder</b>	<b>Track</b>	<b>Sector</b>
RP07HT	1,008,000	630	32	50
RA82	1,216,665	1,423	15	57
RF72	1,954,050	1,861	21	50
RA90	2,376,153	2,649	13	69

### 3.1.5 Contiguity and Positioning

The allocation options, selected during the initial activation can have a significant effect on run-time performance. DiskMaker supports both contiguous and contiguous-best-try (CBT) backing stores. A contiguous backing store (the default) is preferable for two major reasons:

- The DiskMaker Device Driver handles the entire I/O request. In contrast, each I/O to a CBT disk causes a WAKE to the server process, which then performs the I/O from process context.
- There is no XQP overhead.

The performance of volume-backed virtual disks is equivalent to contiguous-file-backed virtual disks.

In addition to selecting the contiguity of a backing store, you also select its position on a real disk. DiskMaker supports six (6) methods of positioning a backing store, as summarized by Table 3–2.

**Table 3–2 Backing-Store Positioning Methods**

Method	Unit	Description
EXACT_LBN	lbn	You can indicate an exact location for your backing store. You specify the location by a specific logical-block number. If VMS is unable to comply, an error occurs. This method is supported for volume-backed virtual disks.
EXACT_CYL	cylinder	You can indicate an exact location for your backing store. You specify the location by a specific cylinder number. If VMS is unable to comply, an error occurs. This method is supported for volume-backed virtual disks.
APPROX_LBN	lbn	You can indicate an approximate location for your backing store. You specify the location by an approximate logical-block number. VMS attempts to locate the file on the <i>lbn</i> you want or as closely as possible.
APPROX_CYL	cylinder	You can indicate an approximate location for your backing store. You specify the location by an approximate cylinder number. VMS attempts to locate the file on the <i>cylinder</i> you want or as closely as possible.
CYL	n/a	You can indicate that the file be located on any cylinder boundary.
ANY	n/a	The file is positioned, wherever VMS finds sufficient space. (Default)

## TERMS AND CONCEPTS

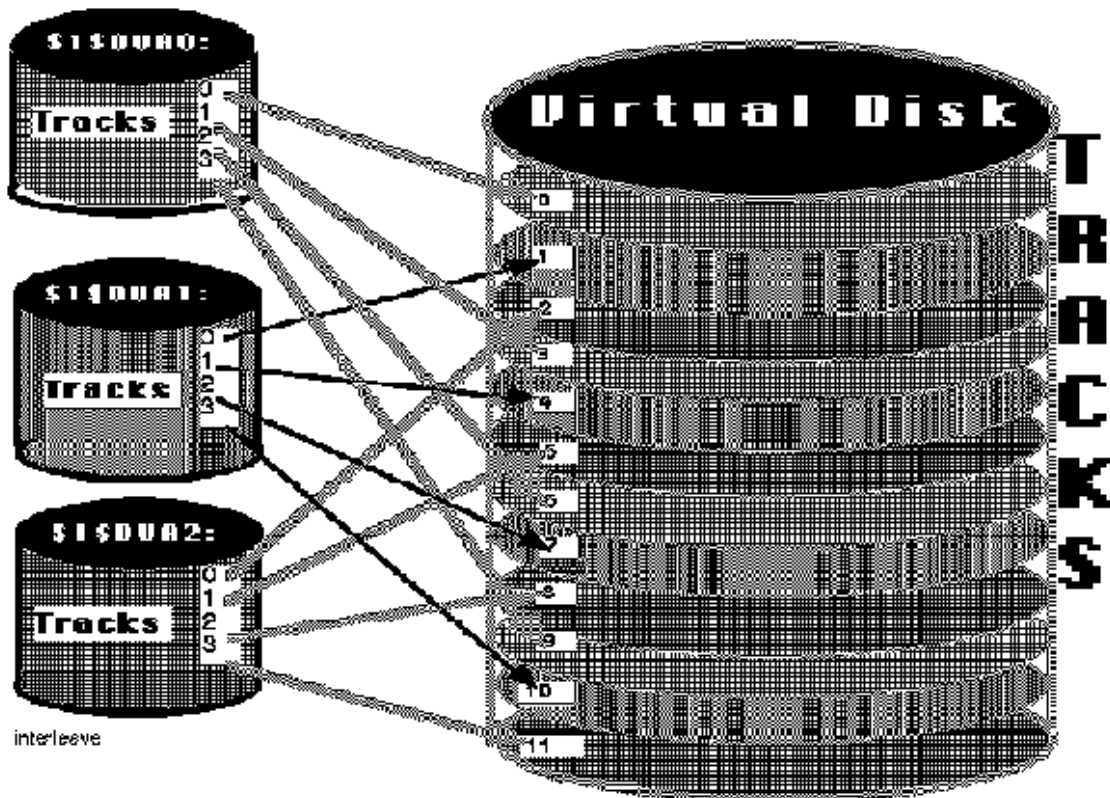
Positioning a backing store can improve performance since you can reduce seek time by locating the file/partition towards the middle of the disk.

## 3.2 DISKMAKER WITH DISK STRIPING

**Note:** This feature is a separately priced option available as the **DiskMaker with Striping option**

**Disk Striping** is a technique that improves the response time for a disk I/O operation by decomposing the request and spreading it over multiple real-disk drives. In this manner, you can use multiple-data paths and disk heads to avoid a bottleneck at a single drive. Under DiskMaker the logical space of a virtual disk is interleaved among its backing stores. Therefore, Disk Striping requires at least two (2) backing stores. In the case of volumes, DiskMaker does not require that they be the same size. DiskMaker interleaves the logical-block-number space of the virtual disk, based upon an interleave factor. By default DiskMaker uses a track as the interleave. Figure 3-4 shows this.

Figure 3-4 Interleaved Stripe Set



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As the DiskMaker system decomposes the I/O request, it determines the number of *revolutions* it must make through the entire range of backing stores to satisfy this request. The best striping efficiency is gained, when the *number of revolutions* is 1 or less. A *greater-than-1-revolution* means that you are generating at least two (2) I/O's to a backing store and, therefore, increasing I/O requests to a single drive. An improper-interleave factor (specifically a too small-interleave value) can cause this. Sometimes this is just unavoidable. The VMS Files-11 XQP issues a large ERASE function before extending the INDEXF.SYS file. Since this is quite infrequent, it is not a cause for concern. DiskMaker does track the *number of revolutions > 1*, so you can detect if this is frequently happening on your system.

Disk Striping allows you to improve total disk throughput significantly, as well as create very large, logical disks.

DiskMaker provides a great deal of performance metrics, concerning striping, so you can determine its benefit.

When you must issue the I/O to a disk, Disk Striping can be an effective technique for avoiding a bottleneck, when using a single physical drive. *Disk Striping* is the interleaving of a disk's logical space over two or more real-disk drives. For example, if the interleave factor is one (1) track and the virtual disk contains 1,000 tracks, a two-disk striped set would contain 500 tracks each. The 1,000 tracks are interleaved so that tracks one (1) and two (2), are accessed on different drives.

Disk Striping is an effective technique, when the number of I/O requests for a single file exceeds the maximum number of I/O's for a single disk.

---

### 3.2.1 Disk Striping and Performance

Disk Striping is an application of parallel-processing technology. The stripeset uses parallel processing by creating a virtual device that has the characteristics of multiple-data paths and multiple actuators. A *stripeset* consists of two or more backing stores. The backing stores must be on different-disk drives to gain maximum positive effect. Disk Striping attempts to maximize data-transfer rates by diverting I/O-requests to multiple drives. The maximum I/O-request rate for an RA82 is approximately 35 to 40 I/O requests/second. If your file is very large and located on this disk, even that I/O rate might be unsustainable. On the other hand, with a stripeset your file would be *logically* stored within one virtual-disk device, but *physically* spread across two real disk devices. If your application required an I/O rate of 40 to 50 I/O requests/second, it might be very feasible.

The following subsections provide guidelines for the use and configuration of DiskMaker's Disk Striping.

### 3.2.2 Disk Striping Versus File Placement

The first question you might ask, "Is Disk Striping right for my applications?" To thoroughly answer you, we would need an equally complete understanding of your application's I/O behavior. However, we can provide initial answers to the following questions:

- **Does your application use very small or very large files?**

Assuming you have multiple disks, if your application uses several small files, then you can maximize your disk resources by individually placing these files on different disks and observing the results. Depending upon your application and its files, this might achieve better results than striping. If your application tends to "hit" several large files (large, meaning greater than a track), striping might be advantageous.

- **Have you tried placing your most frequently accessed files on different disks?**

If not, you might want to. You can use the DiskMaker Data Collector to help you gain knowledge as to how your disks and files are used under load.

If you have tried this approach, the problem might be that you have one or more **very** hot files that bottleneck your application at a single drive. If that's the case, read on—striping might be in your future.

### 3.2.3 **Interleave Factor**

---

DiskMaker, when it creates a stripeset, spreads a virtual disk's logical space over multiple physical drives. The unit of storage that it uses is called the *interleave factor*. The interleave factor is expressed in disk sectors (or blocks). By default DiskMaker uses one (1) track's worth of sectors as the interleave factor. This value tends to maximize data-transfer rates without creating an excessive number of I/O requests.

To understand the interleave factor and how its value is critically important to performance, let's examine several different values. (The cases, described below, assume that two-disk devices are used.)

#### **Interleave Factor = 1 Sector**

Setting the above value allocates alternate blocks on each disk. Disk A would have even blocks (LBN's start from zero.) and Disk B would have odd blocks. If your application always transferred one (1) sector, this interleave value might be appropriate. However, what would happen if eight sectors needed to be transferred? Eight I/O requests (four to each disk) would need to be issued! While this would certainly drive up I/O requests, it would not improve data-transfer rates.

#### **Interleave Factor = 1,000 Sectors**

Setting the above value avoids excessive I/O requests, when decomposing the original request. Very few applications issue read and write requests to transfer 1,000 sectors. If the application issues an eight (8) sector I/O, striping won't be effective, since little parallelism occurs.

**Interleave Factor = 1 Track's Worth of Sectors**

Using an RA81-disk drive, this value is fifty-one (51) sectors. If your file is greater than fifty-one sectors, DiskMaker interleaves it. When your application tends to randomly access most of the file, striping can be effective, if sufficient I/O requests are queued to the virtual disk. A striping "utopia" is one in which the transfer size equals the *interleave factor* times the number of backing stores. This produces exactly one I/O per stripeset member, achieving a maximum data-transfer rate and a minimum I/O-request overhead per disk. *Revolution* is the term, DiskMaker uses, when an application-I/O request visits each stripeset member. As long as each member is visited only once and multiple members are involved, striping improves performance. When the number of revolutions to satisfy an application-I/O request exceeds one, striping performance drops.<sup>1</sup>

Another approach to striping "utopia" exists, when the application's transfer-request size is equal to or less than an interleave factor. Data is randomly selected so that all stripeset members are equally involved. This requires that a sustainable load be present for the stripeset.

It is important to note that smart controllers (like an HSC) perform various queuing optimizations (if sufficient loading is present) that also assist Disk Striping. If your stripeset is MSCP-served, data-transfer rates do not perform as well as direct-path systems, due to the increased-interprocessor communications and CPU overhead and capability of the target system.

The sample dialogues that follow present some typical configurations for Disk Striping.

---

<sup>1</sup> Sometimes this is unavoidable. Files-11 extends the INDEXF.SYS file massively with a several hundred-K-erase operation. This is very infrequent though.

# TERMS AND CONCEPTS

## Example 3-1 File-Backing-Store Stripesets

---

```
$ DISKMAKER ACTIVATE STRIPE_DISK/INITIALIZE=YES/SIZE=10000-
_ $ /BACKING=(($1$DUA2:[TEST],$1$DUA12:[VIRT_TEST])/LOG 1
%RUN-S-PROC_ID, identification of created process is 20200132
%VIRTUOSO-S-ACTVSUCC, virtual disk STRIPE_DISK (_$1$VDA1:) activated
-SYSTEM-S-NORMAL, normal successful completion
$ INITIALIZE STRIPE_DISK GOLF
$ MOUNT/SYSTEM STRIPE_DISK GOLF
%MOUNT-I-MOUNTED, GOLF mounted on _$1$VDA1: (VIRTUOSO)
$ SHOW DEVICE STRIPE_DISK/FULL

Disk _$1$VDA1: (VIRTUOSO), device type RA81, is online, mounted, file-oriented
device, shareable, served to cluster via MSCP Server.

Error count          0      Operations completed          33
Owner process        ""      Owner UIC                    [ASCII,KATY]
Owner process ID     00000000  Dev Prot      S:RWED,O:RWED,G:RWED,W:RWED
Reference count      1      Default buffer size          512
Total blocks         9996   Sectors per track            51
Total cylinders      14      Tracks per cylinder           14
Allocation class     1

Volume label         "GOLF"   Relative volume number        0
Cluster size         1      Transaction count             1
Free blocks          8891   Maximum files allowed         2499
Extend quantity      5      Mount count                   1
Mount status         System   Cache name                    "_$1$DUA13:XQPCACHE"
Extent cache size    64      Maximum blocks in extent cache  889
File ID cache size   64      Blocks currently in extent cache  0
Quota cache size     0      Maximum buffers in FCP cache    486

Volume status:  subject to mount verification, file high-water marking, write-
through caching enabled.

$ DISKMAKER LIST/FULL STRIPE_DISK

DiskMaker V013-000 Virtual Disk System on node VIRTUOSO 24-MAR-1993 15:55:26
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Virtual Disk: STRIPE_DISK [$1$VDA1: (VIRTUOSO)]
Type: File          Options: Stripe,Contig,Noshare,Servable

          --- Characteristics ---

Size          9996   Cylinders/disk          14
Device Type   RA81    Tracks/cylinder         14
Number of Backing Stores  2   Sectors/track           51
Stripe Interleave (blocks)  51  2

          --- Backing Store Information ---

Specification                                Start      Alignment
                                                Position   Option
DISK$VIRT:[TEST]VIRTUOSO_STRIPE_DISK.BACKING_1;3 3  268536     EXACT LBN
DISK$CRASH:[VIRT_TEST]VIRTUOSO_STRIPE_DISK.BACKING_2;1
                                                275373     EXACT LBN

          --- I/O Performance Statistics ---

Read I/O Count      10      Write I/O Count          21
Unaligned Reads     8      Unaligned Writes         21
# Revolution > 1    0      Stripe Interleave        51

Backing Store Device, FID                    Read I/O   Write I/O   Percent
_ $1$DUA2: (34,61293,0)                       10         19          91  4
_ $1$DUA12: (1022,8,0)                         0          2           9
```

---

Example 3-1 Cont'd on next page

**Example 3-1 (Cont.) File-Backing-Store Stripesets**

```

$ CREATE/DIR/LOG STRIPE_DISK:[TEST]
%CREATE-I-CREATED, _$1$VDA1:[TEST] created
$ COPY/LOG SYS$MANAGER:*START*.COM STRIPE_DISK:[TEST]*.*
%COPY-S-COPIED, SYS$COMMON:[SYSMGR]DECW$STARTAPPS.COM;1 copied to
_ $1$VDA1:[TEST]DECW$STARTAPPS.COM;1 (9 blocks)
%COPY-S-COPIED, SYS$COMMON:[SYSMGR]DECW$STARTLIBS.COM;1 copied to
_ $1$VDA1:[TEST]DECW$STARTLIBS.COM;1 (8 blocks)
%COPY-S-COPIED, SYS$COMMON:[SYSMGR]DECW$STARTSERVER.COM;1 copied to
_ $1$VDA1:[TEST]DECW$STARTSERVER.COM;1 (20 blocks)
.... NOT ALL FILES SHOWN ....
%COPY-S-NEWFILES, 28 files created
$ DISKMAKER LIST/FULL STRIPE_DISK

DiskMaker V013-000 Virtual Disk System on node VIRTUOSO 24-MAR-1993 15:58:41
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Virtual Disk: STRIPE_DISK [$1$VDA1: (VIRTUOSO)]
Type: File Options: Stripe,Contig,Noshare,Servable

--- Characteristics ---
Size                9996    Cylinders/disk          14
Device Type         RA81    Tracks/cylinder         14
Number of Backing Stores 2    Sectors/track          51
Stripe Interleave (blocks) 51

--- Backing Store Information ---
Specification                               Start Position Alignment
                                                Option
DISK$VIRT:[TEST]VIRTUOSO_STRIPE_DISK.BACKING_1;3 268536 EXACT LBN
DISK$CRASH:[VIRT_TEST]VIRTUOSO_STRIPE_DISK.BACKING_2;1
                                                275373 EXACT LBN

--- I/O Performance Statistics ---
Read I/O Count      44    Write I/O Count         158
Unaligned Reads     8    Unaligned Writes        22
# Revolution > 1    6 6    Stripe Interleave       51

Backing Store Device, FID          Read I/O  Write I/O  Percent
_ $1$DUA2: (34,61293,0)           22        86        49 5
_ $1$DUA12: (1022,8,0)            22        90        51

$ DISMOUNT STRIPE_DISK
$ DISKMAKER DEACTIVATE STRIPE_DISK/LOG
%VIRTUOSO-S-DEACTVSUCC, virtual disk STRIPE_DISK (_$1$VDA1:) deactivated
-VIRTUOSO-S-NORMAL, normal successful completion
$ DIR $1$DUA2:[TEST]VIRTUOSO_STRIPE_DISK*/FU 7

Directory $1$DUA2:[TEST]

VIRTUOSO_STRIPE_DISK.BACKING_1;3    File ID: (34,61293,0)
Size: 4998/4998    Owner: [60,1]
Created: 24-MAR-1990 15:54:23.99
Revised: 24-MAR-1990 15:54:23.99 (0)
Expires: <None specified>
Backup: <No backup recorded>
File organization: Sequential
File attributes: Allocation: 4998, Extend: 0, Global buffer count: 0
No version limit, Contiguous
Record format: Fixed length 512 byte records
Record attributes: None
RMS attributes: None
Journaling enabled: None
File protection: System:RWED, Owner:RWED, Group:RWE, World:
Access Cntrl List: None

```

**Example 3-1 Cont'd on next page**

## TERMS AND CONCEPTS

### Example 3–1 (Cont.) File-Backing-Store Stripesets

---

```
Total of 1 file, 4998/4998 blocks.
$ DIR $1$DUA12:[VIRT_TEST]VIRTUOSO_STRIPE_DISK*/FULL

Directory $1$DUA12:[VIRT_TEST]

VIRTUOSO_STRIPE_DISK.BACKING_2;1      File ID: (1022,8,0)
Size:      4998/4998      Owner:      [60,1]
Created:   24-MAR-1990 15:54:26.31
Revised:   24-MAR-1990 15:54:26.31 (0)
Expires:   <None specified>
Backup:    <No backup recorded>
File organization: Sequential
File attributes: Allocation: 4998, Extend: 0, Global buffer count: 0
                No version limit, Contiguous
Record format: Fixed length 512 byte records
Record attributes: None
RMS attributes: None
Journaling enabled: None
File protection: System:RWED, Owner:RWED, Group:RWE, World:
Access Cntrl List: None

Total of 1 file, 4998/4998 blocks.
```

---

- 1 This command creates a stripeset, consisting of two backing stores.<sup>1</sup>
- 2 A new field, "Stripe Interleave," which indicates the interleave factor for each stripeset member, appears. The value 51 is derived from the "sectors-per-track" field in the above SHOW DEVICE listing.
- 3 Note that the default-file specifications are slightly different for a stripeset. Each backing store has a numbered extension.
- 4 Notice that after so few I/O's the first backing store has a heavy advantage (91 to 9) in completing I/O's.
- 5 But after we transfer some files, the "advantage" disappears (49 to 51). If this could be maintained, a perfect balance of I/O requests could be achieved.
- 6 Notice that the field, "# revolutions >1," now shows a six. This is due to a massive-erase function the XQP issues, when extending the INDEXF.SYS file. With the exception of infrequent file-system actions, you should attempt to keep this statistic from increasing.
- 7 A full directory listing of each backing store indicates that the STRIPE\_DISK storage allocation is divided evenly between the two backing stores.

---

<sup>1</sup> interestingly, DUA2 is an RA81, and DUA12 is an RA82.

**Example 3–2 Volume-Backing-Store Stripesets**

```

$ MOUNT/FOREIGN/SYSTEM 1 $1$DUA1: STRIPE_1 2
%MOUNT-I-MOUNTED, STRIPE_1 mounted on _$1$DUA1: (HSC000)
$ MOUNT/FOREIGN/SYSTEM $1$DUA2: STRIPE_2
%MOUNT-I-MOUNTED, STRIPE_2 mounted on _$1$DUA2: (HSC000)
$ DISKMAKER ACTIVATE STRIPE_VOL/INITIALIZE=YES-
_ $ /BACKING=($1$DUA1:,$1$DUA2:)/LOG 3
%RUN-S-PROC_ID, identification of created process is 2020013A
%VIRTUOSO-S-ACTVSUCC, virtual disk STRIPE_VOL (_$1$VDA4:) activated
-SYSTEM-S-NORMAL, normal successful completion
$ SHOW DEVICE $1$DUA1:/FULL 4

Disk $1$DUA1: (HSC000), device type RA81, is online, mounted foreign, file-
oriented device, shareable, served to cluster via MSCP Server, error logging
is enabled.

Error count                0      Operations completed                4
Owner process              ""      Owner UIC                          [ASCII,KATY]
Owner process ID          00000000  Dev Prot                          S:RWED,O:RWED,G:,W:
Reference count           2      Default buffer size                 512
Total blocks              891072  Sectors per track                   51
Total cylinders           1248  Tracks per cylinder                  14
Host name                  "HSC000"  Host type, avail                    HS70, yes
Allocation class           1

Volume label              "STRIPE_1"  Relative volume number              0
Cluster size              0      Transaction count                   1
Free blocks                0      Maximum files allowed                0
Extend quantity           0      Mount count                          1
Mount status               System    ACP process name                    ""

$ SHOW DEVICE $1$DUA2:/FULL

Disk $1$DUA2: (HSC000), device type RA81, is online, mounted foreign, file-
oriented device, shareable, served to cluster via MSCP Server, error logging
is enabled.

Error count                0      Operations completed                269
Owner process              ""      Owner UIC                          [ASCII,KATY]
Owner process ID          00000000  Dev Prot                          S:RWED,O:RWED,G:,W:
Reference count           2      Default buffer size                 512
Total blocks              891072  Sectors per track                   51
Total cylinders           1248  Tracks per cylinder                  14
Host name                  "HSC000"  Host type, avail                    HS70, yes
Allocation class           1

Volume label              "STRIPE_2"  Relative volume number              0
Cluster size              0      Transaction count                   1
Free blocks                0      Maximum files allowed                0
Extend quantity           0      Mount count                          1
Mount status               System    ACP process name                    ""

$ SHOW DEVICE STRIPE_VOL/FULL 5

Disk $1$VDA4: (VIRTUOSO), device type RA81, is online, mounted, file-oriented
device, shareable, served to cluster via MSCP Server.

Error count                0      Operations completed                436
Owner process              ""      Owner UIC                          [ASCII,KATY]
Owner process ID          00000000  Dev Prot                          S:RWED,O:RWED,G:RWED,W:RWED
Reference count           1      Default buffer size                 512
Total blocks              1782144  Sectors per track                   51
Total cylinders           2496  Tracks per cylinder                  14
Allocation class           1

```

**Example 3–2 Cont'd on next page**

# TERMS AND CONCEPTS

## Example 3-2 (Cont.) Volume-Backing-Store Stripesets

---

```
Volume label          "BIGDISK"      Relative volume number      0
Cluster size         3          Transaction count          1
Free blocks          1781910    Maximum files allowed      222768
Extend quantity      5          Mount count                1
Mount status         System    Cache name                  "_$1$DUA13:XQPCACHE"
Extent cache size    64        Maximum blocks in extent cache 178191
File ID cache size   64        Blocks currently in extent cache 0
Quota cache size     0          Maximum buffers in FCP cache 486

Volume status:  subject to mount verification, file high-water marking, write-
through caching enabled.

$ CREATE/DIR/LOG STRIPE_VOL:[TEST]
%CREATE-I-CREATED, _$1$VDA4:[TEST] created
$ DISKMAKER LIST/FULL STRIPE_VOL

DiskMaker V013-000 Virtual Disk System on node VIRTUOSO 24-MAR-1993 17:09:28
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Virtual Disk: STRIPE_VOL [$_$1$VDA4: (VIRTUOSO)]
Type: Volume          Options: Stripe,Noshare,Servable

          --- Characteristics ---

Size              1782144    Cylinders/disk            2496
Device Type       RA81      Tracks/cylinder           14
Number of Backing Stores 2      Sectors/track            51
Stripe Interleave (blocks) 51

          --- Backing Store Information ---

Specification                    Start      Alignment
                                  Position   Option
_$$1$DUA1:                        0         EXACT LBN
_$$1$DUA2:                        0         EXACT LBN

          --- I/O Performance Statistics ---

Read I/O Count      259          Write I/O Count            284
Unaligned Reads     205          Unaligned Writes          227
# Revolution > 1    0            Stripe Interleave         51

Backing Store Device      Read I/O   Write I/O   Percent
_$$1$DUA1:                155        173         60
_$$1$DUA2:                104        111         40

$ MC SYSGEN
SYSGEN> CREATE STRIPE_VOL:[TEST]TEST_FILE.DAT/SIZE=10000/CONTIG
%SYSGEN-I-CREATED, _$1$VDA4:[TEST]TEST_FILE.DAT;1 created
SYSGEN> EXIT
$ DISKMAKER LIST/FULL STRIPE_VOL

DiskMaker V013-000 Virtual Disk System on node VIRTUOSO 24-MAR-1993 17:10:24
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Virtual Disk: STRIPE_VOL [$_$1$VDA4: (VIRTUOSO)]
Type: Volume          Options: Stripe,Noshare,Servable

          --- Characteristics ---

Size              1782144    Cylinders/disk            2496
Device Type       RA81      Tracks/cylinder           14
Number of Backing Stores 2      Sectors/track            51
Stripe Interleave (blocks) 51

          --- Backing Store Information ---
```

---

Example 3-2 Cont'd on next page

**Example 3-2 (Cont.) Volume-Backing-Store Stripsets**


---

```

Specification                               Start      Alignment
                                           Position   Option
_ $1$DUAL:                                   0          EXACT LBN
_ $1$DUA2:                                   0          EXACT LBN

      --- I/O Performance Statistics ---

Read I/O Count          261      Write I/O Count          367
Unaligned Reads        205      Unaligned Writes        227
# Revolution > 1       79 6      Stripe Interleave       51

Backing Store Device           Read I/O   Write I/O   Percent
_ $1$DUAL:                   157       313        57
_ $1$DUA2:                   104       248        43

$ RUN VIRTUAL_TESTER

DISKMAKER Virtual I/O Test                24-Mar-90 05:10 PM

Enter File to use for test ? STRIPE_VOL:[TEST]TEST_FILE.DAT
# iterations ? 1000
Max I/O Xfer Size ? 512
# async IOs (1=SYNC) ? 10
ELAPSED:    0 00:00:11.54 7  CPU: 0:00:04.96 8  BUFIO: 0  DIRIO: 1000  FAULTS: 6
$ DISKMAKER LIST/FULL STRIPE_VOL

DiskMaker V013-000 Virtual Disk System on node VIRTUOSO 24-MAR-1993 17:11:19
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Virtual Disk: STRIPE_VOL [_ $1$VDA4: (VIRTUOSO)]
Type: Volume      Options: Stripe,Noshare,Servable

      --- Characteristics ---

Size                1782144   Cylinders/disk          2496
Device Type         RA81      Tracks/cylinder         14
Number of Backing Stores 2      Sectors/track           51
Stripe Interleave (blocks) 51

      --- Backing Store Information ---

Specification                               Start      Alignment
                                           Position   Option
_ $1$DUAL:                                   0          EXACT LBN
_ $1$DUA2:                                   0          EXACT LBN

      --- I/O Performance Statistics ---

Read I/O Count          1261     Write I/O Count          368
Unaligned Reads        1205     Unaligned Writes        227
# Revolution > 1       79 9      Stripe Interleave       51

Backing Store Device           Read I/O   Write I/O   Percent
_ $1$DUAL:                   676       314        54
_ $1$DUA2:                   585       248        46

$ DISMOUNT STRIPE_VOL
$ DISKMAKER DEACTIVATE STRIPE_VOL/LOG
%VIRTUOSO-S-DEACTVSUCC, virtual disk STRIPE_VOL (_ $1$VDA4:) deactivated
-VIRTUOSO-S-NORMAL, normal successful completion

```

---

## TERMS AND CONCEPTS

- 1 This example demonstrates how two volumes can participate in a stripeset. Both volumes must be mounted foreign *prior* to virtual-disk activation. This helps ensure that an accidental volume specification doesn't destroy a Files-11 disk.
- 2 You must give each disk a unique-volume name for VMS purposes. This volume name is not written back to the disk, and is only used while the disk is mounted. If another node needs to access this virtual disk, this exact mount command would be used on that node, as well.
- 3 Note that the size of the virtual disk is automatically computed for a full-volume backing store.
- 4 These SHOW DEVICE commands indicate how large the physical disk is (891,072 blocks each).
- 5 When combined into a single, logical disk, it becomes twice as large. (DiskMaker uses none of the disk(s) for its own purposes.)
- 6 Notice that after creation of the large file (TEST\_FILE.DAT), a large number of "revolutions >1" occur. This is due to file high-water marking.
- 7 This elapsed time is more than three (3) seconds less than the same experiment on a single-disk drive.
- 8 CPU time is almost a full second more. This is primarily due to IRP allocation and fill-in, LBN computation and post-I/O processing.
- 9 As you would expect this statistic didn't change, since all reads are 512 bytes.

### 3.3 ERROR SIMULATION

---

The DiskMaker system offers a facility that allows you to test your recovery systems fully through the simulation of disk-subsystem errors.

DiskMaker allows you to simulate TWO types of errors:

- *Medium Offline* This condition simulates a medium off-line (SS\$\_MEDOFL) error. To continue sending operations to the disk, you need to issue a **PACKACK** command. Files-11-mounted disks typically enter VMS Mount Verification, when receiving this error. Resetting this condition causes VMS Mount Verification to continue and validate the drive.
- *Medium Write-Locked* This condition simulates a medium write-locked error (SS\$\_WRITLCK). Like Medium Off-Line errors, VMS usually enters Mount Verification, when receiving this error.

## 3.4 QIO FUNCTIONS AND ERRORS

DiskMaker supports all standard, disk-driver QIO functions—virtual, logical, and physical. Diagnostic-QIO functions are not supported. The maximum byte-transfer count for a virtual disk is determined by using the smallest value found for any backing-store device. The only exception to this rule is that DiskMaker limits Paged and Encrypted disks to 65K transfers. Any user-specified-transfer length that exceeds the devices' maximum-transfer size (UCB\$*L*\_MAXBCNT) undergoes I/O segmentation through the VMS I/O subsystem.

DiskMaker is capable of inherently generating the following errors on a QIO operation (in Table 3–3). Any other error received is either from a VMS facility or an underlying-device driver.

**Table 3–3 QIO-Operations Errors**

Message	Explanation
SS\$_MEDOFL	Medium Offline error. (See Error Simulation, Section 3.3.)
SS\$_WRITLCK	Medium is write locked. (See Error Simulation, Section 3.3.)
SS\$_VOLINV	Volume not software-enabled. This error indicates that the bit UCB\$ <i>V</i> _VALID in the cell UCB\$ <i>W</i> _STS is clear.

## 3.5 INITIALIZING NONSTANDARD DISKS

DiskMaker allows you to create disks of any size. If the size of your virtual disk exceeds 3.1 million blocks, you need to specify a volume-cluster size as part of the DCL INITIALIZE command. To calculate the minimum cluster size, you can use the formula below.

$$/CLUSTER\_SIZE = \frac{\text{disk size (blocks)}}{1,044,480}$$

The result of this division should be rounded up to the nearest whole number. The maximum-cluster size cannot exceed one-hundredth (1/100) of the size of the virtual disk.

ASCI does not manufacture virtual disks with bad blocks. Therefore, it is unnecessary for you to execute ANALYZE/MEDIA. The DiskMaker system supports all standard VMS QIO functions, normally associated with disk drives.

---

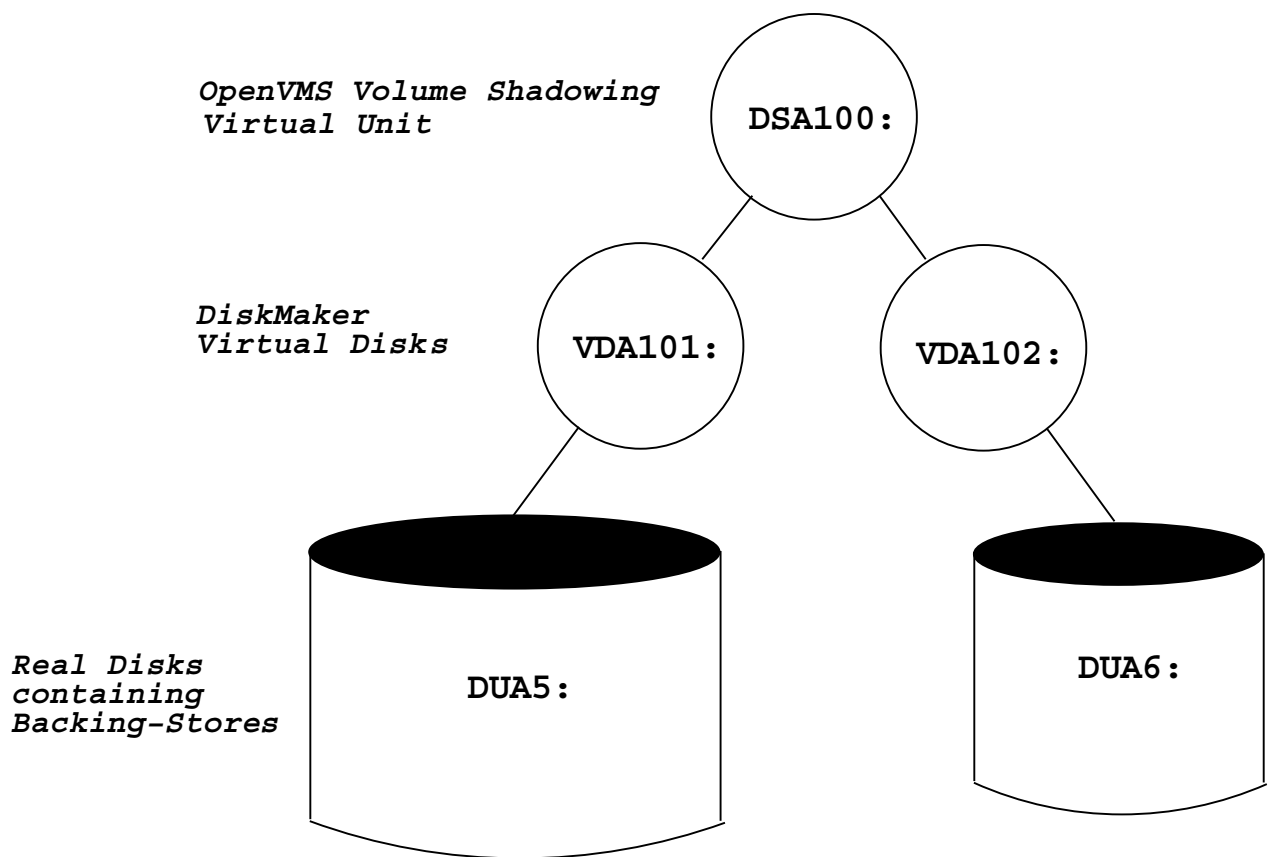
## 3.6 CREATING SHADOW SETS WITH VIRTUAL DISKS

The previous sections in this chapter discussed the creation of virtual disks. This section discusses the use of the virtual disk to achieve the goals of selective and heterogeneous shadowing.

Figure 3-5 shows the relationship of the OpenVMS Volume Shadowing Virtual Unit, the DiskMaker Virtual Disks, and the real disks that serve as the underlying backing-stores.

Figure 3-5 Virtual Units, Virtual Disks, Real Disks

---



## TERMS AND CONCEPTS

Once a virtual disk is activated, use it just as you would a newly installed real disk device. Initialize it, mount it, create directories and move files into it. Example Example 3-3 shows the steps to create a selective shadow set (using file-backed virtual disks). Example Example 3-4 shows the steps to create a heterogeneous shadow set (using a volume-backed virtual disk).

### Example 3-3 Sample DCL to Create a Selective Shadow Set

---

```
$!  
$ MOUNT/SYSTEM $1$DUA1: USER_DATA_1  
$ MOUNT/SYSTEM $1$DUA2: USER_DATA_2  
$!  
$! create 2 virtual disk to be shadow members ...  
$! geometry=(2000,10,16) --> size=2000*10*16 --> size=320000 (blocks)  
$!  
$ DISKMAKER ACTIVATE SS1/INIT=Y/DISK/DEVICE=VDA101:/BACK=$1$DUA1: [BACKING] -  
    /VOLSHAD/LOG/GEOMETRY=(2000,10,16)  
$ INITIALIZE SS1 SELECT_DATA  
$!  
$ DISKMAKER ACTIVATE SS2/INIT=Y/DISK/DEVICE=VDA102:/BACK=$1$DUA2: [BACKING] -  
    /VOLSHAD/LOG/GEOMETRY=(2000,10,16)  
$ INITIALIZE SS2 SELECT_DATA  
$!  
$! populate one member with the files to be selectively shadowed  
$ MOUNT      SS1 SELECT_DATA  
$ BACKUP $1$DUA5: [SMALL_APPLICATION] SS1:[*...]  
$ DISMOUNT SS1  
$!  
$! create the shadow set  
$ MOUNT/SYSTEM DSA100:/SHADOW=(SS1,SS2) SELECT_DATA  
$!
```

---

### Example 3-4 Sample DCL to Create a Heterogeneous Shadow Set

---

```
$!  
$! mount the backing-store disk as a non-file-structured device  
$ MOUNT/SYSTEM/FOREIGN $1$DIA1: unique_label  
$!  
$! create 1 virtual disk to be shadow member along with $1$dia3, a rf31  
$ DISKMAKER ACTIVATE HS1/INIT=Y/DISK/DEVICE=VDA301:/BACK=$1$DIA1: -  
    /VOLSHAD/LOG/TYPE=RF31  
$! HS1 uses the first 744,400 (rf31 size) blocks on $1$DIA1 (a larger disk)  
$!  
$ INITIALIZE SS1 SELECT_DATA  
$!  
$! create the shadow set  
$ MOUNT/SYSTEM DSA300:/SHADOW=($1$DIA3:,HS1) RF31_DATA  
$!
```

---

---

## 3.7 ERROR HANDLING

The creation of virtual disks, and formation of shadow sets, are means to provide you with 2 benefits: safe data, and uninterrupted access to that data. When errors occur, these two objectives may be at odds with each other. This is because a quick removal of a shadow member due to an error eliminates the protection of redundancy, while waiting for the condition to clear causes users to also wait.

There are two major classes of disk errors: media integrity and device availability.

There are two SYSGEN parameters that control access to disks and shadow sets during error events.

---

### 3.7.1 Media Integrity Errors or Programmatic Errors

Media integrity errors are those that occur when the disk is reachable, but it is determined that the data read is invalid (for hardware or programmatic reasons). The most common of these are DATACHECK and FORCED READ errors. When a read is performed to a shadow set member, and the data is deemed to be invalid, the invalid block(s) may be restored by retrieving the data from another valid member, and rewriting the bad member. This type of error handling is transparent to the virtual disks.

---

### 3.7.2 Device Availability Errors

Device availability errors occur when the disk device appears to the OpenVMS system as unreachable. This class of errors includes: MEDOFL, DEVOFFLINE, VOLINV, NOSUCHDEV, DRVERR, CTRLERR and WRITLCK. In the case of these errors, it is reasonable to re-try operations to the device, because the condition may be transitory (the port button on the drive could have been accidentally popped out); or because an alternate path is available. The re-try mechanism for Files-11 mounted disks is *Mount Verification*. The re-try mechanism for shadow set member disks is *Shadow Volume Processing*.

---

### 3.7.3 Mount Verification

When a Files-11 disk returns an availability error, the device is set to "Mount Verification In Progress", and the following steps occur:

- 1 User I/O operations to the device are stalled
- 2 A "PACKACK" I/O is issued to the disk
- 3 If the PACKACK can re-establish the connection to the disk through the original path or a new path, the volume valid bits are set, and the disk is potentially eligible to service I/Os again.

## TERMS AND CONCEPTS

- 4 If the PACKACK fails, it is re-issued until either it succeeds, or until the SYSGEN parameter MVTIMEOUT is reached. If the timeout is reached, no more re-tries are performed, stalled I/Os are returned with failure status, the message "mount verification aborted" is sent to OPCOM, and the device status is "Mount Verify Timed Out".
- 5 If the PACKACK succeeded, then the volume label is read from the disk, and compared to the label that was previously stored in memory. If the label is correct, the disk is returned to normal mounted status, the message "mount verification completed" is sent to OPCOM, and the stalled I/Os are resumed.

The SYSGEN parameter MVTIMEOUT is a system-wide dynamic parameter. Mount verification eligibility is set on a per-disk basis. Therefore, all disks that have mount verification enabled are subject to the same timeout period. Disks that do not have mount verification enabled, when they receive an availability error, go directly to "Mount Verify Timed Out" state.

---

### 3.7.3.1 Mount Verification for the Virtual Unit

Virtual units use mount verification for all membership state transitions, and therefore should never be mounted /NOMOUNT\_VERIFICATION.

---

### 3.7.3.2 Mount Verification for the Backing-Store Disk

When the backing-store disk is mounted Files-11 (as is the case for file-backed virtual disks), it is recommended that Mount Verification be disabled for that disk. The reason for this is that it is counter-productive to have multiple layers of retry logic occurring simultaneously. *Note: FOREIGN mounted disks are not subject to mount-verification.*

---

## 3.7.4 Shadow Volume Processing

Shadow Volume Processing is analogous to Mount Verification, but for shadow set members. Its timeout period is 20 seconds in VMS version 5.4, and is controlled by the SYSGEN parameter SHADOW\_MBR\_TMO in version 5.5 and above.

# 4

---

## COMMANDS

DiskMaker is made possible by the use of Virtual Disks. This chapter describes the commands that control virtual disks; for a discussion of virtual disk concepts, see Chapter 3.

---

### 4.1 Help Text

The DISKMAKER installation process adds the necessary help text to your system-help library. For online help, type the following command:

```
$ HELP DISKMAKER
```

This command displays the following information:

```
$ HELP DISKMAKER
```

```
DISKMAKER
```

```
The DISKMAKER for Volume Shadowing System, produced by
Advanced Systems Concepts, Inc., allows you to implement selective
and heterogeneous shadowing, by the use of virtual disks.
A virtual disk is a software generated and software
maintained representation of a disk device.
```

```
.
.
.
```

```
For more information concerning DISKMAKER, see the "DISKMAKER for
Volume Shadowing User's Guide".
```

```
Format:
```

```
DISKMAKER command/qualifiers virtual-disk-name
```

```
Additional information available:
```

```
ACTIVATE   DEACTIVATE LIST      MODIFY      MONITOR
virtual-disk-name      Release_notes
```

### 4.2 Maintaining Virtual Disks

---

DiskMaker Virtual Disks allow you to perform these operations:

- **Activate** a virtual disk
- **Deactivate** a virtual disk
- **List** active or known virtual disks
- **Modify** a virtual disk's characteristics
- **Monitor** a virtual disk

**Note:** DiskMaker utilizes technologies found in the VIRTUOSO product as well as specific DiskMaker facilities implemented within VIRTUOSO, but accessible only through the DiskMaker license.

## 4.3 **Activating a Virtual Disk**

---

Activating a virtual disk is in many ways similar to acquiring and installing a real hardware disk. You decide what your size requirements are (with a real disk you look in a catalogue, with a virtual disk you look for space for the backing-store); you set the unit number, make the disk known and available to the system; you then initialize, mount, populate, and use the device.

The `ACTIVATE` command specifies a series of characteristics, concerning a uniquely-named virtual disk, and makes that disk known to VMS. When you initially create a virtual disk, you must give it a unique name, consisting of up to thirty-one (31) characters in length, as well as a number of mandatory and/or optional qualifiers. `DISKMAKER` uses this name to associate a system-wide logical name with the disk's actual device name.

### 4.3.1 CREATING A NEW VIRTUAL DISK

To create a new virtual disk or to supercede the characteristics of a previously created disk, you would enter the /INITIALIZE=YES qualifier (the ACTIVATE qualifier /INITIALIZE=YES indicates that this is a NEW virtual disk definition; the backing store's contents are not modified).

While the ACTIVATE command has quite a few qualifiers, you can omit many, as all are not applicable to each disk. The table below shows which qualifiers you may use to activate a new virtual disk. Qualifiers in **bold face** are mandatory; those, *underlined and in italics* indicate a required choice among several qualifiers.

**Table 4-1 ACTIVATE Qualifiers for Activating a NEW Virtual Disk**

<b>BACKING_STORE</b>	DEVICE	<b>DISK</b>
ERASE	<u>GEOMETRY</u>	<b>INITIALIZE</b>
INTERLEAVE	LOG	MSCP_SERVE
OFFLINE	OPEN_ONLY	<u>SIZE</u>
START_POSITION	<u>TYPE</u>	<b>VOLSHAD</b>
WRTLCK		

### 4.3.2 ACTIVATING A KNOWN VIRTUAL DISK

To activate a previously created disk, you specify /INITIALIZE=NO or omit the qualifier entirely. Activating a known virtual disk is as simple as this:

```
$ DISKMAKER ACTIVATE virtual_disk_name
```

This command activates the virtual disk and makes it available to the system. You can specify several ACTIVATE qualifiers with the ACTIVATE command, depending upon the disk type. Any qualifiers you enter in this manner are temporary and are used only while the disk is currently activated. If you want these same qualifiers the next time you activate the disk, you must respecify them. Some characteristics may be permanently modified; see Section 4.5.

**Table 4–2 ACTIVATE Qualifiers for A Known Disk**

---

BACKING_STORE	DEVICE	LOG
MSCP_SERVE	OFFLINE	WRTLCK

---

## COMMANDS

### ACTIVATE

---

## ACTIVATE

This command activates a virtual disk.

---

### FORMAT

**DISKMAKER ACTIVATE/qualifiers** *virtual\_disk\_name*

---

Command Qualifiers	Defaults
/[NO]BACKING_STORE= <i>list</i>	/BACKING_STORE
/CONTIGUOUS	CONTIGUOUS
/CBT	None
/DEVICE= <i>device_name</i>	See text
/DISK	/DISK
/[NO]ERASE	/NOERASE
/GEOMETRY= <i>list</i>	See text
/INITIALIZE=YES NO IF	/INITIALIZE=NO
/INTERLEAVE= <i>value</i>	/INTERLEAVE=sectors/track
/LOG	None
/[NO]MSCP_SERVE	/MSCP_SERVE
/[NO]OFFLINE	None
/OPEN_ONLY	See text
/SIZE= <i>value</i>	See text
/START_POSITION= <i>keyword_list</i>	See text
/TYPE= <i>drive_type</i>	See text
/VOLSHAD	/VOLSHAD
/[NO]WRTLCK	None

---

**prompts**

Virtual Disk Name:            virtual\_disk\_name

---

**restrictions**

- File protection privileges are applied, when creating/opening file-backing stores.
- VOLPRO is required for a volume-backing store.

---

**PARAMETERS**

***virtual\_disk\_name***

This parameter specifies the name of the virtual disk you want to activate. This name can have up to thirty-one (31) characters and must be acceptable as a system-wide logical name. If the /INITIALIZE=YES qualifier is present, the supplied name overrides any previous use of same; if /INITIALIZE=NO, then the name is used to locate the virtual disk definition in the DISKMAKER permanent data base.

---

**DESCRIPTION**

Use this command to activate a virtual disk with the name and characteristics you want. There is no default virtual-disk name. Valid qualifiers for the ACTIVATE command depend upon the type of virtual disk that you specify. If you issue an ACTIVATE command on a virtual disk that is *already* active, an error occurs.

# COMMANDS

## ACTIVATE

---

### COMMAND QUALIFIERS

***/[NO]BACKING\_STORE=(dev/file\_spec,...)***  
***/BACKING\_STORE (default)***

This qualifier allows you to establish one or more backing stores for your virtual disk. The backing store is a nonvolatile representation of a virtual disk's contents. The following list shows the format to be specified for the supported backing-store types for DiskMaker virtual disks:

- A File:** device and directory
- B Volume:** device

DiskMaker allows one (1) backing store. DiskMaker with Striping<sup>1</sup> allows up to eight (8) backing stores. They must all be the same kind (one of the formats shown above). By default, a backing store is enabled and the following defaults applied:

```
current_device:[current_directory]VIRTUOSO_virt_disk_name.BACKING[_n]
```

File-backing stores are created, using the requestor's identifier and privileges. A file-backing store's default protection is this:

```
SYSTEM: RWED OWNER: RWED GROUP: RW WORLD: NONE
```

You can change this protection or set ACLs after the backing stores have been created.

Volume backing stores **must** be mounted foreign, system-wide, prior to activation. Remember, the label on a system-wide mount must not conflict with any other mounted disk (real or virtual) on the node or in the VMScluster.

---

<sup>1</sup> DiskMaker with Striping is available as a separately priced option

### ***/CONTIGUOUS***

This qualifier specifies that a file backing-store be created with the RMS contiguous option. May not be combined with /CBT.

### ***/CBT***

This qualifier specifies that a file backing-store be created with the RMS contiguous-best-try option. May not be combined with /CONTIGUOUS.

### ***/DEVICE=device\_name***

This qualifier is intended for use with disk-based virtual disks only. It indicates that the disk's backing stores are on VMSclusterable devices (like an HSC), which do not *require* MSCP serving. The purpose of this qualifier is to create a common clusterable device that is known on all nodes with a direct path. DISKMAKER does not allow you to specify a DEVICE, if your backing store are not local (MSCP-served by another OpenVMS node).

If specified, the device must take the form VDA $nnn$ , wherein  $nnn$  is a unique numeric value, acceptable as a device-unit number. By default DISKMAKER creates a unique device for each disk activation.

### ***/DISK***

#### ***/DISK (default)***

This qualifier indicate that the virtual disk is disk-based (as opposed to memory-based or RAM disk).

### ***/GEOMETRY=(cylinders,tracks,sectors)***

This qualifier allows you to define a specific geometry in cylinders, tracks, and sectors for the virtual disk. The list consists of three values in this order—cylinders, tracks, sectors. These specifications supercede the geometry, implied by the /TYPE qualifier. If you do not specify either the /TYPE or the /GEOMETRY qualifiers, by default the system determines the type and geometry of the virtual disk, depending upon its size and backing store.

### ***/INITIALIZE=YES | IF | NO***

#### ***/INITIALIZE=NO (default)***

This qualifier allows you to initialize virtual disks under the following conditions:

- Initialize a new or known—but not active—virtual disk
- Conditionally initialize a virtual disk, if it is not known to DISKMAKER
- Activate a known virtual disk

The qualifier, INITIALIZE=YES, creates a new virtual disk or supercedes an existing virtual disk. If it is *not* already known, the qualifier, INITIALIZE=IF, initializes a virtual disk. When conditionally initializing a disk, you must present all necessary qualifiers in the event the actual creation needs to take place. INITIALIZE=NO (the default) indicates that DISKMAKER recognizes the disk and will activate it. However, if the virtual disk is *not* known to DISKMAKER, an error occurs.

## COMMANDS

### ACTIVATE

#### ***/INTERLEAVE=value***

#### ***/INTERLEAVE=sectors/track (default)***

This qualifier allows you to specify the *width* of each stripe for striped-virtual disks. *Value* represents the number of sectors that are to be used when decomposing an I/O request. You can only specify the */INTERLEAVE* qualifier, if you have more than one backing store. By default the system uses the sectors' per-track value from the disk's geometry. ASCII recommends that you use the one (1) track value as tests have shown that it works best for most applications. This qualifier is available only when DiskMaker with Striping has been licensed.

#### ***/LOG***

This qualifier allows you to specify that DISKMAKER display all success messages to SYSS\$OUTPUT. By default the system displays only warning, error, and fatal messages.

#### ***/[NO]MSCP\_SERVE***

#### ***/MSCP\_SERVE (default)***

This qualifier allows you to enable or disable the virtual disk as MSCP-server capable. By default all disks are capable of being MSCP-served.

#### ***/OPEN\_ONLY***

When used with the */INITIALIZE=YES* option, this qualifier (relevant only to file-backed virtual disks) prevents DISKMAKER from creating a new version of the disk's backing stores. When this command is used, DISKMAKER opens the file and performs checks to ensure that the size and contiguity characteristics are correct. This qualifier is used whenever you require a new virtual disk use the backing-store (and data) of a previously existing virtual disk.

#### ***/SIZE=value***

This qualifier allows you to define the size of the virtual disk. The *value* consists of the number of usable blocks on the disk. DISKMAKER rounds out the size of the virtual disk, down to the nearest cylinder boundary, if necessary. By default DISKMAKER calculates the size by using the */TYPE* and */GEOMETRY* qualifiers in conjunction with any backing store(s) specified. There *is* no default size.

**Note:** You only need to specify one of three parameters—*/SIZE*, */GEOMETRY*, or */TYPE*. DISKMAKER stores valid types, their configurations, and their sizes in a table. When */TYPE* is used, DISKMAKER then refers to this table to calculate the remaining information. See Table 3-1.

***/START\_POSITION=(keyword,...)***

This qualifier allows you to control the starting position of a backing store on the real-disk device. It applies to virtual disks, using local files or volumes. The valid *keywords* are, as follows:

- EXACT\_LBN=lbn
- EXACT\_CYL=cylinder
- APROX\_LBN=lbn
- APROX\_CYL=cylinder
- CYL
- ANY

Each keyword/value in the list corresponds to the backing store, you specified in the value list for the /BACKING\_STORE qualifier. If you specify an exact LBN or an exact cylinder, DISKMAKER attempts to locate the backing store *exactly* on the requested LBN or cylinder. However, if DISKMAKER cannot obtain the exact position, the ACTIVATE command fails.

If you specify an approximate LBN or cylinder number, DISKMAKER attempts to locate the backing store as closely as possible to the requested LBN or cylinder. If the backing store is allocated anywhere on the requested device, the ACTIVATE command succeeds.

If you simply specify cylinder (CYL), DISKMAKER attempts to position the backing store on *any cylinder boundary*. Only when no cylinder boundaries are available, does it fail.

When you specify *ANY*, DISKMAKER attempts to position the backing store on *any* available LBN on the disk.

Volume-backing stores are limited to using the EXACT\_LBN keyword since the term, *approximate*, is a files-oriented concept. By default file-backing stores use the keyword, ANY, and volume-backing stores use the keyword, EXACT\_LBN=0.

# COMMANDS

## ACTIVATE

### ***/TYPE=drive\_type***

This qualifier allows you to specify the *drive\_type* from a list of known disk devices. If neither size or geometry is specified, type defines both. For a list of all the available drive types for DISKMAKER, see the Table 3-1. By default DISKMAKER selects a drive type, based either upon the size of the virtual disk or its backing stores.

### ***/VOLSHAD***

### ***/VOLSHAD (default)***

This qualifier indicates that the virtual disk is to be used as an OpenVMS Volume Shadowing member.

### ***/[NO]WRTLCK***

This qualifier allows you to simulate a write-locked disk. By default error simulation is not enabled.

---

## EXAMPLES

**1**    \$ DISKMAKER ACTIVATE VIR81/INITIALIZE=YES/DISK-  
      \_ \$ /TYPE=RA81/BACK=\$1\$DIA7:[VT]/DEVICE=VDA100:/VOLSHAD

This example shows how to create a file-backed virtual disk. The virtual disk will have the size and geometry of a RA81. A RA81-sized, contiguous file will be created (\$1\$DIA7:[VT]VIRTUOSO\_VIR81.BACKING).

**2**    \$ DISKMAKER ACTIVATE VIR31/INITIALIZE=YES/DISK-  
      \_ \$ /TYPE=RF31/BACK=\$1\$DUA5:/DEVICE=VDA500:/VOLSHAD

This example shows how to create a volume-backed virtual disk. The virtual disk will have the size and geometry of a RF31, backed on the foreign mounted \$1\$DUA5:.

## 4.4 Deactivating a Virtual Disk

---

To place an active-virtual disk in an inactive state and/or remove a known virtual disk from the permanent database, use the DEACTIVATE command. You can only deactivate a disk that has been dismounted and has a reference count of zero.

When you deactivate a disk, the virtual-disk device disappears from the system, and the virtual-disk's logical name is de-assigned. An MSCP-served disk, however, retains its UCB, although the resources to which it had claim are returned to VMS.

The virtual disk may be re-activated, with the same data and characteristics, by the "DISKMAKER ACTIVATE virtual-disk-name" command.

# COMMANDS

## DEACTIVATE

---

## DEACTIVATE

This command deactivates an active remote disk.

---

**FORMAT**                    **DISKMAKER DEACTIVATE/qualifier**    *virtual\_disk\_name*

---

Command Qualifiers	Defaults
<i>/LOG</i>	<i>None</i>
<i>/PERMANENT</i>	<i>None</i>

---

**prompts**                    Virtual Disk Name:                    *virtual\_disk\_name*

---

**PARAMETERS**    *virtual\_disk\_name*  
This parameter specifies the name of the virtual disk you want to deactivate.

---

**DESCRIPTION**    Use this command to place an active virtual disk in an inactive state and/or delete a known virtual disk from the VIRTUOSO permanent database.

---

**COMMAND QUALIFIERS**    ***/LOG***  
This qualifier allows you to specify that DiskMaker display all success messages to SYSS\$OUTPUT. By default the system displays only warning, error, and fatal messages.

***/PERMANENT***  
This qualifier allows you to specify that DiskMaker remove the virtual-disk information from the permanent DiskMaker database. By default DiskMaker saves information, concerning a remote disk, for subsequent activations.

---

## EXAMPLES

**1**    \$ DISKMAKER DEACTIVATE MYDISK\_1

This example deactivates the specified virtual disk, MYDISK\_1.

**2**    \$ DISKMAKER DEACTIVATE MYDISK\_2 /PERMANENT

This example deactivates the specified virtual disk, MYDISK\_2, and removes the record(s) of the disk from the permanent database.

---

## 4.5 Modifying a Virtual Disk

The MODIFY command changes certain characteristics of a virtual disk. Volatile changes affect the current incarnation of an active virtual disk, and are not saved. Permanent changes take effect only with a subsequent re-activation. To change characteristics that MODIFY does not support, re-define the virtual disk with a "DISKMAKER ACTIVATE/INIT=YES ..." command.

# COMMANDS

## MODIFY

---

# MODIFY

This command changes the characteristics of your virtual disk.

---

## FORMAT

**DISKMAKER MODIFY/qualifiers** *virtual\_disk\_name*

---

Command Qualifiers	Defaults
<i>/BACKING_STORE=list</i>	<i>None</i>
<i>/LOG</i>	<i>None</i>
<i>/[NO]OFFLINE</i>	<i>See text</i>
<i>/[NO]PERMANENT</i>	<i>/VOLATILE</i>
<i>/[NO]VOLATILE</i>	<i>/VOLATILE</i>
<i>/[NO]WRTLCK</i>	<i>See text</i>

---

## prompts

Virtual Disk Name: *virtual\_disk\_name*

---

## PARAMETERS

***virtual\_disk\_name***

This parameter specifies the name of a known virtual disk that you want to modify.

---

## DESCRIPTION

Use this command to change the characteristics of a virtual disk. To change other characteristics, not available via the MODIFY command, you need to deactivate and reactivate your virtual disk.

---

**COMMAND  
QUALIFIERS**

***/BACKING\_STORE=(dev/file\_spec,...)***

This qualifier allows you to change the backing store specification for an inactive virtual disk. The new backing store will be open/used at the next activation. This qualifier is only valid when used with the /PERMANENT qualifier. The backing store(s) characteristics and size must remain the same.

***/LOG***

This qualifier allows you to specify that DISKMAKER display all success messages to SYS\$OUTPUT. By default the system displays only warning, error, and fatal messages.

---

**EXAMPLES**

**1** \$ DISKMAKER MODIFY TEST\_DISK /OFFLINE

This example sets offline-error simulation for the active virtual disk, TEST\_DISK.

**2** \$ DISKMAKER MODIFY USER1 /BACK=\$1\$DIA8: [VT]/PERM

This example changes the backing store that will be used by virtual disk USER1 at next activation.

## 4.6 Listing Virtual Disk Information

---

The DISKMAKER LIST command allows you to list one or more virtual disks' characteristics and performance metrics. Since DISKMAKER maintains a nonvolatile (permanent) and volatile (active) database, you can use LIST to display active, as well as known (but inactive) virtual disks.

The information that you can list is categorized, as follows:

**Table 4–3 Groups of Virtual-Disk Information**

---

BRIEF information	Lists the virtual-disk name, the VMS-device name, size and options
STATIC information	Lists various characteristics, concerning the disk, stored in the nonvolatile database—including geometry, size, device type, etc.
I/O information	Lists performance metrics, concerning I/O activity—including a breakdown by backing store

---

With the exception of BRIEF (which is always listed), you can choose one or more groups on which to report. The /FULL qualifier obtains information from all applicable groups.

## 4.6.1 An Annotated Full Listing

### Example 4-1 Example of a Full Listing

---

```

DISKMAKER V021-000 for OpenVMS on node VAXA 24-MAR-1993 10:49:36.90
Copyright © 1989 by Advanced Systems Concepts, Inc. All Rights Reserved
Licensed to ASCII-INTERNAL
Virtual Disk: FS1 [$1$VDA101: (VAXA)] 1
Type: File 2 Options: Contig,Share,Servable,VolShdl 3

--- Characteristics ---
Size                325500 4 Cylinders/disk          310 7
Device Type         RD54 5 Tracks/cylinder           21 8
Number of Backing Stores 1 6 Sectors/track          50 9

--- Backing Store Information ---

Specification                               Start      Alignment
Position                                     Option
DISK$D4:[VT]VIRTUOSO_FS1.BACKING;1 10         1149120 11 EXACT LBN 12

--- I/O Performance Statistics ---
Read I/O Count          73738 13 Write I/O Count          31083 15
Unaligned Reads         9020 14 Unaligned Writes         4851 16

```

---

#### 1 Virtual Disk: The complete DISKMAKER and VMS device names

If an allocation class is present, the local system is displayed as its controller. If the disk is inactive (as part of a permanent database list), the word "Inactive" is prefixed.

#### 2 Type

The type is one of these: File, Volume

#### 3 Options

You can have one or more of these:

**Table 4–4 Virtual Disk Options**

Option	Description
Contig	The backing stores are contiguous.
Offline	Device uses offline error simulation.
[Non]Servable	Device is/is not MSCP-server capable.
[No]Share	Device is/is not direct-path clusterable.
Wrtlck	Device use write-lock-error simulation.
Volshadn	Device supports OpenVMS Volume Shadowing.

4 Size of disk (in blocks)

5 Device type (a VMS Digital model)

6 Number of backing stores

7 Cylinders/disk (number of cylinders)

8 Tracks/Cylinder

9 Sectors/Track

10 Specification

This field provides the file specification for each backing store, associated with the virtual disk.

11 Start Position

This value represents the actual starting LBN of the file or volume for all backing stores (except network). A value of "n/a" means not available or not applicable.

12 Alignment Option

For an active contiguous-file or volume disk the option is always EXACT LBN.

13 Read I/O Count

14 Unaligned Reads (user's buffer is not page aligned)

15 Write I/O Count

16 Unaligned Writes (user's buffer is not page aligned)

---

## LIST

This command displays information concerning virtual disk(s).

---

**FORMAT**            **DISKMAKER LIST/qualifiers** *[virtual\_disk\_name]*

---

Command Qualifiers	Defaults
<i>/FULL</i>	<i>See text</i>
<i>/IO</i>	<i>See text</i>
<i>/OUTPUT[=file_spec]</i>	<i>/OUTPUT=SYS\$OUTPUT</i>
<i>/PERMANENT</i>	<i>/VOLATILE</i>
<i>/STATIC</i>	<i>See text</i>
<i>/VOLATILE</i>	<i>/VOLATILE</i>

---

**PARAMETERS**    *virtual\_disk\_name*

This optional parameter specifies the name of a virtual disk about which you want to list information. If omitted, all virtual disks are displayed.

---

**DESCRIPTION**    Use this command to view information, concerning one or all virtual disks that are either active or known.

---

**COMMAND  
QUALIFIERS**

***/FULL***

This qualifier allows you to receive a listing of all groups of information available for a virtual device, both static as well as dynamic, in addition to the one-line-default listing.

***/IO***

This qualifier allows you to request a listing of I/O-count information. If you have specified striping, the LIST facility also shows the I/O counts and percentages for each backing store.

***/OUTPUT[=file\_spec]***

***/OUTPUT=SYS\$OUTPUT (default)***

This qualifier allows you to specify a file as the destination of the listed data. You can specify your own filename, represented by the file specification or depend upon the default file, SYS\$OUTPUT.

# COMMANDS

## LIST

### ***/PERMANENT***

### ***/VOLATILE (default)***

This qualifier lists virtual-disk data from the permanent database. You cannot specify the */PERMANENT* qualifier on the same command line with the */VOLATILE* qualifier. If you do not specify either qualifier, by default DISKMAKER lists data from the volatile database.

### ***/STATIC***

This qualifier allows you to request a listing of the static characteristics of a virtual disk.

### ***/VOLATILE***

### ***/VOLATILE (default)***

This qualifier allows you to specify that the LIST command read virtual-disk data from the volatile database. You cannot specify the */VOLATILE* qualifier on the same command line with the */PERMANENT* qualifier. If you do not specify either qualifier, by default DISKMAKER lists data from the volatile database.

---

## EXAMPLES

### **1** \$ DISKMAKER LIST

```
DISKMAKER V021-000 for OpenVMS on node VAXA 24-MAR-1993 11:05:14.46
Copyright © 1989 by Advanced Systems Concepts, Inc. All Rights Reserved
Licensed to ASCI-INTERNAL
Virtual Disk Name          Type      State      Size      Options
FS1 [$1$VDA101: (VAXA)]   File      Active     325500    Contig,Share,
                          Servable,VolShd1
FS2 [$1$VDA102: (VAXA)]   File      Active     325500    Contig,Share,
                          Servable,VolShd1
```

This example shows a brief listing for each virtual disk.

### **2** \$ DISKMAKER LIST/IO

```
DISKMAKER V021-000 for OpenVMS on node VAXA 24-MAR-1993 11:05:25.24
Copyright © 1989 by Advanced Systems Concepts, Inc. All Rights Reserved
Licensed to ASCI-INTERNAL
Virtual Disk: FS1 [$1$VDA101: (VAXA)]
Type: File          Options: Contig,Share,Servable,VolShd1
--- I/O Performance Statistics ---
Read I/O Count      76911          Write I/O Count    33084
Unaligned Reads     9812           Unaligned Writes   5820
```

This example shows an I/O listing for virtual disk FS1.

# 5

---

## CLUSTER CONSIDERATIONS

---

### 5.1 Virtual Disks in a VMScLuster

DiskMaker fully supports VMScLuster operations. Multiple nodes can use and access all virtual disks. You might decide to prevent this, and DiskMaker allows you this choice.

#### 5.1.1 Local Only Versus Clusterable

Devices in a VMScLuster system can be divided into two categories: Local only and Clusterable. A *Local only* device means that only a single node has a direct path, and that other nodes requiring access can only do so via MSCP-serving. Figure 5-1 illustrates this. A *Clusterable* device means that multiple nodes have a direct physical path. Figure 5-2 depicts this. A direct path is defined as one *not* having another OpenVMS node service its I/O requests. Disk drives on an HSC are considered clusterable devices, since each node can access the HSC disks directly without requiring another node's assistance. An RM05-disk drive, connected through a MASSbus, on the other hand, is considered a local device, since only one node can access the device.

A virtual disk takes its local-only or clusterable characteristic from the underlying backing-store disk.

# CLUSTER CONSIDERATIONS

Figure 5-1 Local Only Virtual-Disk Device, MSCP-served

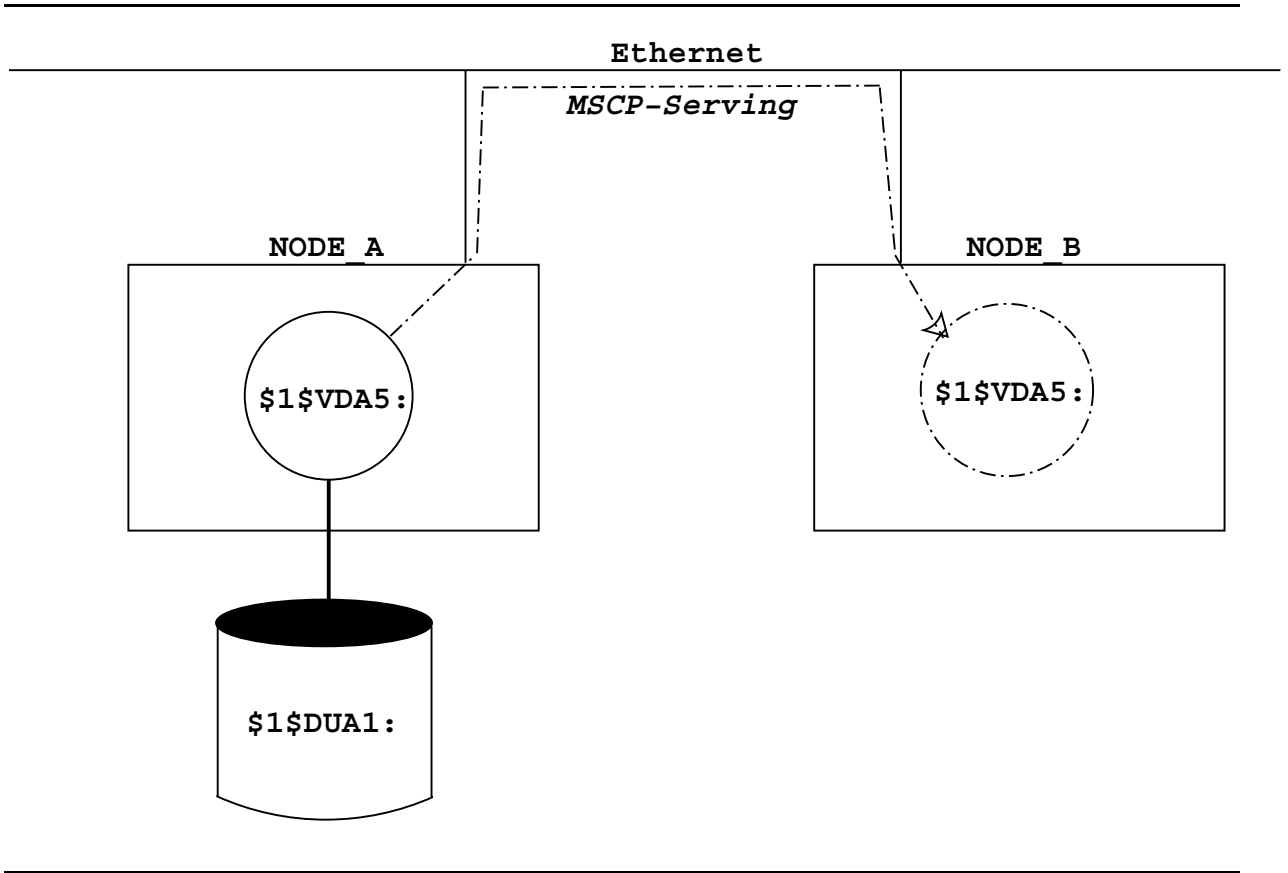
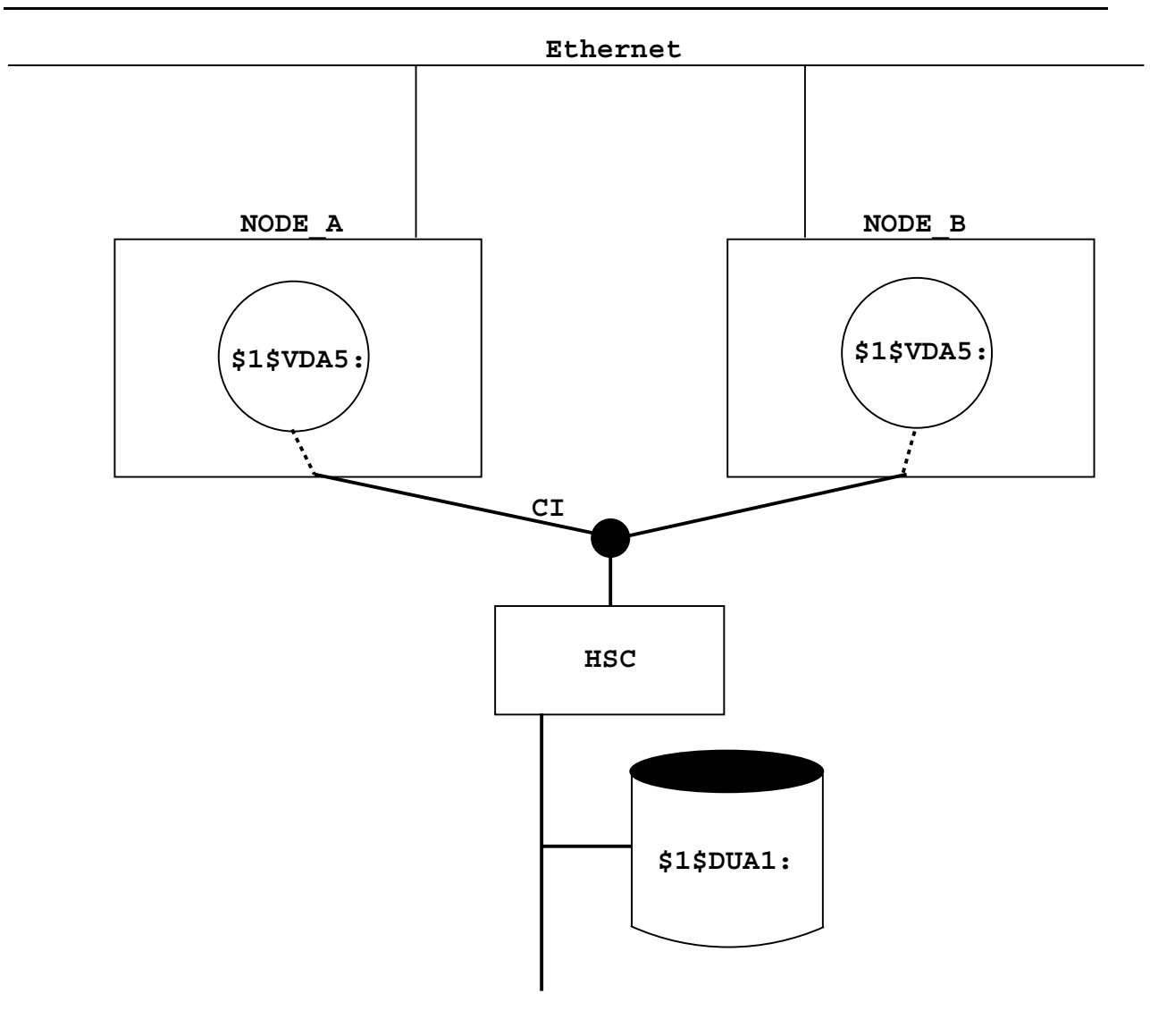


Figure 5–2 Clusterable Virtual-Disk Device, Physically Shared



VMS does allow you to access and share *local-only* devices on a VMScluster through the MSCP-server facility. This facility makes the local device appear on other nodes in the cluster. However, when the nonlocal node issues an I/O request to an MSCP-served disk, the local system must actually handle the request. Depending upon your usage, this can have a severe impact on the local, as well as on the remote, system. In other words the local (serving) system can become a bottleneck.

DiskMaker supports both *local only* MSCP-served and direct *clusterable* devices. If one or more backing store(s) for a virtual disk are on a clusterable device, you should elect to have your virtual disks **directly** clusterable, as well.

## CLUSTER CONSIDERATIONS

If your backing store is on a *local only* device, you can elect to use the MSCP-server feature for your virtual disks.

### 5.1.2 MSCP-Served Virtual Disks

By default DiskMaker creates *Local only* devices, capable of being MSCP-served. If you don't want this device to be MSCP-served, simply specify `/NOMSCP_SERVE`, when you activate the device.<sup>1</sup> Once the device is activated, if you decide to enable MSCP serving, you must deactivate and then reactivate the device.

A servable device becomes served either by issuing the "`$ SET DEVICE SERVED`" command, or automatically by the `CONFIGURE` process if the `SYSGEN` parameter `MSCP_SERVE_ALL` is set.

### 5.1.3 Direct-Path Shared Virtual Disks

If your backing store(s) are on HSC- or DSSI-connected devices, you can have DiskMaker establish direct paths for your virtual disks. Normally, DiskMaker assigns a unique VMS-device name to your disk, when it activates the disk. Since a common clusterable device has the same VMS-device name on all nodes in the cluster, you need to assign your disk a specific DiskMaker-device name. You do this by using the `/DEVICE` qualifier. On all nodes that have a direct path to the disk, you must specify the same DiskMaker-device name (for example, `VDA100:`). Internally, DiskMaker assigns the virtual device the same *allocation class* as your backing store. If the allocation class is one (1), this would mean a full device name of `$1$VDA100:`. All nodes accessing that disk would use the same device name. Of course, systems on which DiskMaker is running would have used the *virtual-disk-name* logical, when accessing the device. If your backing store(s) are on MSCP-served disks (such as, those not having a direct path) and you specify `/DEVICE`, DiskMaker returns an error.

DiskMaker ensures that only clusterable devices can be shared by a direct path. If another system attempts to access a *local only* virtual disk directly, DiskMaker produces a *not-shareable* error. Local only disks can be MSCP-served only within a cluster. Direct-path clusterable disks can also be MSCP-served just like HSC disks. The `SYSGEN` parameters, `MSCP_LOAD` and `MSCP_SERVE_ALL`, indicate, whether to load the MSCP server and what type of automatic serving to initiate. If your system does not perform automatic-disk serving, then you must use the `DCL SET DEVICE/SERVED` command.

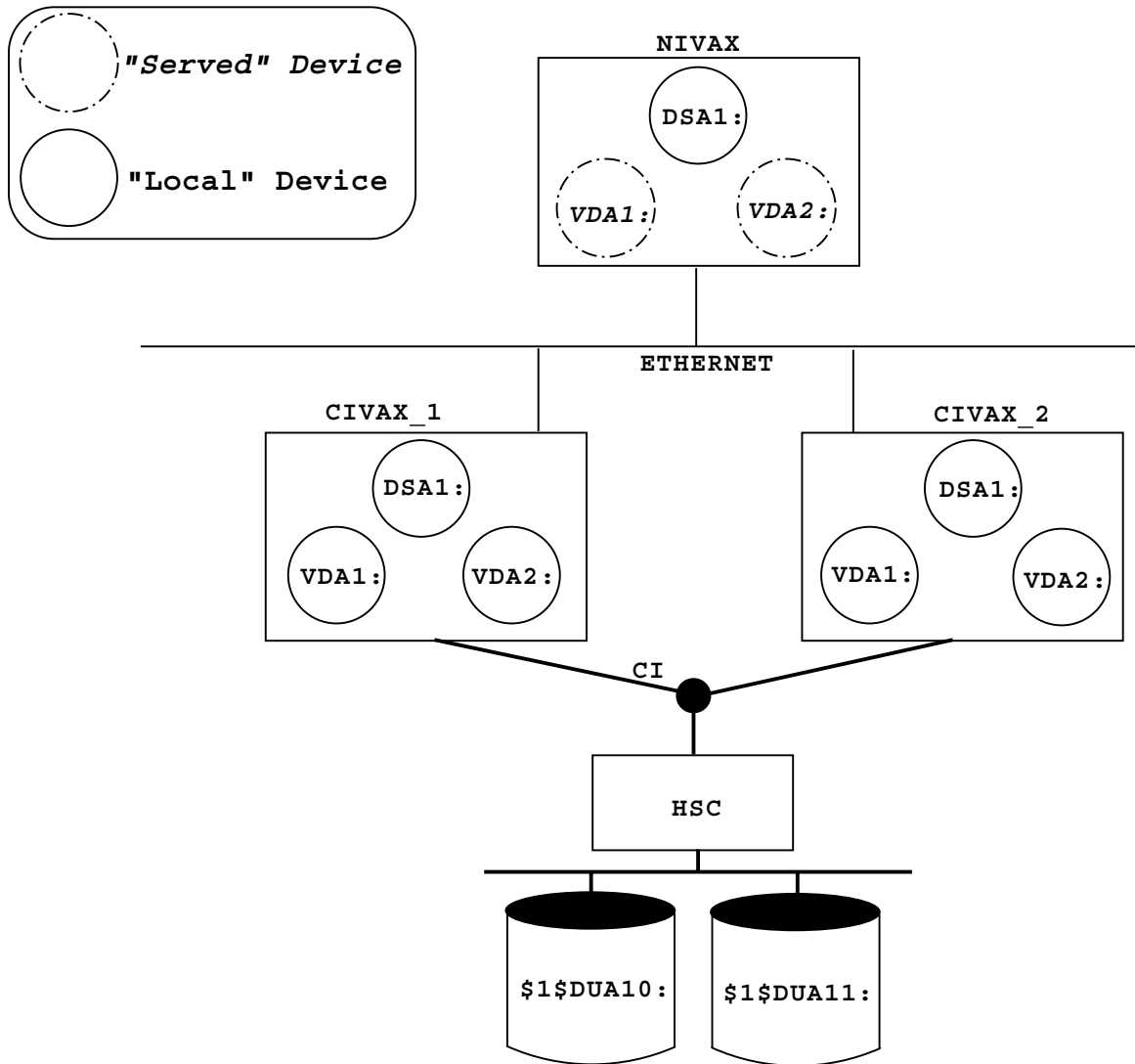
Direct-path virtual disks exhibit much better performance characteristics than disks that are MSCP-served. In addition Direct-path virtual disks achieve greater reliability, since a failure of the serving node won't deny you access to the disk.

<sup>1</sup> A `SHOW DEVICE/FULL` command indicates that the device is served through MSCP, but a `SHOW DEVICE/SERVED` indicates no MSCP knowledge of the device.

## 5.2 Volume Shadowing in a VMScuser

Volume Shadowing Virtual Units (DSAnnn: devices) are not servable. Each node that needs to access the shadow set must mount the virtual unit; to do so each node must have either direct access to the member drives, or the member drives must be served to the node. In Figure 5-3, the configuration illustrates the used of both serving and sharing for shadowing in a mixed VMScuser.

Figure 5-3 Clusterable Virtual-Disk Device



# 6

---

## SAMPLE APPLICATIONS

This chapter contains actual, interactive examples of DiskMaker usage, showing commands and resulting output. The following scenarios are included:

- 1 Selective shadowing: startup,usage,shutdown (see Section 6.1)
- 2 Heterogeneous shadowing: startup,usage,shutdown (see Section 6.2)
- 3 Removing and adding shadow set members (see Section 6.3)
- 4 Failure and recovery of a shadow set member (see Section 6.4)
- 5 Usage in a VMSccluster (see Section 6.5)
- 6 Usage with Digital's Disk Striping product (see Section 6.6)

Please note that, where appropriate, OPCOM messages are shown.

## 6.1 Selective Shadowing

This example show *selective shadowing*, i.e. a shadow set comprised of all virtual disk members. In this example, the virtual disks use *file backing-stores*, located on Files-11 mounted drives. A copy of this procedure can be found in `diskmaker_device:[DISKMAKER.EXAMPLES]DISKMAKER_SELECTIVE.COM`.

### Example 6-1 Selective Shadowing

```

$
$ SET DEVICE/NOMOUNT_VERIFICATION $1$DIA4: [Return]
$ SET DEVICE/NOMOUNT_VERIFICATION $1$DIA7: [Return]
$
$ DISKMAKER ACTIVATE DM1 /INITIALIZE=YES /DISK /DEVICE=VDA101: - [Return]
_ $ /VOLSHAD /GEOMETRY=(310,21,50) /BACKING=$1$DIA4:[VT] /LOG [Return]
%RUN-S-PROC_ID, identification of created process is 20C002F9
%VIRTUOSO-S-ACTVSUCC, virtual disk DM1 (_$1$VDA101:) activated
-SYSTEM-S-NORMAL, normal successful completion
$
$ DISKMAKER ACTIVATE DM2 /INITIALIZE=YES /DISK /DEVICE=VDA102: - [Return]
_ $ /VOLSHAD /GEOMETRY=(310,21,50) /BACKING=$1$DIA7:[VT] /LOG [Return]
%RUN-S-PROC_ID, identification of created process is 20C002FB
%VIRTUOSO-S-ACTVSUCC, virtual disk DM2 (_$1$VDA102:) activated
-SYSTEM-S-NORMAL, normal successful completion
$
$ DISKMAKER LIST [Return]
DISKMAKER V021-000 for OpenVMS on node VAXA 31-MAR-1993 10:41:38.73
Copyright © 1989 by Advanced Systems Concepts, Inc. All Rights Reserved
Licensed to ASCI-INTERNAL

Virtual Disk Name          Type          State          Size          Options
DM1 [$1$VDA101: (VAXA)]   File          Active          325500        Contig,Share,
                          Servable,VolShd1
DM2 [$1$VDA102: (VAXA)]   File          Active          325500        Contig,Share,
                          Servable,VolShd1

$
$ DISKMAKER LIST/FULL [Return]
DISKMAKER V021-000 for OpenVMS on node VAXA 31-MAR-1993 10:41:46.19
Copyright © 1989 by Advanced Systems Concepts, Inc. All Rights Reserved
Licensed to ASCI-INTERNAL

Virtual Disk: DM1 [$1$VDA101: (VAXA)]
Type: File          Options: Contig,Share,Servable,VolShd1

          --- Characteristics ---

Size              325500      Cylinders/disk          310
Device Type       RD54        Tracks/cylinder         21
Number of Backing Stores 1          Sectors/track          50

          --- Backing Store Information ---

Specification                               Start      Alignment
Position                                     Option
DISK$D4:[VT]VIRTUOSO_DM1.BACKING;1         1149120    EXACT LBN

          --- I/O Performance Statistics ---

Read I/O Count      0          Write I/O Count         0
Unaligned Reads     0          Unaligned Writes        0
    
```

Example 6-1 Cont'd on next page

**Example 6-1 (Cont.) Selective Shadowing**

```

-----
Virtual Disk: DM2 [$1$VDA102: (VAXA)]
Type: File          Options: Contig,Share,Servable,VolShd1

          --- Characteristics ---
Size                325500   Cylinders/disk           310
Device Type        RD54     Tracks/cylinder          21
Number of Backing Stores 1     Sectors/track            50

          --- Backing Store Information ---

Specification                               Start   Alignment
Disk$D7: [VT]VIRTUOSO_DM2.BACKING;1         Position Option
                                                626688 EXACT LBN

          --- I/O Performance Statistics ---

Read I/O Count      0           Write I/O Count          0
Unaligned Reads     0           Unaligned Writes         0

$ SHOW DEVICE VD Return

Device              Device      Error   Volume   Free  Trans Mnt
Name                Status     Count   Label    Blocks Count Cnt
$1$VDA0:            (VAXA)    Offline 0
$1$VDA101:          (VAXA)    Online  0
$1$VDA102:          (VAXA)    Online  0
$
$ SHOW DEVICE VDA101:/FULL Return

Disk $1$VDA101: (VAXA), device type RD54, is online, file-oriented device,
shareable, served to cluster via MSCP Server.

Error count          0   Operations completed          0
Owner process        ""   Owner UIC                      [0,0]
Owner process ID     00000000   Dev Prot   S:RWED,O:RWED,G:RWED,W:RWED
Reference count      0   Default buffer size           512
Total blocks         325500   Sectors per track              50
Total cylinders      310   Tracks per cylinder            21
Allocation class     1

$
$ SHOW DEVICE VDA102:/FULL Return

Disk $1$VDA102: (VAXA), device type RD54, is online, file-oriented device,
shareable, served to cluster via MSCP Server.

Error count          0   Operations completed          0
Owner process        ""   Owner UIC                      [0,0]
Owner process ID     00000000   Dev Prot   S:RWED,O:RWED,G:RWED,W:RWED
Reference count      0   Default buffer size           512
Total blocks         325500   Sectors per track              50
Total cylinders      310   Tracks per cylinder            21
Allocation class     1

```

**Example 6-1 Cont'd on next page**

# SAMPLE APPLICATIONS

## Example 6-1 (Cont.) Selective Shadowing

---

```
$
$ INITIALIZE DM1 USER_DATA [Return]
$ INITIALIZE DM2 USER_DATA [Return]
$
$ REPLY/ENABLE [Return]
%%%%%%%% OPCOM 31-MAR-1993 10:44:23.75 %%%%%%%%%
Operator _VAXA$RTA1: has been enabled, username TESTER
$
$ MOUNT/SYSTEM DSA100:/SHADOW=(DM1,DM2) USER_DATA [Return]
%MOUNT-I-MOUNTED, USER_DATA mounted on _DSA100:
%%%%%%%% OPCOM 31-MAR-1993 10:44:34.37 %%%%%%%%%
Message from user SYSTEM on VAXA
%SHADOW_SERVER-I-SSRVINIFCPY,
initiating full copy sequence 7341551 on device _DSA100: at LBN 0,
I/O size: 125 blocks

%MOUNT-I-SHDWMEMSUC, _$1$VDA101: (VAXA) is now a valid member of the shadow set
%MOUNT-I-SHDWMEMCOPY, _$1$VDA102: (VAXA) added to the shadow set with a copy operation
$
$ SHOW DEVICE DSA100: [Return]

Device          Device          Error    Volume      Free  Trans  Mnt
Name            Status          Count    Label       Blocks Count Cnt
DSA100:         Mounted         0        USER_DATA  325428  1  1
$1$VDA101:     (VAXA) ShadowSetMember  0        (member of DSA100:)
$1$VDA102:     (VAXA) ShadowCopying  0        (copy trgt DSA100:  3% copied)
$
$ CREATE/DIRECTORY/LOG DSA100:[USER_1] [Return]
%CREATE-I-CREATED, DSA100:[USER_1] created
$
$ COPY $1$DIA3:[TESTER.WRK]*.* DSA100:[USER_1] [Return]
$
$ DIRECTORY/TOTAL DSA100:[USER_1] [Return]

Directory DSA100:[USER_1]

Total of 44 files.
$
$ SHOW DEVICE DSA100: [Return]

Device          Device          Error    Volume      Free  Trans  Mnt
Name            Status          Count    Label       Blocks Count Cnt
DSA100:         Mounted         0        USER_DATA  323700  1  1
$1$VDA101:     (VAXA) ShadowSetMember  0        (member of DSA100:)
$1$VDA102:     (VAXA) ShadowCopying  0        (copy trgt DSA100:  73% copied)
$
$
%%%%%%%% OPCOM 31-MAR-1993 10:49:38.53 %%%%%%%%%
Message from user SYSTEM on VAXA
%SHADOW_SERVER-I-SSRVNORMAL, successful copy completion of sequence 7341551
on device _DSA100:
%%%%%%%% OPCOM 31-MAR-1993 10:49:38.66 %%%%%%%%%
DSA100: all shadow set copy operations are completed.
%%%%%%%% OPCOM 31-MAR-1993 10:50:28.59 %%%%%%%%%
$
$ SHOW DEVICE DSA100: [Return]
```

---

Example 6-1 Cont'd on next page

**Example 6-1 (Cont.) Selective Shadowing**

```

Device          Device          Error   Volume      Free  Trans  Mnt
  Name          Status          Count   Label        Blocks Count  Cnt
DSA100:         Mounted         0      USER_DATA   323700    1    1
$1$VDA101:     (VAXA) ShadowSetMember  0      (member of DSA100:)
$1$VDA102:     (VAXA) ShadowSetMember  0      (member of DSA100:)
$
$ DISMOUNT DSA100: Return
%%%%%%%%%% OPCOM 31-MAR-1993 10:52:26.57 %%%%%%%%%%%
$1$VDA101: (VAXA) has been removed from shadow set.
%%%%%%%%%% OPCOM 31-MAR-1993 10:52:26.58 %%%%%%%%%%%
$1$VDA102: (VAXA) has been removed from shadow set.
$
$ SHOW DEVICE DSA100: Return

Device          Device          Error   Volume      Free  Trans  Mnt
  Name          Status          Count   Label        Blocks Count  Cnt
DSA100:         Online         0
$
$ SHOW DEVICE VD Return

Device          Device          Error   Volume      Free  Trans  Mnt
  Name          Status          Count   Label        Blocks Count  Cnt
$1$VDA0:       (VAXA) Offline    0
$1$VDA101:     (VAXA) Online    0
$1$VDA102:     (VAXA) Online    0
$
$ MOUNT DM1 USER_DATA Return
%MOUNT-W-VOLSHDWMEM, mounting a shadow set member volume; volume write locked
%MOUNT-I-MOUNTED, USER_DATA mounted on _$1$VDA101: (VAXA)
$
$ MOUNT DM2 USER_DATA Return
%MOUNT-W-VOLSHDWMEM, mounting a shadow set member volume; volume write locked
%MOUNT-I-MOUNTED, USER_DATA mounted on _$1$VDA102: (VAXA)
$
$ BACKUP/COMPARE/IMAGE DM1 DM2 Return
$ SHOW SYM $STATUS
$STATUS == "%X10000001"
$
$ DISMOUNT/NOUNLOAD DM1 Return
$ DISMOUNT/NOUNLOAD DM2 Return
$
$ MOUNT/FOREIGN DM1 USER_DATA Return
%MOUNT-W-VOLSHDWMEM, mounting a shadow set member volume; volume write locked
%MOUNT-I-MOUNTED, USER_DATA mounted on _$1$VDA101: (VAXA)
$
$ MOUNT/FOREIGN DM2 USER_DATA Return
%MOUNT-W-VOLSHDWMEM, mounting a shadow set member volume; volume write locked
%MOUNT-I-MOUNTED, USER_DATA mounted on _$1$VDA102: (VAXA)
$
$ MOUNT/FOREIGN DM2 USER_DATA Return
$ MOUNT/FOREIGN DM1 USER_DATA Return
$
$ BACKUP/COMPARE/PHYSICAL DM1 DM2 Return
$ SHOW SYMBOL $STATUS Return
$STATUS == "%X10000001"
$
$ SHOW DEVICE VD Return

```

**Example 6-1 Cont'd on next page**

# SAMPLE APPLICATIONS

## Example 6-1 (Cont.) Selective Shadowing

---

```
Device          Device      Error   Volume   Free  Trans  Mnt
  Name          Status     Count   Label    Blocks Count  Cnt
$1$VDA0:        (VAXA)    Offline      0
$1$VDA101:      (VAXA)    Mounted alloc  0  USER_DATA    0    1    1
                foreign wrtlck
$1$VDA102:      (VAXA)    Mounted alloc  0  USER_DATA    0    1    1
                foreign wrtlck

$
$ DISMOUNT/NOUNLOAD DM2 
$ DISMOUNT/NOUNLOAD DM1 
$
$ MOUNT/SYSTEM DSA100:/SHADOW=(DM1,DM2) USER_DATA 
%MOUNT-I-MOUNTED, USER_DATA mounted on _DSA100:
%MOUNT-I-SHDWMEMSUCC, _$1$VDA101: (VAXA) is now a valid member of the shadow set
%MOUNT-I-SHDWMEMSUCC, _$1$VDA102: (VAXA) is now a valid member of the shadow set
$
$ SHOW DEVICE DSA100: 

Device          Device      Error   Volume   Free  Trans  Mnt
  Name          Status     Count   Label    Blocks Count  Cnt
DSA100:         Mounted      0  USER_DATA   323700    1    1
$1$VDA101:      (VAXA)    ShadowSetMember  0  (member of DSA100:)
$1$VDA102:      (VAXA)    ShadowSetMember  0  (member of DSA100:)
$
$
$ DIRECTORY/SIZE $1$DIA4: [VT] VIRTUOSO_DM1.BACKING 

Directory $1$DIA4: [VT]
DISKMAKER_DM1.BACKING;1          325500

Total of 1 file, 325500 blocks.
$
$ DIRECTORY/SIZE $1$DIA7: [VT] VIRTUOSO_DM2.BACKING 

Directory $1$DIA7: [VT]
DISKMAKER_DM2.BACKING;1          325500

Total of 1 file, 325500 blocks.
$
```

---

## 6.2 Heterogeneous Shadowing

This example show *heterogeneous shadowing*, i.e. a shadow set comprised of a real disk member and a virtual disk member. In this example, the virtual disk uses a *volume backing-stores*, located on a Foreign-mounted drive. A copy of this procedure can be found in `diskmaker_device:[DISKMAKER.EXAMPLES]DISKMAKER_HETEROGENEOUS.COM`.

### Example 6-2 Heterogeneous Shadowing

```

$
$ SHOW DEVICE $1$DIA6:/FULL 
Disk $1$DIA6: (VAXA6), device type RF31, is online, file-oriented device,
shareable, served to cluster via MSCP Server, error logging is enabled.

Error count          0      Operations completed          200
Owner process        ""      Owner UIC                      [0,0]
Owner process ID     00000000    Dev Prot      S:RWED,O:RWED,G:RWED,W:RWED
Reference count      0      Default buffer size           512
Total blocks         744400    Sectors per track             50
Total cylinders      1861    Tracks per cylinder            8
Host name            "VAXA6"      Host type, avail              RF31, yes
Allocation class     1

$ SHOW DEVICE $1$DUA1:/FUL 
Disk $1$DUA1: (HSC000), device type RA81, is online, allocated, deallocate on
dismount, mounted foreign, file-oriented device, shareable, served to
cluster via MSCP Server, error logging is enabled.

Error count          0      Operations completed          37368
Owner process        ""      Owner UIC                      [0,0]
Owner process ID     00000000    Dev Prot      S:RWED,O:RWED,G:W:
Reference count      2      Default buffer size           512
Total blocks         891072    Sectors per track             51
Total cylinders      1248    Tracks per cylinder            14
Host name            "HSC000"      Host type, avail              HS70, yes
Allocation class     1

$
$ DISKMAKER ACTIVATE VIRTUAL_RF31/INIT=Y/DISK/TYPE=RF31/BACK=$1$DUA1:/VOLSHAD/DEVICE=VDA600:/LOG 
%RUN-S-PROC_ID, identification of created process is 20C00704
%VIRTUOSO-S-ACTVSUCC, virtual disk VIRTUAL_RF31 (_$1$VDA600:) activated
-SYSTEM-S-NORMAL, normal successful completion
$
$ SHOW DEVICE VIRTUAL_RF31 
Device              Device          Error    Volume    Free  Trans  Mnt
Name                Status         Count    Label    Blocks Count  Cnt
$1$VDA600:          (VAXA) Online         0
$
$ SHOW LOGICAL VIRTUAL_RF31 
"VIRTUAL_RF31" = "_$1$VDA600:" (LNM$SYSTEM_TABLE)
$
$ DISKMAKER LIST 
DISKMAKER V021-000 for OpenVMS on node VAXA 2-APR-1993 12:38:25.92
Copyright © 1989 by Advanced Systems Concepts, Inc. All Rights Reserved
Licensed to ASCII-INTERNAL

```

Example 6-2 Cont'd on next page

# SAMPLE APPLICATIONS

## Example 6-2 (Cont.) Heterogeneous Shadowing

```
Virtual Disk Name      Type      State      Size      Options
DM1 [$1$VDA101: (VAXA)] File      Active     325500   Contig,Share,
                          Servable,VolShd1
DM2 [$1$VDA102: (VAXA)] File      Active     325500   Contig,Share,
                          Servable,VolShd1
VIRTUAL_RF31 [$1$VDA600: (VAXA)]
                          Volume     Active     744400   Contig,Share,
                          Servable,VolShd1

$
$ REPLY/ENABLE [Return]
%%%%%%%%%% OPCOM 2-APR-1993 12:40:12.23 %%%%%%%%%%%
Operator _VAXA$RTA1: has been enabled, username TESTER
$
$ INITIALIZE VIRTUAL_RF31 D6 [Return]
$
$ MOUNT/SYSTEM DSA600:/SHADOW=( $1$DIA6:,VIRTUAL_RF31) D6 [Return]
%MOUNT-I-MOUNTED, D6 mounted on _DSA600:
%%%%%%%%%% OPCOM 2-APR-1993 12:42:21.29 %%%%%%%%%%%
Message from user SYSTEM on VAXA
%SHADOW_SERVER-I-SSRVINIFCPY, initiating full copy sequence 113772591
on device _DSA600: at LBN 0, I/O size: 100 blocks
%MOUNT-I-SHDWMEMSUCC, _$1$DIA6: (VAXA6) is now a valid member of the shadow set
%MOUNT-I-SHDWMEMCOPY, _$1$VDA600: (VAXA) added to the shadow set with a copy operation
$
$
$ SHOW DEVICE DSA600: [Return]

Device      Device      Error      Volume      Free      Trans      Mnt
Name        Status      Count      Label      Blocks    Count     Cnt
DSA600:     Mounted     0          D6          744282    1         1
$1$DIA6:    (VAXA6)    ShadowSetMember 0 (member of DSA600:)
$1$VDA600: (VAXA)    ShadowCopying 0 (copy trgt DSA600: 0% copied)
$
$ SHOW DEVICE DSA600/FULL [Return]

Disk DSA600:, device type RF31, is online, mounted, file-oriented device,
shareable, available to cluster, error logging is enabled.

Error count          0      Operations completed          177
Owner process        ""      Owner UIC                    [ASCII,TESTER]
Owner process ID     00000000  Dev Prot      S:RWED,O:RWED,G:RWED,W:RWED
Reference count      1      Default buffer size          512
Total blocks         744400  Sectors per track            50
Total cylinders      1861   Tracks per cylinder           8

Volume label         "D6"    Relative volume number        0
Cluster size         3      Transaction count             1
Free blocks          744282  Maximum files allowed         93050
Extend quantity      5      Mount count                   1
Mount status         System  Cache name                    "_$1$DIA0:XQPCACHE"
Extent cache size    64     Maximum blocks in extent cache 74428
File ID cache size   64     Blocks currently in extent cache 0
Quota cache size     0      Maximum buffers in FCP cache   1496

Volume status: subject to mount verification, file high-water marking, write-
through caching enabled.

Disk $1$DIA6:, device type RF31, is online, member of shadow set DSA600:, served
to cluster via MSCP Server, error logging is enabled.

Error count          0      Shadow member operation count    469
Host name            "VAXA6"  Host type, avail                RF31, yes
Allocation class     1

Disk $1$VDA600:, device type RF31, is online, member of shadow set DSA600:,
served to cluster via MSCP Server.
```

Example 6-2 Cont'd on next page

**Example 6-2 (Cont.) Heterogeneous Shadowing**

```

Error count                0      Shadow member operation count    1989
Allocation class           1
Volume status: volume is being added to the shadow set by a full copy
operation.

$
$ SHOW DEVICE DSA600: Return
Device                    Device      Error   Volume      Free  Trans Mnt
Name                     Status    Count   Label        Blocks Count Cnt
$1$VDA0:                 (VAXA)   Offline 0
$1$VDA101:               (VAXA)   ShadowSetMember 0 (member of DSA100:)
$1$VDA102:               (VAXA)   ShadowSetMember 0 (member of DSA100:)
$1$VDA600:               (VAXA)   ShadowCopying 0 (copy trgt DSA600: 1% copied)
$
$ DISKMAKER LIST Return
DISKMAKER V021-000 for OpenVMS on node VAXA 2-APR-1993 12:43:09.37
Copyright © 1989 by Advanced Systems Concepts, Inc. All Rights Reserved
Licensed to ASCII-INTERNAL

Virtual Disk Name        Type      State      Size      Options
DM1 [$1$VDA101: (VAXA)] File      Active     325500    Contig,Share,
                          Servable,VolShd1
DM2 [$1$VDA102: (VAXA)] File      Active     325500    Contig,Share,
                          Servable,VolShd1
VIRTUAL_RF31 [$1$VDA600: (VAXA)]
                          Volume    Active     744400    Contig,Share,
                          Servable,VolShd1
$
%%%%%%%%%% OPCOM 2-APR-1993 13:23:54.78 %%%%%%%%%%%
Message from user SYSTEM on VAXA
%SHADOW_SERVER-I-SSRVNORMAL, successful copy completion of sequence 113772591
on device _DSA600:
%%%%%%%%%% OPCOM 2-APR-1993 13:23:54.88 %%%%%%%%%%%
DSA600: all shadow set copy operations are completed.
$
$ SHOW DEVICE VDA600: Return
Device                    Device      Error   Volume      Free  Trans Mnt
Name                     Status    Count   Label        Blocks Count Cnt
DSA600:                 Mounted    0      D6           744282 1 1
$1$DIA6:                 (VAXA6)   ShadowSetMember 0 (member of DSA600:)
$1$VDA600:               (VAXA)   ShadowSetMember 0 (member of DSA600:)
$
$
$ DISMOUNT/NOUNLOAD DSA600: Return
%%%%%%%%%% OPCOM 2-APR-1993 14:09:35.11 %%%%%%%%%%%
$1$DIA6: (VAXA6) has been removed from shadow set.
%%%%%%%%%% OPCOM 2-APR-1993 14:09:35.13 %%%%%%%%%%%
$1$VDA600: (VAXA) has been removed from shadow set.
$
$
$ MOUNT $1$DIA6: D6 Return
%MOUNT-W-VOLSHDWMEM, mounting a shadow set member volume; volume write locked
%MOUNT-I-MOUNTED, D6 mounted on _$1$DIA6: (VAXA6)
$
$ MOUNT VIRTUAL_RF31 D6 Return
%MOUNT-W-VOLSHDWMEM, mounting a shadow set member volume; volume write locked
%MOUNT-I-MOUNTED, D6 mounted on _$1$VDA600: (VAXA)
$ SHOW DEVICE $1$DIA6:

```

**Example 6-2 Cont'd on next page**

# SAMPLE APPLICATIONS

## Example 6-2 (Cont.) Heterogeneous Shadowing

---

```
Device          Device          Error   Volume      Free  Trans Mnt
Name           Status          Count   Label       Blocks Count Cnt
$1$DIA6:      (VAXA6) Mounted alloc    0  D6       744282    1  1
                wrtlck

$
$ SHOW DEVICE VIRTUAL_RF31 
Device          Device          Error   Volume      Free  Trans Mnt
Name           Status          Count   Label       Blocks Count Cnt
$1$VDA600:    (VAXA) Mounted alloc    0  D6       744282    1  1
                wrtlck

$
$ BACKUP/COMPARE/IMAGE $1$DIA6: VIRTUAL_RF31 
$
$ DISMOUNT/NOUNLOAD $1$DIA6: 
$ DISMOUNT/NOUNLOAD VIRTUAL_RF31 
$
$ MOUNT/SYSTEM DSA600:/SHADOW=($1$DIA6:,VIRTUAL_RF31) D6 
%MOUNT-I-MOUNTED, D6          mounted on _DSA600:
%MOUNT-I-SHDWMEMSUCC, _$1$DIA6: (VAXA6) is now a valid member of the shadow set
%MOUNT-I-SHDWMEMSUCC, _$1$VDA600: (VAXA) is now a valid member of the shadow set
$
$
$ SHOW DEVICE DSA600: 

Device          Device          Error   Volume      Free  Trans Mnt
Name           Status          Count   Label       Blocks Count Cnt
DSA600:        Mounted          0  D6       744282    1  1
$1$DIA6:      (VAXA6) ShadowSetMember  0  (member of DSA600:)
$1$VDA600:    (VAXA) ShadowSetMember  0  (member of DSA600:)
$
```

---

## 6.3 Removing and Adding Shadow Set Members

This example shows the removal of a shadow set member using DISMOUNT, and the re-addition of the member using MOUNT.

### Example 6–3 Removing and Adding Shadow Set Members

```

$ REPLY/ENABLE 
%%%%%%%%%% OPCOM 2-APR-1993 11:44:27.41 %%%%%%%%%%%
Operator _VAXA$RTA1: has been enabled, username TESTER
$
$ MOUNT/SYSTEM DSA100:/SHADOW=(FS1,FS2) USER_DATA 
%MOUNT-I-MOUNTED, USER_DATA mounted on _DSA100:
%MOUNT-I-SHDWMEMSUCC, _$1$VDA101: (VAXA) is now a valid member of the shadow set
%MOUNT-I-SHDWMEMSUCC, _$1$VDA102: (VAXA) is now a valid member of the shadow set
$
$ SHOW DEVICE DSA100: 

Device          Device          Error    Volume          Free  Trans  Mnt
Name            Status          Count    Label           Blocks Count  Cnt
DSA100:         Mounted         0        USER_DATA      323700  1    1
$1$VDA101:     (VAXA)         ShadowSetMember  0  (member of DSA100:)
$1$VDA102:     (VAXA)         ShadowSetMember  0  (member of DSA100:)
$
$
$ DISMOUNT FS2 
%%%%%%%%%% OPCOM 2-APR-1993 11:44:54.03 %%%%%%%%%%%
$1$VDA102: (VAXA) has been removed from shadow set.
%%%%%%%%%% OPCOM 2-APR-1993 11:44:54.07 %%%%%%%%%%%
DSA100: shadow set has been reduced.
$
$ SHOW DEVICE DSA100: 

Device          Device          Error    Volume          Free  Trans  Mnt
Name            Status          Count    Label           Blocks Count  Cnt
DSA100:         Mounted         0        USER_DATA      323700  1    1
$1$VDA101:     (VAXA)         ShadowSetMember  0  (member of DSA100:)
$
$
$ SHOW DEVICE VD 

Device          Device          Error    Volume          Free  Trans  Mnt
Name            Status          Count    Label           Blocks Count  Cnt
$1$VDA0:       (VAXA)         Offline   0
$1$VDA101:     (VAXA)         ShadowSetMember  0  (member of DSA100:)
$1$VDA102:     (VAXA)         Online    0
$
$
$ MOUNT FS2 USER_DATA 
%MOUNT-W-VOLSHDWMEM, mounting a shadow set member volume; volume write locked
%MOUNT-I-MOUNTED, USER_DATA mounted on _$1$VDA102: (VAXA)
$
$ SHOW DEVICE VD 

Device          Device          Error    Volume          Free  Trans  Mnt
Name            Status          Count    Label           Blocks Count  Cnt
$1$VDA0:       (VAXA)         Offline   0
$1$VDA101:     (VAXA)         ShadowSetMember  0  (member of DSA100:)
$1$VDA102:     (VAXA)         Mounted alloc  0  USER_DATA      323700  1    1
wrtlck
$
$
$ DISMOUNT FS2 
$
$ SHOW DEVICE VD 

```

Example 6–3 Cont'd on next page

# SAMPLE APPLICATIONS

## Example 6-3 (Cont.) Removing and Adding Shadow Set Members

```
Device          Device      Error   Volume      Free  Trans  Mnt
  Name          Status     Count   Label       Blocks Count  Cnt
$1$VDA0:      (VAXA)  Offline      0
$1$VDA101:    (VAXA)  ShadowSetMember  0 (member of DSA100:)
$1$VDA102:    (VAXA)  Online       0
$
$ MOUNT/SYSTEM DSA100:/SHADOW=FS2 USER_DATA Return
%%%%%%%%%% OPCOM 2-APR-1993 11:46:08.11 %%%%%%%%%%%
Message from user SYSTEM on VAXA
%SHADOW_SERVER-I-SSRVINIFCPY, initiating full copy sequence 216531159
on device _DSA100: at LBN 0, I/O size: 125 blocks
%MOUNT-I-SHDWMEMCOPY, _$1$VDA102: (VAXA) added to the shadow set with a copy operation
$
$ SHOW DEVICE DSA100: Return

Device          Device      Error   Volume      Free  Trans  Mnt
  Name          Status     Count   Label       Blocks Count  Cnt
DSA100:        Mounted      0  USER_DATA   323700    1    1
$1$VDA101:    (VAXA)  ShadowSetMember  0 (member of DSA100:)
$1$VDA102:    (VAXA)  ShadowCopying  0 (copy trgt DSA100: 76% copied)
$
$
%%%%%%%%%% OPCOM 2-APR-1993 11:51:37.32 %%%%%%%%%%%
Message from user SYSTEM on VAXA
%SHADOW_SERVER-I-SSRVNORMAL, successful copy completion of sequence 216531159
on device _DSA100:
%%%%%%%%%% OPCOM 2-APR-1993 11:51:37.39 %%%%%%%%%%%
DSA100: all shadow set copy operations are completed.
$
$ SHOW DEVICE DSA100: Return

Device          Device      Error   Volume      Free  Trans  Mnt
  Name          Status     Count   Label       Blocks Count  Cnt
DSA100:        Mounted      0  USER_DATA   323700    1    1
$1$VDA101:    (VAXA)  ShadowSetMember  0 (member of DSA100:)
$1$VDA102:    (VAXA)  ShadowSetMember  0 (member of DSA100:)
$
$ DISMOUNT DSA100: Return
%%%%%%%%%% OPCOM 2-APR-1993 11:51:51.75 %%%%%%%%%%%
$1$VDA101: (VAXA) has been removed from shadow set.
%%%%%%%%%% OPCOM 2-APR-1993 11:51:51.78 %%%%%%%%%%%
$1$VDA102: (VAXA) has been removed from shadow set.
$
$ SHOW DEVICE DSA100: Return

Device          Device      Error   Volume      Free  Trans  Mnt
  Name          Status     Count   Label       Blocks Count  Cnt
DSA100:        Online      0
$
$ SHOW DEVICE VD Return

Device          Device      Error   Volume      Free  Trans  Mnt
  Name          Status     Count   Label       Blocks Count  Cnt
$1$VDA0:      (VAXA)  Offline      0
$1$VDA101:    (VAXA)  Online       0
$1$VDA102:    (VAXA)  Online       0
$
$ MOUNT/SYSTEM DSA100:/SHADOW=(FS1,FS2) USER_DATA Return
%MOUNT-I-MOUNTED, USER_DATA mounted on _DSA100:
%MOUNT-I-SHDWMEMSUC, _$1$VDA101: (VAXA) is now a valid member of the shadow set
%MOUNT-I-SHDWMEMSUC, _$1$VDA102: (VAXA) is now a valid member of the shadow set
$
$ SHOW DEVICE DSA100: Return
```

Example 6-3 Cont'd on next page

**Example 6-3 (Cont.) Removing and Adding Shadow Set Members**

---

```

Device          Device          Error   Volume      Free  Trans  Mnt
  Name          Status          Count   Label       Blocks Count  Cnt
DSA100:         Mounted         0      USER_DATA   323700    1    1
$1$VDA101:     (VAXA) ShadowSetMember  0      (member of DSA100:)
$1$VDA102:     (VAXA) ShadowSetMember  0      (member of DSA100:)
$
$ SHOW DEVICE VD Return

```

```

Device          Device          Error   Volume      Free  Trans  Mnt
  Name          Status          Count   Label       Blocks Count  Cnt
$1$VDA0:       (VAXA) Offline         0
$1$VDA101:     (VAXA) ShadowSetMember  0      (member of DSA100:)
$1$VDA102:     (VAXA) ShadowSetMember  0      (member of DSA100:)

```

---

## 6.4 Failure and Recovery of a Member

This example shows the failure of a shadow set member, and the re-addition of the member using MOUNT.

### Example 6-4 Failure and Recovery of a Member

```

$ SHOW DEVICE DSA100: Return
Device          Device          Error    Volume      Free  Trans  Mnt
Name            Status          Count    Label       Blocks Count Cnt
DSA100:         Mounted         0        TEST1       4510   1    1
$1$VDA100:     (VAX_1)        ShadowSetMember 0 (member of DSA100:)
$1$VDA101:     (VAX_1)        ShadowSetMember 0 (member of DSA100:)
$
$! backing store disks for vda100 (dua0) and vda101 (dual)
$!                               are mounted with NOMOUNT_VERIFICATION
$
$ REPLY/ENABLE Return
%%%%%%%%%%%% OPCOM 22-APR-1993 12:16:40.78 %%%%%%%%%%%%%
Operator _VAX_1$VTA3: has been enabled, username TESTER
$
$ MCR SYSGEN SHOW SHADOW_MBR_TMO Return
Parameter Name      Current      Default      Min.      Max.      Unit  Dynamic
-----
SHADOW_MBR_TMO      20           20           0         65535    Seconds  D
$
$ SHOW DEVICE $1$DUA1: Return
Device          Device          Error    Volume      Free  Trans  Mnt
Name            Status          Count    Label       Blocks Count Cnt
$1$DUA1:        (VAX_1)        Mounted   0    TESTER     149550  2    1
$
$ !!! now fail out dual, causing vda101 to go offline
$
%%%%%%%%%%%% OPCOM 22-APR-1993 12:21:58.85 %%%%%%%%%%%%%
DSA100: shadow set has changed state.
Mount verification in progress.
$ SHOW DEVICE $1$DUA1: Return
Device          Device          Error    Volume      Free  Trans  Mnt
Name            Status          Count    Label       Blocks Count Cnt
$1$DUA1:        (VAX_1)        MntVerifyTimeout 0    TESTER     149550  2    1
                        mounted
$ SHOW DEVICE DSA100: Return
Device          Device          Error    Volume      Free  Trans  Mnt
Name            Status          Count    Label       Blocks Count Cnt
DSA100:         MountVerify    0        TEST1       3336   2    1
                        mounted
$1$VDA100:     (VAX_1)        ShadowSetMember 0 (member of DSA100:)
$1$VDA101:     (VAX_1)        ShadowSetMember 0 (member of DSA100:)
$
%%%%%%%%%%%% OPCOM 22-APR-1993 12:22:18.67 %%%%%%%%%%%%%
Device $1$VDA101: (VAX_1) is offline.
Mount verification is in progress.
%%%%%%%%%%%% OPCOM 22-APR-1993 12:22:18.78 %%%%%%%%%%%%%
$1$VDA101: (VAX_1) has been removed from shadow set.
%%%%%%%%%%%% OPCOM 22-APR-1993 12:22:18.89 %%%%%%%%%%%%%
Mount verification has completed for device DSA100:
$ SHOW DEVICE $1$DUA1: Return

```

Example 6-4 Cont'd on next page

**Example 6-4 (Cont.) Failure and Recovery of a Member**

```

Device          Device          Error    Volume      Free  Trans  Mnt
  Name          Status          Count    Label      Blocks Count  Cnt
$1$DUA1:      (VAX_1)  MntVerifyTimeout  0  TESTER      149550    2    1
              mounted
$ SHOW DEVICE DSA100: Return

Device          Device          Error    Volume      Free  Trans  Mnt
  Name          Status          Count    Label      Blocks Count  Cnt
DSA100:      Mounted          0  TEST1          3312    2    1
$1$VDA100:   (VAX_1)  ShadowSetMember  0  (member of DSA100:)
$
$ SHOW DEVICE VD Return

Device          Device          Error    Volume      Free  Trans  Mnt
  Name          Status          Count    Label      Blocks Count  Cnt
$1$VDA0:     (VAX_1)  Offline          0
$1$VDA100:   (VAX_1)  ShadowSetMember  0  (member of DSA100:)
$1$VDA101:   (VAX_1)  Online           0
$
$ DISKMAKER DEACT TEST2 Return
$
$ SHOW DEVICE VD Return

Device          Device          Error    Volume      Free  Trans  Mnt
  Name          Status          Count    Label      Blocks Count  Cnt
$1$VDA0:     (VAX_1)  Offline          0
$1$VDA100:   (VAX_1)  ShadowSetMember  0  (member of DSA100:)
$
$ DISMOUNT/NOUNLOAD $1$DUA1: Return
$
$ MOUNT/SYSTEM $1$DUA1:/NOMOUNT VERIFICATION TESTER Return
%MOUNT-I-MOUNTED, TESTER      mounted on _$1$DUA1: (VAX_1)
%MOUNT-I-REBUILD, volume was improperly dismounted; rebuild in progress
$
$ DISKMAKER ACTIVATE/LOG TEST2 Return
%RUN-S-PROC_ID, identification of created process is 202000A5
%VIRTUOSO-S-ACTVSUCC, virtual disk TEST2 (_$1$VDA101:) activated
-SYSTEM-S-NORMAL, normal successful completion
$
$ MOUNT/SYSTEM DSA100:/SHADOW=(TEST2) TEST1 Return
%%%%%%%%%% OPCOM 22-APR-1993 12:26:06.06 %%%%%%%%%%%
Message from user SYSTEM on VAX_1
%SHADOW_SERVER-I-SSRVINIFCPY, initiating Full-Copy sequence 16777704
  on device _DSA100: at LBN 0, I/O size: 119 blocks

%MOUNT-I-SHDWMEMCOPY, _$1$VDA101: (VAX_1) added to the shadow set with a copy operation
$
$ SHOW DEVICE DSA100: Return

Device          Device          Error    Volume      Free  Trans  Mnt
  Name          Status          Count    Label      Blocks Count  Cnt
DSA100:      Mounted          0  TEST1          2217    2    1
$1$VDA100:   (VAX_1)  ShadowSetMember  0  (member of DSA100:)
$1$VDA101:   (VAX_1)  ShadowCopying    0  (copy trgt DSA100: 26% copied)
$
%%%%%%%%%% OPCOM 22-APR-1993 12:26:25.93 %%%%%%%%%%%
Message from user SYSTEM on VAX_1
%SHADOW_SERVER-I-SSRVNORMAL, successful copy completion of copy sequence 16777704 on device _DSA100:
$
%%%%%%%%%% OPCOM 22-APR-1993 12:26:26.10 %%%%%%%%%%%
DSA100: all shadow set copy operations are completed.
$
$ SHOW DEVICE DSA100: Return

```

**Example 6-4 Cont'd on next page**

## SAMPLE APPLICATIONS

### Example 6-4 (Cont.) Failure and Recovery of a Member

---

Device Name	Device Status	Error Count	Volume Label	Free Blocks	Trans Count	Mnt Cnt
DSA100:	Mounted	0	TEST1	3432	1	1
\$1\$VDA100: (VAX_1)	ShadowSetMember	0	(member of DSA100:)			
\$1\$VDA101: (VAX_1)	ShadowSetMember	0	(member of DSA100:)			
\$						

---

## 6.5 Shadowing in a Cluster

This example shows the use of DiskMaker for a shadow set in a mixed VMScLuster (CI-NI), using both *sharing* and *servng* of the virtual disks.

### Example 6-5 Shadowing in a Cluster

```

CIVAX_1>
CIVAX_1> DISKMAKER LIST /FULL /PERMANENT DM1 

DiskMaker V021-000 for OpenVMS on node CIVAX_1 12-APR-1993 09:25:52.67
Copyright © 1989 by Advanced Systems Concepts, Inc. All Rights Reserved
Licensed to ASCI-INTERNAL
Inactive Virtual Disk: DM1
Type: File          Options: Contig,Share,Servable,VolShd1

          --- Characteristics ---
Size                42750    Cylinders/disk          50
Device Type         RL02     Tracks/cylinder         15
Number of Backing Stores 1     Sectors/track           57
Working Set Default 256     Server Base Priority     4
Working Set Maximum 1024    Shadow Cost              n/a
Working Set Extent  2048
Cluster Device      VDA201

          --- Backing Store Information ---

Specification                               Start      Alignment
Position                                     Option
$1$DUAL1: [VT]VIRTUOSO_DM1.BACKING         n/a        ANY

CIVAX_1>
CIVAX_1> DISKMAKER LIST /FULL /PERMANENT DM2 

DiskMaker V021-000 for OpenVMS on node CIVAX_1 12-APR-1993 09:25:59.76
Copyright © 1989 by Advanced Systems Concepts, Inc. All Rights Reserved
Licensed to ASCI-INTERNAL
Inactive Virtual Disk: DM2
Type: File          Options: Contig,Share,Servable,VolShd1

          --- Characteristics ---
Size                42750    Cylinders/disk          50
Device Type         RL02     Tracks/cylinder         15
Number of Backing Stores 1     Sectors/track           57
Working Set Default 256     Server Base Priority     4
Working Set Maximum 1024    Shadow Cost              n/a
Working Set Extent  2048
Cluster Device      VDA202

          --- Backing Store Information ---

Specification                               Start      Alignment
Position                                     Option
$1$DUAL10: [VT]VIRTUOSO_DM2.BACKING        n/a        ANY

```

Example 6-5 Cont'd on next page

# SAMPLE APPLICATIONS

## Example 6-5 (Cont.) Shadowing in a Cluster

```
CIVAX_1>
CIVAX_1> DISKMAKER ACTIVATE DM1 /LOG Return
%RUN-S-PROC_ID, identification of created process is 20800127
%VIRTUOSO-S-ACTVSUCC, virtual disk DM1 (_$1$VDA201:) activated
-SYSTEM-S-NORMAL, normal successful completion
CIVAX_1>
VAX_1> DISKMAKER ACTIVATE DM2 /LOG Return
%RUN-S-PROC_ID, identification of created process is 20800129
%VIRTUOSO-S-ACTVSUCC, virtual disk DM2 (_$1$VDA202:) activated
-SYSTEM-S-NORMAL, normal successful completion
CIVAX_1>
CIVAX_1>
CIVAX_1> SET DEVICE/SERVED DM1 Return
%SET-E-NOTSET, error modifying DM1
-SET-E-INVDEV, device is invalid for requested operation
CIVAX_1>
CIVAX_1>
CIVAX_1> DISKMAKER LIST Return

DiskMaker V021-000 for OpenVMS on node CIVAX_1 12-APR-1993 09:29:25.62
Copyright © 1989 by Advanced Systems Concepts, Inc. All Rights Reserved
Licensed to ASCI-INTERNAL

Virtual Disk Name          Type      State      Size      Options
DM1 [$1$VDA201: (CIVAX_1)] File      Active     42750    Contig,Share,
                          Servable,VolShd1
DM2 [$1$VDA202: (CIVAX_1)] File      Active     42750    Contig,Share,
                          Servable,VolShd1

CIVAX_1>
CIVAX_1> SHOW DEVICE VD Return

Device          Device          Error   Volume      Free  Trans  Mnt
Name            Status          Count   Label       Blocks Count  Cnt
$1$VDA00:      (CIVAX_1)      Offline 0           0
$1$VDA201:    (CIVAX_1)      Online  0           0
$1$VDA201:    (CIVAX_2)      Online  0           0
$1$VDA202:    (CIVAX_1)      Online  0           0
$1$VDA202:    (CIVAX_2)      Online  0           0
CIVAX_1>
CIVAX_1>
CIVAX_1> MOUNT/SYSTEM DSA200:/SHADOW=(DM1,DM2) SELECT_DATA Return
%MOUNT-I-MOUNTED, SELECT_DATA mounted on _DSA200:
%MOUNT-I-SHDWMEMSUCC, _$1$VDA201: (CIVAX_1) is now a valid member of the shadow set
%MOUNT-I-SHDWMEMSUCC, _$1$VDA202: (CIVAX_1) is now a valid member of the shadow set
CIVAX_1>
CIVAX_1> SHOW DEVICE DSA200: Return

Device          Device          Error   Volume      Free  Trans  Mnt
Name            Status          Count   Label       Blocks Count  Cnt
DSA200:        Mounted         0       SELECT_DATA 42713    1    3
$1$VDA201:    (CIVAX_1)      ShadowSetMember 0 (member of DSA200:)
$1$VDA202:    (CIVAX_1)      ShadowSetMember 0 (member of DSA200:)
CIVAX_1>
CIVAX_1> SHOW DEVICE/FULL DSA200: Return

Disk DSA200:, device type RL02, is online, mounted, file-oriented device,
shareable, available to cluster, error logging is enabled.

Error count          0      Operations completed          34
Owner process        ""      Owner UIC                    [ASCI,TESTER]
Owner process ID     00000000  Dev Prot      S:RWED,O:RWED,G:RWED,W:RWED
Reference count      1      Default buffer size          512
Total blocks         42750  Sectors per track            57
Total cylinders      50     Tracks per cylinder          15
```

Example 6-5 Cont'd on next page

**Example 6-5 (Cont.) Shadowing in a Cluster**

```

Volume label      "SELECT_DATA"      Relative volume number      0
Cluster size     1                Transaction count           1
Free blocks      42713           Maximum files allowed       10687
Extend quantity  5                Mount count                 3
Mount status     System           Cache name                  "_$1$DUA13:XQPCACHE"
Extent cache size 64           Maximum blocks in extent cache 4271
File ID cache size 64          Blocks currently in extent cache 0
Quota cache size 0                Maximum buffers in FCP cache 534

Volume status: subject to mount verification, file high-water marking, write-
through caching enabled.
Volume is also mounted on CIVAX_2, NIVAX.

Disk $1$VDA201:, device type RL02, is online, member of shadow set DSA200:,
served to cluster via MSCP Server.

Error count      0                Shadow member operation count 65
Allocation class 1

Disk $1$VDA202:, device type RL02, is online, member of shadow set DSA200:,
served to cluster via MSCP Server.

Error count      0                Shadow member operation count 30
Allocation class 1

CIVAX_1>
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

CIVAX_2>
CIVAX_2> DISKMAKER ACTIVATE DM1 /LOG 
%RUN-S-PROC_ID, identification of created process is 20A00120
%VIRTUOSO-S-ACTVSUCC, virtual disk DM1 (_$1$VDA201:) activated
-SYSTEM-S-NORMAL, normal successful completion
CIVAX_2>
CIVAX_2> DISKMAKER ACTIVATE DM2 /LOG 
%RUN-S-PROC_ID, identification of created process is 20A00120
%VIRTUOSO-S-ACTVSUCC, virtual disk DM2 (_$1$VDA202:) activated
-SYSTEM-S-NORMAL, normal successful completion
CIVAX_2>
CIVAX_2>
CIVAX_2> DISKMAKER LIST 

DiskMaker V021-000 for OpenVMS on node CIVAX_2 12-APR-1993 09:29:44.50
Copyright © 1989 by Advanced Systems Concepts, Inc. All Rights Reserved
Licensed to ASCI-INTERNAL
Virtual Disk Name      Type      State      Size      Options
DM1 [$1$VDA201: (CIVAX_2)]  File      Active     42750    Contig,Share,
                          Servable,VolShd1
DM2 [$1$VDA202: (CIVAX_2)]  File      Active     42750    Contig,Share,
                          Servable,VolShd1

CIVAX_2>
CIVAX_2>
CIVAX_2> SHOW DEVICE VD 

```

**Example 6-5 Cont'd on next page**

# SAMPLE APPLICATIONS

## Example 6-5 (Cont.) Shadowing in a Cluster

```

Device          Device          Error   Volume      Free  Trans Mnt
Name           Status         Count   Label       Blocks Count  Cnt
$1$VDA0:      (CIVAX_2)    Offline 0
$1$VDA201:   (CIVAX_2)    Online  0
$1$VDA201:   (CIVAX_1)    Online  0
$1$VDA202:   (CIVAX_2)    Online  0
$1$VDA202:   (CIVAX_1)    Online  0
CIVAX_2>
CIVAX_2>
CIVAX_2> MOUNT/SYSTEM DSA200:/SHADOW=(DM1,DM2) SELECT_DATA Return
%MOUNT-I-MOUNTED, SELECT_DATA mounted on _DSA200:
%MOUNT-I-SHDWMEMSUCC, _$1$VDA201: (CIVAX_2) is now a valid member of the shadow set
%MOUNT-I-SHDWMEMSUCC, _$1$VDA202: (CIVAX_2) is now a valid member of the shadow set
CIVAX_2>
CIVAX_2>
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

NIVAX> SHOW DEVICE VD Return

Device          Device          Error   Volume      Free  Trans Mnt
Name           Status         Count   Label       Blocks Count  Cnt
NIVAX$VDA0:    (NIVAX)       Offline 0
$1$VDA201:    (CIVAX_1)    Online  0
$1$VDA202:    (CIVAX_1)    Online  0
NIVAX>
NIVAX>
NIVAX> DISKMAKER LIST Return
%VIRTUOSO-E-LISTVERR, virtual disk(s) not listed
-VIRTUOSO-W-NOVOLALIST, no virtual disks found in volatile database
%VIRTUOSO-E-LISTVERR, virtual disk(s) not listed
NIVAX>
NIVAX> DEFINE/SYSTEM DM2 $1$VDA202: Return
NIVAX> DEFINE/SYSTEM DM1 $1$VDA201: Return
NIVAX>
NIVAX> MOUNT/SYSTEM DSA200:/SHADOW=(DM1,DM2) SELECT_DATA Return
%MOUNT-I-MOUNTED, SELECT_DATA mounted on _DSA200:
%MOUNT-I-SHDWMEMSUCC, _$1$VDA201: (CIVAX_1) is now a valid member of the shadow set
%MOUNT-I-SHDWMEMSUCC, _$1$VDA202: (CIVAX_2) is now a valid member of the shadow set
NIVAX>
NIVAX> SHOW DEVICE/FULL DSA200: Return

Disk DSA200:, device type (type not yet identified), is online, mounted, file-
oriented device, shareable, available to cluster, error logging is enabled.

Error count          0      Operations completed          19
Owner process        ""      Owner UIC                    [ASCII,TESTER]
Owner process ID     00000000  Dev Prot      S:RWED,O:RWED,G:RWED,W:RWED
Reference count      1      Default buffer size          512
Total blocks         42750  Sectors per track            57
Total cylinders      50     Tracks per cylinder           15

Volume label         "SELECT_DATA"  Relative volume number        0
Cluster size         1      Transaction count             1
Free blocks          42713  Maximum files allowed         10687
Extend quantity      5      Mount count                   3
Mount status         System   Cache name                    "_$1$DUA13:XQPCACHE"
Extent cache size    64     Maximum blocks in extent cache 4271
File ID cache size   64     Blocks currently in extent cache 0
Quota cache size     0      Maximum buffers in FCP cache   488

Volume status:  subject to mount verification, file high-water marking, write-
through caching enabled.
Volume is also mounted on CIVAX_2, CIVAX_1.

```

Example 6-5 Cont'd on next page

**Example 6–5 (Cont.) Shadowing in a Cluster**

---

Disk \$1\$VDA201:, device type (type not yet identified), is online, member of shadow set DSA200:, error logging is enabled.

Error count	0	Shadow member operation count	19
Host name	"CIVAX_1"	Host type, avail	VAX 8250, yes
Alternate host name	"CIVAX_2"	Alt. type, avail	VAX 8250, yes
Allocation class	1		

Disk \$1\$VDA202:, device type (type not yet identified), is online, member of shadow set DSA200:, error logging is enabled.

Error count	0	Shadow member operation count	14
Host name	"CIVAX_2"	Host type, avail	VAX 8250, yes
Alternate host name	"CIVAX_1"	Alt. type, avail	VAX 8250, yes
Allocation class	1		

NIVAX>

---

## 6.6 Usage with Digital's Disk Striping product

This example shows how DiskMaker can be used to create either a heterogeneous stripeset, or a stripeset for a very hot and critical file. A copy of this procedure can be found in diskmaker\_device:[DISKMAKER.EXAMPLES]DISKMAKER\_STRIPED.COM.

### Example 6-6 Heterogeneous Striping

```

$ SHOW DEV DK

Device                               Device      Error   Volume      Free  Trans Mnt
Name                               Status      Count   Label        Blocks Count Cnt
$3$DKA200:   (SCOTTY) Mounted      0   DKDATA        86217    1  1
$3$DKA300:   (SCOTTY) Mounted      0   DKDATA2       204804   1  1
$ DISKMAKER ACTIVATE TEST1/DISK/INITIALIZE=YES/BACK=$3$DKA200: [VT] /SIZE=25000-
_$ /DEVICE=VDA400:/VOLSHAD/LOG
%RUN-S-PROC_ID, identification of created process is 21000112
%VIRTUOSO-S-ACTVSUCC, virtual disk TEST1 (_$3$VDA400:) activated
-SYSTEM-S-NORMAL, normal successful completion
$ DISKMAKER ACTIVATE TEST2/DISK/INITIALIZE=YES/BACK=$3$DKA300: [VT] /SIZE=25000-
_$ /DEVICE=VDA405:/VOLSHAD/LOG
%RUN-S-PROC_ID, identification of created process is 21000119
%VIRTUOSO-S-ACTVSUCC, virtual disk TEST2 (_$3$VDA405:) activated
-SYSTEM-S-NORMAL, normal successful completion
$ STRIPE INITIALIZE TEST1,TEST2 TEST1,TEST2
%STRIPE-I-VOLID, unit _$3$VDA400: contains volume TEST1
%STRIPE-I-NOVOL, unit _$3$VDA405: volume has no FILES-11 volume label
Proceed to initialize specified units? [Y/N] (N) : Y
%STRIPE-I-INIT, initializing member unit TEST1 as volume TEST1
%STRIPE-I-INIT, initializing member unit TEST2 as volume TEST2
%STRIPE-I-MOUNTING, mounting volume TEST1 on unit TEST1
%MOUNT-I-MOUNTED, TEST1      mounted on _$3$VDA400: (SCOTTY)
%STRIPE-I-MOUNTING, mounting volume TEST2 on unit TEST2
%MOUNT-I-MOUNTED, TEST2      mounted on _$3$VDA405: (SCOTTY)
$ STRIPE BIND/SYSTEM/DEVICE=STA100 TEST1,TEST2
%STRIPE-S-BOUNDLOG, stripe set STA100: defined as STRIPESET
%STRIPE-I-CLUSTER_SUPPORT, DEVICE CLUSTER WIDE AFTER BINDING ON EACH NODE
%STRIPE-I-WSYNDEQ, Waiting for synch-lock to dequeue
$ SHOW DEVICE $3$VDA400:/FULL

Disk $3$VDA400: (SCOTTY), device type RZ23, is online, mounted, file-oriented
device, shareable.

Error count                0      Operations completed                63
Owner process              ""      Owner UIC                          [1,1]
Owner process ID          00000000  Dev Prot                          S:.,O:.,G:.,W:
Reference count            2      Default buffer size                512
Total blocks               25000   Sectors per track                  33
Total cylinders            95      Tracks per cylinder                 8
Allocation class           3

Volume label               "TEST1"  Relative volume number              0
Cluster size               1      Transaction count                   1
Free blocks                 598    Maximum files allowed               13
Extend quantity            5      Mount count                         1
Mount status                System   Cache name                          "_$1$DIA0:XQPCACHE"
Extent cache size          64     Maximum blocks in extent cache      59
File ID cache size         64     Blocks currently in extent cache    56
Quota cache size           0      Maximum buffers in FCP cache        220

Volume status: subject to mount verification, file high-water marking, write-
through caching enabled.

$ SHOW DEVICE $3$VDA405:/FULL

```

Example 6-6 Cont'd on next page

**Example 6-6 (Cont.) Heterogeneous Striping**

Disk \$3\$VDA405: (SCOTTY), device type RZ23, is online, mounted, file-oriented device, shareable.

Error count	0	Operations completed	150
Owner process	" "	Owner UIC	[1,1]
Owner process ID	00000000	Dev Prot	S:,O:,G:,W:
Reference count	2	Default buffer size	512
Total blocks	25000	Sectors per track	33
Total cylinders	95	Tracks per cylinder	8
Allocation class	3		
Volume label	"TEST2"	Relative volume number	0
Cluster size	1	Transaction count	1
Free blocks	598	Maximum files allowed	13
Extend quantity	5	Mount count	1
Mount status	System	Cache name	"_\$1\$DIA0:XQPCACHE"
Extent cache size	64	Maximum blocks in extent cache	59
File ID cache size	64	Blocks currently in extent cache	57
Quota cache size	0	Maximum buffers in FCP cache	220

Volume status: subject to mount verification, file high-water marking, write-through caching enabled.

**\$ SHOW DEV STA100:/FULL**

Disk STA100:, device type SSTRIPED, is online, file-oriented device, shareable, available to cluster.

Error count	0	Operations completed	1
Owner process	" "	Owner UIC	[0,0]
Owner process ID	00000000	Dev Prot	S:RWED,O:RWED,G:RWED,W:RWED
Reference count	0	Default buffer size	512
Total blocks	48708	Sectors per track	33
Total cylinders	185	Tracks per cylinder	8

**\$ INITIALIZE STRIPESD STRIPE**

**\$ MOUNT/SYSTEM STRIPESD STRIPE**

%MOUNT-I-MOUNTED, STRIPE mounted on \_STA100:

**\$ SHOW DEVICE STRIPESD/FULL**

Disk STA100:, device type SSTRIPED, is online, mounted, file-oriented device, shareable, available to cluster.

Error count	0	Operations completed	64
Owner process	" "	Owner UIC	[ASCII,BEN21]
Owner process ID	00000000	Dev Prot	S:RWED,O:RWED,G:RWED,W:RWED
Reference count	1	Default buffer size	512
Total blocks	48708	Sectors per track	33
Total cylinders	185	Tracks per cylinder	8
Volume label	"STRIPED"	Relative volume number	0
Cluster size	1	Transaction count	1
Free blocks	48670	Maximum files allowed	12177
Extend quantity	5	Mount count	1
Mount status	System	Cache name	"_\$1\$DIA0:XQPCACHE"
Extent cache size	64	Maximum blocks in extent cache	4867
File ID cache size	64	Blocks currently in extent cache	0
Quota cache size	0	Maximum buffers in FCP cache	220

Volume status: subject to mount verification, file high-water marking, write-through caching enabled.

**Example 6-6 Cont'd on next page**

## SAMPLE APPLICATIONS

### Example 6-6 (Cont.) Heterogeneous Striping

---

```
$ STRIPE LIST STRIPESET
Configuration for stripe device _STA100:
  Local cluster access available
  Number of units:                2
  Units:
  $3$VDA400: TEST1 (SCOTTY) errcnt:0
  $3$VDA405: TEST2 (SCOTTY) errcnt:0
  Blocks/chunk:                   33
  Blocks/trip:                    66
  Overhead file system size:      627
  Largest unsegmented IO size (blks) 127
Statistics for stripe device STRIPESET
  Collection start time            17-MAY-1993 15:56:54.86
  Dynamic memory in use:          60024
  Maximum queue length:          1
  <= 1 chunk transfers:          55
  <= 1 trip transfers:           0
  > 1 trip transfers:            0
  Aligned transfers > 1 trip:    0
  Unaligned transfers > 1 trip:  0
  IOs split by member units:     0
  Read operations:               22
  Write operations:              33
  Blocks read:                   22
  Blocks written:                33
  Average number of blocks read:  1
  Average number of blocks written: 1
  Average Bytes/sec 0 IOs/sec    0.48
  Average queue depth             0.0
  Transfers blocked for no memory: 0
  Transfers blocked for no STRP:  0
Device is present on the following nodes:
  SCOTTY
$ DISMOUNT/NOUNLOAD STRIPESET
$ STRIPE UNBIND STRIPESET
%STRIPE-I-DEASSIGNED, deassigned system logical name STRIPESET
%STRIPE-I-DISMOUNTED, dismounted volume on unit _SCOTTY$VDA400:
%STRIPE-I-DISMOUNTED, dismounted volume on unit _SCOTTY$VDA405:
%STRIPE-S-UNBOUND, stripeset STRIPESET unbound
$ DISKMAKER DEACTIVATE TEST1/LOG
%VIRTUOSO-S-DEACTVSUCC, virtual disk TEST1 (_$3$VDA400:) deactivated
-VIRTUOSO-S-NORMAL, normal successful completion
$ DISKMAKER DEACTIVATE TEST2/LOG
%VIRTUOSO-S-DEACTVSUCC, virtual disk TEST2 (_$3$VDA405:) deactivated
-VIRTUOSO-S-NORMAL, normal successful completion
```

---

# A

---

## MESSAGES

This section describes all of the known condition codes that VIRTUOSO can produce.

**NOTE:** A secondary message that further explains the primary message you might encounter accompanies many VIRTUOSO messages. While ASCII has made every attempt to document the system errors which can occur, the secondary-error code can refer to almost any VMS error. However, in most cases, the error is self-explanatory.

---

### A.1 MESSAGES

ACTVERR, virtual disk *disk-name* not activated

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** This message indicates that an error occurred while attempting to activate a virtual disk. A secondary message that explains the problem in more detail accompanies this message.

**User Action:** Based upon the secondary message, ascertain the cause of the problem and correct it.

ACTVSUCC, virtual disk *disk-name (device-name)* activated

**Facility:** VIRTUOSO

**Severity:** Success

**Explanation:** This message indicates that your ACTIVATE command has succeeded. The virtual disk is now active.

**User Action:** None.

## MESSAGES

BSCNFLCT, backing store conflict(s) encountered

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** This message indicates that an attempt was made to activate a virtual disk with backing store(s), identical to that for another virtual disk.

**User Action:**

- 1 Correct the backing store specification or
- 2 Delete the existing virtual device which claims the backing store.
- 3 Retry the ACTIVATE command.

BSDNF, backing store directory not found

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** This message indicates that the directory, specified as part of one or more backing store(s) associated with this disk, could not be found.

**User Action:**

- 1 Verify the directory specified.
- 2 Reexecute the command.

BSFNF, backing store file not found

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** This message indicates that the backing store could not be found while reactivating the virtual disk.

**User Action:**

- 1 Verify your actions.
- 2 Reexecute the command.

BSPRV, insufficient privilege to access backing store file

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** This message indicates that VIRTUOSO could not access the backing store file(s) associated with the virtual disk due to insufficient privilege.

**User Action:**

- 1 Verify the backing store file protection and Access Control List.
- 2 Verify your privileges.
- 3 Reexecute the command.

BSREQ, backing store required

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** This message indicates that a backing store specification was not specified, and the type of virtual disk, you specified, requires one. For example, creating a disk-based virtual disk, requires that a backing store be specified.

**User Action:**

- 1 Specify a backing store.
- 2 Reexecute the command.

DEACTVERR, virtual disk *disk-name* not deactivated

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** Your DEACTIVATE command failed for the reason listed in the secondary message that accompanies this message. The most likely reasons are:

- 1 The device was not active to begin with.
- 2 The device must be dismounted and/or have a reference count of zero.

**User Action:** Correct the problem and try again.

## MESSAGES

DEACTVSUCC, virtual disk *disk-name (device-name)* deactivated

**Facility:** VIRTUOSO

**Severity:** Success

**Explanation:** Your virtual disk has been deactivated.

**User Action:** None

DEPCONERR, Error on CONNECT to Depository File

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** An error occurred during a \$CONNECT operation to the VIRTUOSO Depository file.

**User Action:** If you are under warranty or maintenance services, please contact ASCI for additional assistance.

DEPDELERR, Error on DELETE from Depository File

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** An error occurred during a \$DELETE operation to the VIRTUOSO Depository file.

**User Action:** If you are under warranty or maintenance services, please contact ASCI for additional assistance.

DEPGETERR, Error on GET from Depository File

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** An error occurred during a \$GET operation to the VIRTUOSO Depository file.

**User Action:** If you are under warranty or maintenance services, please contact ASCI for additional assistance.

DEPNOTFND, Error on OPEN of Depository File (file not found)

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** The VIRTUOSO Depository file could not be found.

**User Action:** Ensure that VIRTUOSO is properly started. The logical name VIRTUOSO\_PRODUCT must be defined. If the logical name VIRTUOSO\_DEPOSITORY is defined, it must point to an existing file.

DEPOPNERR, Error on OPEN of Depository File

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** The VIRTUOSO Depository file could not be opened. The most likely cause is one of insufficient privileges and/or quotas.

**User Action:**

- 1 Verify your actions.
- 2 Correct the problem.

DEPUPDERR, Error on UPDATE to Depository File

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** An error occurred during an \$UPDATE operation to the VIRTUOSO Depository file.

**User Action:** If you are under warranty or maintenance services, please contact ASCI for additional assistance.

DEQERR, Error dequeing lock

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** An error occurred during a \$DEQ operation.

**User Action:** If you are under warranty or maintenance services, please contact ASCI for additional assistance.

DEVALACT, device already active

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** You attempted to ACTIVATE a disk which was already active.

**User Action:**

- 1 Verify your actions.
- 2 Correct the problem.

## MESSAGES

DEVALINACT, device already inactive

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** You attempted to DEACTIVATE a disk which was not active.

**User Action:**

- 1 Verify your actions.
- 2 Correct the problem.

DEVINUSE, virtual device is still in use

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** This message indicates that an attempt was made to deactivate a virtual device that was still in use.

**User Action:** Ensure that the virtual disk is dismounted before trying to deactivate it.

DEVNOTACT, virtual device is not active

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** This message indicates that a VIRTUOSO command, other than ACTIVATE or DEACTIVATE, was issued to a virtual disk that was not active.

**User Action:** Issue the VIRTUOSO ACTIVATE command prior to any other commands.

DEVNOTFOR, backing store device is not mounted FOREIGN

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** You attempted to ACTIVATE a virtual disk that uses volume-backing stores. The volume-backing stores must be mounted FOREIGN prior to issuing the ACTIVATE command.

**User Action:**

- 1 Verify your actions.
- 2 Ensure the volume(s) are mounted foreign.

DEVNOTMNT, backing store device is not mounted

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** The device your backing store is located on is not mounted.

**User Action:** Mount the device so it is accessible to VIRTUOSO.

DEVNOTMNTF11, backing store device is not mounted FILES-11

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** The device your backing store is located on is not mounted as a Files-11 volume. In addition the volume must be mounted SYSTEM.

**User Action:**

- 1 Verify your actions.
- 2 Ensure the volume(s) are mounted FILES-11 System.

DRVNOTUP, VIRTUOSO Device Driver not loaded

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** This message indicates that the VIRTUOSO Device Driver is not loaded.

**User Action:** Ensure that the Device Driver is loaded and the product properly started, as described in Chapter 2, INSTALLING DiskMaker.

INACTIVE, virtual disk is inactive

**Facility:** VIRTUOSO

**Severity:** Informational

**Explanation:** The virtual disk is not active.

**User Action:** None.

INVBS, invalid backing store

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** This error is caused by specifying one of the following:

- Different kinds of backing stores

## MESSAGES

- Duplicate backing stores
- A volume-backing store for a memory disk
- A remote backing store for a memory disk
- A wild card for a backing store
- A remote backing store without the required device and directory
- A backing store instead of a disk

**User Action:**

- 1 Verify your actions.
- 2 Correct the problem.

INVBSNUM, invalid number of backing stores

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** This error is caused by one of the following reasons:

- You attempted to specify more than eight (8) backing stores.
- You didn't specify any backing stores for a disk-based device.
- You attempted to specify more than one (1) backing store for a memory disk.

INVCMD, invalid command received

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** This message indicates that an unknown or invalid command was issued to a VIRTUOSO component.

**User Action:** To ensure that you are entering a valid VIRTUOSO command, consult Chapter 4, COMMANDS

INVDEVTYPE, invalid device type

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** The device type you entered does not appear in VIRTUOSO's internal tables. See Table 3-1 for a complete list of acceptable device types you can enter.

**User Action:**

- 1 Verify your actions.

- 2 Correct the problem.

INVERASE, ERASE may only be specified with INITIALIZE=YES

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** Self-explanatory.

**User Action:**

- 1 Verify your actions.
- 2 Correct the problem.

INVFUNC, invalid function for virtual disk *disk-name*

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** An internal consistency check has occurred, indicating that the Command Language Definition does not match the VCLI program.

**User Action:** If you are under warranty or maintenance services, please contact ASCI for additional assistance.

INVINITFLGS, only 1 initialization bit may be set

**Facility:** VIRTUOSO

**Severity:** Fatal

**Explanation:** An internal consistency check has occurred.

**User Action:** If you are under warranty or maintenance services, please contact ASCI for additional assistance.

INVINTER, invalid interleave value

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** The interleave value specified is invalid. The interleave value must be a whole positive non-zero number.

**User Action:**

- 1 Verify your actions.
- 2 Correct the problem.

## MESSAGES

INVITEMCODE, invalid item code

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** An internal consistency check has occurred.

**User Action:** If you are under warranty or maintenance services, please contact ASCI for additional assistance.

INVQUALCOMBO, invalid combination of qualifiers

**Facility:** VIRTUOSO

**Severity:** Error

**User Action:**

- 1 Verify your actions.
- 2 Correct the problem.

**User Action:**

- 1 Verify your actions.
- 2 Correct the problem.

INVQUALVAL, invalid qualifier value

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** This error occurred for one of the following reasons:

- You specified an illegal device with the /DEVICE qualifier.
- You did not specify the INITIALIZE value as YES, NO, or IF.
- A qualifier required a value and no value was present.
- You omitted the required equal (=) sign in constructing the format of the qualifier and value.

**User Action:**

- 1 Verify your actions.
- 2 Correct the problem.

INVSIZGEOM, invalid or absent size or geometry

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** A disk size could not be computed for the following reasons:

- You omitted SIZE, TYPE, and GEOMETRY.
- You specified a generic type and omitted SIZE and GEOMETRY.
- You specified a SIZE equals zero (0).
- You specified a zero within a GEOMETRY command.
- You specified a START\_POSITION, greater than the backing store's size.

**User Action:** You must specify at least one of the following qualifiers: SIZE, TYPE, or GEOMETRY.

INVSTYPE, invalid device subtype specified

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** An internal consistency check has occurred.

**User Action:** If you are under warranty or maintenance services, please contact ASCI for additional assistance.

INVVDTYPE, invalid virtual disk type

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** An internal consistency check has occurred.

**User Action:** If you are under warranty or maintenance services, please contact ASCI for additional assistance.

INWIND, Unknown Window Name

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** You specified a window-name that MONITOR did not understand. Enter a valid window-name.

**User Action:**

- 1 Verify your actions.
- 2 Correct the problem.

## MESSAGES

LCKERR, Virtual Disk cannot be shared and is in use.

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** This message indicates that a virtual disk that was activated with sharing disallowed is in use. The device can be in use on your local system or within a VAXcluster.

**User Action:**

- 1 Verify your actions.
- 2 Correct the problem.

LISTVERR, virtual disk(s) not listed

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** A listing was not produced. A secondary message that explains the problem in more detail accompanies this message.

**User Action:**

- 1 Verify that the disk is either active (for a volatile-database listing) or known (for a permanent-database listing).
- 2 Correct the problem.

MISMATCH, version numbers do not match

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** This message indicates that all of the VIRTUOSO components are not at the same version level.

**User Action:**

- Reinstall the product from the original distribution media, or
- Reboot the system if you have just installed a product upgrade.

MODVERR, virtual disk *disk-name* not modified

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** This is a general message, indicating that your MODIFY command failed. A secondary message that explains the problem in more detail accompanies this message.

**User Action:**

- 1 Verify your actions.
- 2 Correct the problem.

MODVSUCC, virtual disk *disk-name (device-name)* modified

**Facility:** VIRTUOSO

**Severity:** Success

**Explanation:** Your MODIFY request succeeded.

**User Action:** None

NOBACKSTOR, no backing stores specified for this Virtual Disk

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** No backing stores were specified for a disk which requires one.

**User Action:**

- 1 Verify your actions.
- 2 Correct the problem.

NOPERMLIST, no virtual disks found in permanent database

**Facility:** VIRTUOSO

**Severity:** Warning

**Explanation:** A VIRTUOSO operation failed to find any virtual devices in the permanent database when using the LIST command.

**User Action:**

- 1 Verify your actions.

NOPRIV, no privilege for operation

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** A VIRTUOSO operation failed due to insufficient privileges.

**User Action:**

- 1 Verify your actions.
- 2 Correct the problem.

## MESSAGES

NORMAL, normal Successful completion

**Facility:** VIRTUOSO

**Severity:** Success

**Explanation:** General success message

**User Action:** None

NOTUP, VIRTUOSO is not up or no virtual devices found.

**Facility:** VIRTUOSO

**Severity:** Informational

**Explanation:** During a system shutdown, you invoked SYSSSTARTUP:VIRTUOSO\_SHUTDOWN.COM and it discovered that VIRTUOSO was not started.

**User Action:** None.

NOVOLALIST, no virtual disks found in volatile database

**Facility:** VIRTUOSO

**Severity:** Warning

**Explanation:** A VIRTUOSO operation failed to find any virtual devices in the volatile database when using the LIST command.

**User Action:**

1 Verify your actions.

PERMINCONS, internal consistency check failure in permanent database

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** An internal consistency check occurred while scanning the permanent database.

**User Action:** Save a copy of this file for inspection by ASCI. You need to restore a saved copy of this file for use by VIRTUOSO. If you are under warranty or maintenance services, please contact ASCI for additional assistance.

PERMMOD, permanent database modified

**Facility:** VIRTUOSO

**Severity:** Informational

**Explanation:** The command you entered was also successfully applied to the permanent database.

**User Action:** None.

QUALIGNRD, one or more qualifiers ignored

**Facility:** VIRTUOSO

**Severity:** Informational

**Explanation:** This message indicates that one or more qualifiers that were specified on the ACTIVATE command were ignored.

**User Action:**

- 1 Verify your actions.
- 2 Correct the problem.

QUALMISSING, missing required qualifier

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** You must specify /DISK when activating a disk for the first time (/INIT=YES).

**User Action:**

- 1 Verify your actions.
- 2 Correct the problem.

RECLCK, Record in Permanent Database is being modified. Try again later.

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** You attempted to ACTIVATE/INITIALIZE=YES, MODIFY/PERM or DEACTIVATE/PERM and the record in the permanent database was being modified by someone on the same or different system.

**User Action:**

- 1 Verify your actions.
- 2 Try again later.

## MESSAGES

SHUTDOWN\_NOPRIV, Insufficient privileges to shutdown VIRTUOSO

**Facility:** VIRTUOSO

**Severity:** Error

**Explanation:** You lacked privileges to invoke the VIRTUOSO Shutdown procedure. This message is always accompanied by SHUTDOWN\_PRIV which more fully explains the necessary privileges.

**User Action:**

- 1 Verify your privileges.
- 2 Correct the problem.

SHUTDOWN\_PRIV, requires *privilege\_list* privileges.

**Facility:** VIRTUOSO

**Severity:** Informational

**Explanation:** This message describes the privileges necessary to execute the VIRTUOSO Shutdown procedure.

**User Action:**

- 1 Verify your privileges.
- 2 Correct the problem.

SRVTRM, unexpected server process termination message

**Facility:** VIRTUOSO

**Severity:** Fatal

**Explanation:** An unexpected error occurred while starting the VIRTUOSO Disk Server process. The most likely cause is insufficient privileges or quotas.

**User Action:**

- 1 Verify your actions.
- 2 Correct the problem.

START\_SHUTDOWN, VIRTUOSO Shutdown Started.

**Facility:** VIRTUOSO

**Severity:** Informational

**Explanation:** The VIRTUOSO Shutdown procedure has begun.

**User Action:** None.

---

# GLOSSARY

The expressions in this GLOSSARY are alphabetically arranged, strictly by the letters themselves, regardless of spaces, underscores, quotation marks, brackets, slashes, or special characters. When identically spelled, capitalized expressions precede those in lower-case letters, and those expressions, preceded by slashes, precede those without. In addition acronyms are defined only by the spelled-out names they represent. For a full definition look under the complete name of the respective file, service, or subsystem.

## A

**ACTIVATE command:** A VIRTUOSO command that allows you to create or re-create a virtual disk with the name and characteristics you want

**ACP:** *see Ancillary Control Process*

**Active:** Referring to a virtual disk that appears in the volatile database

**Allocation class:** A number from zero to 255 that implicitly references one or more disk controllers

**Ancillary Control Process:** A process that acts as an interface between user software and an I/O driver, providing functions, supplementary to those performed in the driver, such as file and directory management

## B

**Backing store:** The nonvolatile representation of a virtual disk's contents

## C

**Clusterable:** A disk device, having a direct, physical path from multiple OpenVMS nodes

## D

**DEACTIVATE command:** A VIRTUOSO command that allows you to remove a virtual disk from the system and optionally the VIRTUOSO database

**Device type:** A term referring to the disk model

**Direct path:** A path from the system to the device that does not require another system to process I/O requests

## GLOSSARY

**Disk-based virtual disk:** A software-generated disk device that uses an existing disk drive or some portion of a real-disk drive as its working area

**Disk striping:** The interleaving of a disk's logical space over two or more real-disk drives

### E

**Error Simulation :** A facility that allows you to simulate various hardware errors

### F

**Feature:** A facility that provides value

**File-backed virtual disk:** A type of disk-based virtual disk, residing in one or more FILES-11 files on a mounted volume

### G

**Geometry:** A term, relating to a disk's topology, as expressed in cylinders, tracks, and sectors

### H

**Host Based:** Refers to shadowing or striping where the logic is processed by an OpenVMS node, not the disk controller. OpenVMS Volume Shadowing **Phase II** is host based

### I

**Initial size:** The initial number of pages in a cache

**Interleave factor:** A value, expressed in physical blocks, representing the unit of storage that VIRTUOSO uses, when creating a stripe set, to spread a virtual disk's logical space over multiple physical drives

**Interleaving:** The alternating use of physical blocks on two or more disks at the same time, virtually as though they were one disk

### K

**Known:** Referring to a virtual disk that appears in the permanent database

### L

**LIST command:** A VIRTUOSO command that allows you to display a list of all your active/known virtual disks and their attributes

**Local only:** A device that *only* a single node can directly access

**LRU:** Least-recently-used

## M

**Maximum size:** A number that represents the greatest allowable size in pages for a dynamic cache

**Medium offline:** A condition that indicates a disk drive is not physically available to respond to requests

**Medium write-locked errors:** A condition that indicates that write operations are not allowed

**Memory-based virtual disk:** A virtual disk that uses an area of physical or paged memory as its working area and treats this area as if it were a disk drive

**MODIFY command:** A VIRTUOSO command that allows you to modify your virtual disk's characteristics

**MONITOR command:** A VIRTUOSO command that allows you to monitor the metrics of all active or specific virtual disk(s) on the same system

## N

**NETWORK disk:** A type of disk-based virtual disk, residing in a FILES-11 file or Volume on a remote DECnet node

**Number of revolutions:** *See revolution.*

## P

**Paged memory virtual disk:** A virtual disk that uses a portion of memory within the space of the process, mapped to a section that serves as its backing store

**Parity errors:** A condition that indicates data reliability is in question

**Permanent database:** A nonvolatile file, containing information on all known virtual disks

**Physical memory virtual disk:** A virtual disk that uses a portion of nonpaged memory as its work area

**Position-name:** A parameter that specifies the location on the terminal, where you want the window to appear

## GLOSSARY

**Producers, The:** A 1968 Mel Brook's movie, starring Zero Mostel and Gene Wilder in which the main characters sell more than 100% ownership in a play (Springtime for Hitler)

### R

**Refresh interval:** A specified span of time between the Monitor program's automatic updates

**REPORT command:** A VIRTUOSO command that allows you to create a report of your disk(s), using the data you've collected in a file with the COLLECT command

**Revolution:** A term, referring to an I/O request's going through the entire range of backing stores to satisfy this request (with a greater-than-1 revolution, indicating that you are generating at least two I/O's to a single backing store)

### S

**Shadowing:** A method to protect the integrity and availability of disk data by maintaining multiple copies on separate physical media

**Shadow Set:** A group of disks (real and/or virtual) that are maintained with identical updates, so that they all contain the same data

**Shadow Member:** One of the disks in a *shadow set*

**Size:** A value, representing the usable space of a virtual disk (in blocks)

**Stripeset:** A term, referring to the collection of backing stores for a striped virtual disk

### V

**Virtual disk:** A software-generated and software-maintained representation of a disk-drive device

**Virtual-disk name:** A unique name you assign a disk, consisting of from one to 31 characters

**VIRTUOSO Command program:** (VCLI) A component that serves as the user-interface program for the VIRTUOSO system

**VIRTUOSO Data Collector:** (VDC) A facility that records specified classes of historical statistics (caching, device, file, and system data) in a log file for subsequent analysis by the Data Reporter

**VIRTUOSO Data Reporter:** (VDR) A facility that selects the raw data from the data-collection file, calculates it, formats it, and uses it to produce a report

**VIRTUOSO Device Driver:** A component that handles all I/O requests made to a virtual disk and contains a collection of kernel-mode routines, used by other VIRTUOSO components

**VIRTUOSO Disk Server:** (VDS) A component that activates, deactivates, and/or initializes a virtual disk and all the underlying-data structures and can take an active role in handling I/O requests

**VIRTUOSO Monitor program:** A facility that provides a real-time interface into the activity of a particular virtual disk or a summary window on a subset of active virtual disks

**Volatile database:** A collective group of data structures that are allocated, when a disk is activated and lost, when the system is rebooted

**VOLUME disk:** A type of disk-based, virtual disk that uses a whole or partial volume(s)

### W

**Window name:** A parameter that specifies the class of statistics you want to monitor

**Writeback interval:** A span of time, expressed in seconds from zero to 600, used to write the modified contents of a memory-based, virtual disk to its backing store

**Working area:** The operative representation of a virtual disk, such as physical or paged memory and/or disk memory

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