COMPAQ

Software Product Description

PRODUCT NAME: Volume Shadowing for OpenVMS, Version 7.3
SPD 27.29.15

Note:

This is the Software Product Description (SPD) for the following two products:

- Volume Shadowing for OpenVMS Alpha
- Volume Shadowing for OpenVMS VAX

Except where specifically noted, the features described in this SPD apply to both products. The license and part number information is architecture specific. Please refer to the Ordering Information section of this SPD for further details.

DESCRIPTION

Volume Shadowing for OpenVMS is a System Integrated Product (SIP) that runs on the Alpha and VAX families of processors. Volume Shadowing for OpenVMS implements a RAID Level 1 storage strategy that provides high data availability for disk devices by preventing data loss resulting from media deterioration or from controller or device failure. This strategy also prevents storage subsystem component failures from interrupting system or application operations.

Volume shadowing, sometimes referred to as disk mirroring, maintains redundant copies of data on a collection of disks (one copy per disk) called a shadow set. Shadow sets consist of one, two, or three compatible disk volumes or shadow set members. This duplication of data provides enhanced data availability; if data is recorded on multiple disk volumes, it remains accessible if one volume becomes unavailable. Disk read and write operations continue transparently with the remaining members of the shadow set.

Because a shadow set is made up of multiple disks containing the same data, the Volume Shadowing for OpenVMS software can read data from any member of the shadow set. For each read operation, the Volume Shadowing for OpenVMS software determines which disk to read from using an algorithm that maximizes performance. Volume Shadowing for OpenVMS ensures that disk write operations are duplicated on all shadow set members. For maximum performance, Volume Shadowing for OpenVMS ensures that shadow set write operations are issued in parallel to shadow set members.

If some data on a shadow set member becomes unreadable, the shadowing software can read the data from another available member. Additionally, with DIGITAL Storage Architecture (DSA) disks, the member with unreadable data can be repaired by rewriting the data to viable, replacement areas provided on each disk. Small Computer Systems Interface (SCSI) devices certified by Compaq for use with volume shadowing support data repair. For other SCSI devices, replacement and repair algorithms are device specific.

OpenVMS Alpha and VAX system disks, Files–11 On-Disk Structure 2 (ODS-2), and Files–11 On-Disk Structure 5 (ODS-5) data disks that are certified by Compaq can be volume shadowed. For more information, refer to the Hardware Requirements section of this SPD.

Volume Shadowing for OpenVMS implements a host-based (phase II) approach to shadowing disk devices. Previous versions of Volume Shadowing for OpenVMS VAX also implemented a controller-based (phase I) approach to disk shadowing. Phase I shadowing is no longer available or supported.

For the purposes of this document, the term system refers to a single Alpha or VAX computer that contains

one or more processors. A system can be a standalone system or a member of an OpenVMS Cluster system. The term OpenVMS Cluster refers to a cluster that may contain a mix of Alpha systems and VAX systems configured together.

Volume Shadowing for OpenVMS supports clusterwide shadowing of Compaq Alpha SCSI, DSA, and Fibre Channel disk storage systems. Specifically, this implementation supports:

- HSC, HSD, HSF, HSG, HSJ, HSZ, and K.SCSI controlled disks
- All DSA, Fibre Channel, and Compaq Alpha SCSI adapters and controllers that are locally connected to a system
- RF-series controllers and disks connected to the Digital Storage Systems Interconnect (DSSI)

Volume Shadowing also supports OpenVMS MSCP served DSA, Fibre Channel, and Compaq Alpha SCSI disks located within any supported OpenVMS Cluster configuration. Compaq DECram virtual disks can be volume shadowed only with other DECram virtual disks.

Volume Shadowing for OpenVMS allows shadowing of disks that are accessible from the system on which the shadowing software is installed. An OpenVMS system parameter enables shadowing at system initialization.

Configuration Overview

Volume Shadowing for OpenVMS requires a minimum of one system, a disk controller, and a disk unit that is DSA compliant, Fibre Channel compliant, or SCSI compliant. Although only one disk is required for a shadow set, two or more disks are required to maintain multiple copies of the same data. This protects against failure or deterioration of a single volume.

Using two controllers provides a further guarantee of data availability in the event that a single controller fails. OpenVMS Cluster systems can be configured with multiple systems, interconnects, controllers, and disks; the resulting configurations can provide extremely high data availability.

Shadow Set Membership

A shadow set can have one, two, or three members. If one member of a two-member shadow set fails, the shadow set can continue operation with the remaining member.

Shadow set members can be added to or removed from the shadow set without affecting system or user operation. A disk can be removed from the shadow set either by operator command or automatically by the shadowing software. An inoperative disk is removed from the shadow set automatically; operator intervention is not required.

Adding a disk to a shadow set requires an explicit operator command. The shadowing software ensures that data on the newly added disk is made consistent with the other members by means of a copy operation. Full read and write access to the shadow set continues while the copy operation is in progress.

Transparency to the End User

To users and application programs, Volume Shadowing for OpenVMS transparently combines the physical members of a given shadow set into a single virtual unit. The shadow set virtual unit acts as a single disk. User or application program modifications are not necessary to propagate write data to shadow set members; Volume Shadowing for OpenVMS software automatically propagates the data to all shadow set members. Similarly, user and application read operations to the virtual disk are transparently routed to the optimal physical shadow set member.

Volume Shadowing for OpenVMS is invisible to application programs and users. All commands and programming language features that address data on nonshadowed disks can be used unchanged to address data on shadowed disks.

Minicopy and Backup

The minicopy operation, new for Volume Shadowing Version 7.3, is a streamlined copy operation. Minicopy is designed to be used in place of a copy operation when a shadow set member is returned to a shadow set. When a member has been removed from a shadow set (for example, to back up that member), a write bitmap tracks the changes that are made to the shadow set in the member's absence. With minicopy, you no longer need to remove the entire virtual unit (shadow set) to back up data. When the member is returned to the shadow set, the write bitmap is used to direct the minicopy operation. While the minicopy operation takes place, the application can continue to read and write to the shadow set.

The new minicopy feature and its enabling technology, write bitmap, are fully implemented for OpenVMS Alpha systems only. OpenVMS VAX nodes can write to shadow sets which use this feature, but they can neither create master write bitmaps nor manage them with DCL commands. In a mixed-version cluster, remedial Volume Shadowing kits are required for systems running earlier versions of OpenVMS in order to use minicopy.

Multiple-Site Clusters

OpenVMS Version 7.3 introduces new command qualifiers for the DCL commands DISMOUNT and SET for use with Volume Shadowing. These new command qualifiers provide disaster-tolerant support for multiple-site OpenVMS Cluster systems. Designed primarily for multiple-site clusters that use Fibre Channel as a site-to-site interconnect, these command qualifiers can be used in other configurations as well. See more details in the *Volume Shadowing for OpenVMS* manual.

Compatibility

Volume Shadowing for OpenVMS Alpha is compatible and can operate with Volume Shadowing for OpenVMS VAX. The use of both products in a mixed-architecture OpenVMS Cluster (Alpha and VAX machines clustered together) can enable the sharing of data disks between Alpha and VAX systems. However, a single system disk cannot be shared for booting between Alpha and VAX systems in an OpenVMS Cluster because booting is architecture specific.

Configuration Limits

Volume Shadowing for OpenVMS supports a maximum of 500 disks in multiple-member (2- or 3-member) shadow sets on a single OpenVMS Cluster. Up to 10,000 single-member shadow sets are allowed on the same OpenVMS Cluster or standalone system. These limits are independent of controller and device type.

Configuration Restrictions

Controller-based Volume Shadowing for OpenVMS VAX is no longer available.

All members of a shadow set must have the same number of physical blocks. For example, two RA92 disk drives could form a shadow set. An RZ28 and an RZ28B disk drive could also form a shadow set. However, a 6 gigabyte disk and an 8 gigabyte disk could not be members of the same shadow set.

Shadow set members cannot have hardware write protection enabled. Hardware write protection stops volume shadowing software from maintaining identical volumes.

Volume Shadowing for OpenVMS does not support shadow sets mounted with the /FOREIGN qualifier.

Volume Shadowing for OpenVMS provides support for Compaq SCSI disks and controllers on Alpha systems. Shadowing can also be used with third-party SCSI disks that have READL (read long) and WRITEL (write long) commands implemented and that use the OpenVMS SCSI disk driver. Features are restricted when SCSI disks that do not support READL and WRITEL are shadowed; disk bad-block errors resulting from the use of these disks can cause members to be removed from the shadow set.

HARDWARE REQUIREMENTS

Volume Shadowing for OpenVMS does not depend on specific hardware to operate. All shadowing functions can be performed on any supported system. Members of a shadow set can be located on any single system or anywhere in an OpenVMS Cluster system. There are no restrictions on the location of shadow set members beyond the valid disk configurations defined in the OpenVMS Operating System Software Product Description (SPD 25.01.xx) and the OpenVMS Cluster Software Software Product Description (SPD 29.78.xx).

Disk Controller Support

Volume Shadowing for OpenVMS supports all disk controllers listed as supported in the OpenVMS Operating System Software Product Description (SPD 25.01.xx), with the exception of VAX SCSI controllers.

Disk Drive Support

Volume Shadowing for OpenVMS supports all disk drives listed as supported in the OpenVMS Operating System Software Product Description (SPD 25.01.xx), with the following constraints and exceptions:

- RF35 and RF73 disk devices must use at minimum firmware version T392F.
- RF36 and RF74 disk devices must use at minimum firmware version V427P.
- KDM70 controllers must be at minimum microcode revision 4.3.
- Disks attached to a local VAX SCSI controller on VAX 4000 and VAX 3000 series systems are not supported.

OpenVMS Cluster Environment

Volume Shadowing for OpenVMS is fully supported in an OpenVMS Cluster when installed on any valid and licensed configuration. Volume Shadowing for OpenVMS allows shadowing of disks that are locally connected to the Alpha or VAX system on which this software is installed. In addition, Volume Shadowing for OpenVMS allows a user on an OpenVMS system to shadow disks connected to other Alpha or VAX systems within the OpenVMS Cluster.

An OpenVMS Cluster quorum disk cannot be shadowed.

For additional information, refer to the OpenVMS Cluster Software Software Product Description (SPD 29.78.xx).

SOFTWARE REQUIREMENTS

Volume Shadowing for OpenVMS Version 7.3 is a System Integrated Product that requires OpenVMS Version 7.3.

For additional information, and minimum software and firmware revisions for storage subsystems, refer to the OpenVMS Operating System Software Product Description (SPD 25.01.xx).

OPTIONAL SOFTWARE

Optional products that may be useful when running Volume Shadowing for OpenVMS include:

- OpenVMS Cluster Software (SPD 29.78.xx)
- Compaq DECram for OpenVMS (SPD 34.26.xx)
- Compaq RAID Software for OpenVMS (SPD 46.49.xx)

GROWTH CONSIDERATIONS

The minimum hardware and software requirements for any future version of this product may be different from the requirements for the current version.

DISTRIBUTION AND INSTALLATION

Volume Shadowing for OpenVMS Version 7.3 is a System Integrated Product that is distributed and installed with the OpenVMS operating system Version 7.3. Documentation for Volume Shadowing is also included with OpenVMS. Licenses and services are available separately as follows:

ORDERING INFORMATION

For Volume Shadowing on OpenVMS Alpha:

- Software Capacity Licenses: QL-2A1A*-**
- Software Per-Disk Licenses: QL-2A1AA-3B
- Software Product Services: QT-2A1A*-**

For Volume Shadowing on OpenVMS VAX:

- Software Capacity Licenses: QL-AB2A*-**
- Software Per-Disk Licenses: QL-2A1AA-3B
- Software Product Services: QT-AB2A*-**

* Denotes variant fields. For additional information about available licenses, services, and media, refer to the appropriate price list.

SOFTWARE LICENSING

This software is furnished under the licensing provisions of Compaq Computer Corporation's Standard Terms and Conditions.

License Management Facility Support

Volume Shadowing for OpenVMS supports the OpenVMS License Management Facility (LMF).

Licenses for Volume Shadowing for OpenVMS are sold on either a capacity or a per-disk basis.

A capacity license allows a varying number of disks to be shadowed on a single system, up to the maximum specified in the Configuration Limits section. When using a capacity licensing scheme in an OpenVMS Cluster, every system in an OpenVMS Cluster that mounts a shadow set must have a properly sized Volume Shadowing for OpenVMS capacity license installed.

Alternatively, licenses are available on a per-disk basis using concurrent user licensing. With this type of licensing, one per-disk license is required for every disk that may become a member of a shadow set. The per-disk license is attached to a particular disk during the MOUNT process. That disk can then be included in a shadow set by any OpenVMS Alpha or VAX member of the OpenVMS Cluster with access to that disk.

Both methods of licensing can coexist in a single OpenVMS Cluster.

For more information about the License Management Facility, refer to the OpenVMS Operating System Software Product Description (SPD 25.01.xx) or the *OpenVMS License Management Utility Manual* in the OpenVMS documentation set.

For more information about Compaq's licensing terms and policies, contact your local Compaq office.

SOFTWARE PRODUCT SERVICES

A variety of service options are available from Compaq. For more information, contact your local Compaq office.

SOFTWARE WARRANTY

Warranty for this software product is provided by Compaq with the purchase of a license for the product as defined in the Software Warranty Addendum of this SPD.

The previous information is valid at time of release. Please contact your local Compaq office for the most up-to-date information.

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