

# Veritas™ File System Administrator's Guide

HP-UX 11i v3

5.1 Service Pack 1



# Veritas File System Administrator's Guide

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# Introducing Veritas File System

This chapter includes the following topics:

- [About Veritas File System](#)
- [Veritas File System features](#)
- [Veritas File System performance enhancements](#)
- [Using Veritas File System](#)

## About Veritas File System

A file system is simply a method for storing and organizing computer files and the data they contain to make it easy to find and access them. More formally, a file system is a set of abstract data types (such as metadata) that are implemented for the storage, hierarchical organization, manipulation, navigation, access, and retrieval of data.

Veritas File System (VxFS) was the first commercial journaling file system. With journaling, metadata changes are first written to a log (or journal) then to disk. Since changes do not need to be written in multiple places, throughput is much faster as the metadata is written asynchronously.

VxFS is also an extent-based, intent logging file system. VxFS is designed for use in operating environments that require high performance and availability and deal with large amounts of data.

VxFS major components include:

- Logging
- Extents

- File system disk layouts

## Logging

A key aspect of any file system is how to recover if a system crash occurs. Earlier methods required a time-consuming scan of the entire file system. A better solution is the method of logging (or journaling) the metadata of files.

VxFS logs new attribute information into a reserved area of the file system, whenever file system changes occur. The file system writes the actual data to disk only after the write of the metadata to the log is complete. If and when a system crash occurs, the system recovery code analyzes the metadata log and tries to clean up only those files. Without logging, a file system check (`fsck`) must look at all of the metadata.

Intent logging minimizes system downtime after abnormal shutdowns by logging file system transactions. When the system is halted unexpectedly, this log can be replayed and outstanding transactions completed. The check and repair time for file systems can be reduced to a few seconds, regardless of the file system size.

By default, VxFS file systems log file transactions before they are committed to disk, reducing time spent checking and repairing file systems after the system is halted unexpectedly.

## Extents

An extent is a contiguous area of storage in a computer file system, reserved for a file. When starting to write to a file, a whole extent is allocated. When writing to the file again, the data continues where the previous write left off. This reduces or eliminates file fragmentation.

Since VxFS is an extent-based file system, addressing is done through extents (which can consist of multiple blocks) rather than in single-block segments. Extents can therefore enhance file system throughput.

## File system disk layouts

The disk layout is the way file system information is stored on disk. On VxFS, several disk layout versions, numbered 1 through 8, were created to support various new features and specific UNIX environments. Currently, only the Version 5, 6, 7, and 8 disk layouts can be created, and only the Version 4, 5, 6, 7, and 8 disk layouts can be mounted.



# Veritas File System features

VxFS includes the following features:

- **Extent-based allocation**  
Extents allow disk I/O to take place in units of multiple blocks if storage is allocated in consecutive blocks.
- **Extent attributes**  
Extent attributes are the extent allocation policies associated with a file.
- **Fast file system recovery**  
VxFS provides fast recovery of a file system from system failure.
- **Extended mount options**  
The VxFS file system supports extended `mount` options to specify enhanced data integrity modes, enhanced performance modes, temporary file system modes, improved synchronous writes, and large file sizes.
- **Enhanced performance mode**  
VxFS provides mount options to improve performance.
- **Large files and file systems support**  
VxFS supports files larger than two gigabytes and large file systems up to 256 terabytes.
- **Extra Big File Systems**  
VxFS supports file systems greater than 32 terabytes. Extra Big File Systems functionality is separately licensed.  
See the HP OnLineJFS documentation.
- **Storage Checkpoints**  
Backup and restore applications can leverage Storage Checkpoints, a disk- and I/O-efficient copying technology for creating periodic frozen images of a file system.  
See the *Veritas Storage Foundation Advanced Features Administrator's Guide*.
- **VxFS file snapshots**  
A VxFS file snapshot is a space-optimized copy of a file in the same name space, stored in the same file system.  
See the *Veritas Storage Foundation Advanced Features Administrator's Guide*.
- **Quotas**  
VxFS supports quotas, which allocate per-user quotas and limit the use of two principal resources: files and data blocks.
- **Cluster File System**

Clustered file systems are an extension of VxFS that support concurrent direct media access from multiple systems.

- Improved database performance
- Cross-platform data sharing  
Cross-platform data sharing allows data to be serially shared among heterogeneous systems where each system has direct access to the physical devices that hold the data.  
See the *Veritas Storage Foundation Advanced Features Administrator's Guide*.
- File Change Log  
The VxFS File Change Log tracks changes to files and directories in a file system.
- Multi-volume support  
The multi-volume support feature allows several volumes to be represented by a single logical object.
- SmartTier  
The SmartTier option allows you to configure policies that automatically relocate files from one volume to another, or relocate files by running file relocation commands, which can improve performance for applications that access specific types of files.  
See the *Veritas Storage Foundation Advanced Features Administrator's Guide*.

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**Note:** In the previous VxFS 5.x releases, SmartTier was known as Dynamic Storage Tiering.

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- Storage Foundation Thin Reclamation  
The Thin Reclamation feature allows you to release free data blocks of a VxFS file system to the free storage pool of a Thin Storage LUN. This feature is only supported on file systems mounted on a VxVM volume.  
See the *Veritas Storage Foundation Advanced Features Administrator's Guide*.
- Partitioned directories  
The partitioned directories feature improves the directory performance of file systems. This feature operates only on disk layout Version 8 or later file systems.

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**Note:** VxFS supports all HFS file system features and facilities except for the linking, removing, or renaming of "." and ".." directory entries. Such operations may disrupt file system sanity.

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## Extent-based allocation

Disk space is allocated in 1024-byte sectors to form logical blocks. VxFS supports logical block sizes of 1024, 2048, 4096, and 8192 bytes. The default block size is the larger of 1K or the device's hardware sector size for file system sizes of up to 1 TB, and 8K for file system sizes 1 TB or larger.

An extent is defined as one or more adjacent blocks of data within the file system. An extent is presented as an address-length pair, which identifies the starting block address and the length of the extent (in file system or logical blocks). VxFS allocates storage in groups of extents rather than a block at a time.

Extents allow disk I/O to take place in units of multiple blocks if storage is allocated in consecutive blocks. For sequential I/O, multiple block operations are considerably faster than block-at-a-time operations; almost all disk drives accept I/O operations of multiple blocks.

Extent allocation only slightly alters the interpretation of addressed blocks from the inode structure compared to block based inodes. A VxFS inode references 10 direct extents, each of which are pairs of starting block addresses and lengths in blocks.

The VxFS inode supports different types of extents, namely `ext4` and `typed`. Inodes with `ext4` extents also point to two indirect address extents, which contain the addresses of first and second extents:

first	Used for single indirection. Each entry in the extent indicates the starting block number of an indirect data extent
second	Used for double indirection. Each entry in the extent indicates the starting block number of a single indirect address extent.

Each indirect address extent is 8K long and contains 2048 entries. All indirect data extents for a file must be the same size; this size is set when the first indirect data extent is allocated and stored in the inode. Directory inodes always use an 8K indirect data extent size. By default, regular file inodes also use an 8K indirect data extent size that can be altered with `vxtune fs`; these inodes allocate the indirect data extents in clusters to simulate larger extents.

### Typed extents

VxFS has an inode block map organization for indirect extents known as `typed` extents. Each entry in the block map has a typed descriptor record containing a type, offset, starting block, and number of blocks.

Indirect and data extents use this format to identify logical file offsets and physical disk locations of any given extent.

The extent descriptor fields are defined as follows:

type	Identifies uniquely an extent descriptor record and defines the record's length and format.
offset	Represents the logical file offset in blocks for a given descriptor. Used to optimize lookups and eliminate hole descriptor entries.
starting block	Is the starting file system block of the extent.
number of blocks	Is the number of contiguous blocks in the extent.

Typed extents have the following characteristics:

- Indirect address blocks are fully typed and may have variable lengths up to a maximum and optimum size of 8K. On a fragmented file system, indirect extents may be smaller than 8K depending on space availability. VxFS always tries to obtain 8K indirect extents but resorts to smaller indirects if necessary.
- Indirect data extents are variable in size to allow files to allocate large, contiguous extents and take full advantage of optimized I/O in VxFS.
- Holes in sparse files require no storage and are eliminated by typed records. A hole is determined by adding the offset and length of a descriptor and comparing the result with the offset of the next record.
- While there are no limits on the levels of indirection, lower levels are expected in this format since data extents have variable lengths.
- This format uses a type indicator that determines its record format and content and accommodates new requirements and functionality for future types.

The current typed format is used on regular files and directories only when indirection is needed. Typed records are longer than the previous format and require less direct entries in the inode. Newly created files start out using the old format, which allows for ten direct extents in the inode. The inode's block map is converted to the typed format when indirection is needed to offer the advantages of both formats.

## Extent attributes

VxFS allocates disk space to files in groups of one or more extents. VxFS also allows applications to control some aspects of the extent allocation. Extent attributes are the extent allocation policies associated with a file.

The `setext` and `getext` commands allow the administrator to set or view extent attributes associated with a file, as well as to preallocate space for a file.

See the `setext(1M)` and `getext(1M)` manual pages.

The `vxtunefs` command allows the administrator to set or view the default indirect data extent size of a file system.

See the `vxtunefs(1M)` manual page.

## Fast file system recovery

Most file systems rely on full structural verification by the `fsck` utility as the only means to recover from a system failure. For large disk configurations, this involves a time-consuming process of checking the entire structure, verifying that the file system is intact, and correcting any inconsistencies. VxFS provides fast recovery with the VxFS intent log and VxFS intent log resizing features.

### VxFS intent log

VxFS reduces system failure recovery times by tracking file system activity in the VxFS intent log. This feature records pending changes to the file system structure in a circular intent log. The intent log recovery feature is not readily apparent to users or a system administrator except during a system failure. During system failure recovery, the VxFS `fsck` utility performs an intent log replay, which scans the intent log and nullifies or completes file system operations that were active when the system failed. The file system can then be mounted without completing a full structural check of the entire file system. Replaying the intent log may not completely recover the damaged file system structure if there was a disk hardware failure; hardware problems may require a complete system check using the `fsck` utility provided with VxFS.

The `mount` command automatically runs the VxFS `fsck` command to perform an intent log replay if the mount command detects a dirty log in the file system. This functionality is only supported on a file system mounted on a Veritas Volume Manager (VxVM) volume, and is supported on cluster file systems.

See [“The log option and data integrity”](#) on page 23.

### VxFS intent log resizing

The VxFS intent log is allocated when the file system is first created. The size of the intent log is based on the size of the file system—the larger the file system, the larger the intent log. The maximum default intent log size for disk layout Versions 5 and 6 is 16 megabytes. The maximum default intent log size for disk layout Version 7 and 8 is 64 megabytes.

With the Version 6, 7, and 8 disk layouts, you can dynamically increase or decrease the intent log size using the `logsize` option of the `fsadm` command. Increasing the size of the intent log can improve system performance because it reduces the

number of times the log wraps around. However, increasing the intent log size can lead to greater times required for a log replay if there is a system failure.

---

**Note:** Inappropriate sizing of the intent log can have a negative impact on system performance.

---

See the `mkfs_vxfs(1M)` and the `fsadm_vxfs(1M)` manual pages.

## Extended mount options

The VxFS file system provides the following enhancements to the `mount` command:

- Enhanced data integrity modes
- Enhanced performance mode
- Temporary file system mode
- Improved synchronous writes
- Support for large file sizes

See [“Mounting a VxFS file system”](#) on page 36.

See the `mount_vxfs(1M)` manual page.

## Enhanced data integrity modes

For most UNIX file systems, including VxFS, the default mode for writing to a file is delayed, or buffered, meaning that the data to be written is copied to the file system cache and later flushed to disk.

A delayed write provides much better performance than synchronously writing the data to disk. However, in the event of a system failure, data written shortly before the failure may be lost since it was not flushed to disk. In addition, if space was allocated to the file as part of the write request, and the corresponding data was not flushed to disk before the system failure occurred, uninitialized data can appear in the file.

For the most common type of write, delayed extending writes (a delayed write that increases the file size), VxFS avoids the problem of uninitialized data appearing in the file by waiting until the data has been flushed to disk before updating the new file size to disk. If a system failure occurs before the data has been flushed to disk, the file size has not yet been updated to be uninitialized data, thus no uninitialized data appears in the file. The unused blocks that were allocated are reclaimed.

## The blkclear option and data integrity

In environments where performance is more important than absolute data integrity, the preceding situation is not of great concern. However, VxFS supports environments that emphasize data integrity by providing the `mount -o blkclear` option that ensures uninitialized data does not appear in a file.

## The closesync option and data integrity

VxFS provides the `mount -o mincache=closesync` option, which is useful in desktop environments with users who are likely to shut off the power on machines without halting them first. In `closesync` mode, only files that are written during the system crash or shutdown can lose data. Any changes to a file are flushed to disk when the file is closed.

## The log option and data integrity

File systems are typically asynchronous in that structural changes to the file system are not immediately written to disk, which provides better performance. However, recent changes made to a system can be lost if a system failure occurs. Specifically, attribute changes to files and recently created files may disappear.

The `mount -o log` intent logging option guarantees that all structural changes to the file system are logged to disk before the system call returns to the application. With this option, the `rename(2)` system call flushes the source file to disk to guarantee the persistence of the file data before renaming it. The `rename()` call is also guaranteed to be persistent when the system call returns. The changes to file system data and metadata caused by the `fsync(2)` and `fdatasync(2)` system calls are guaranteed to be persistent once the calls return.

# Enhanced performance mode

VxFS has a mount option that improves performance: `delaylog`.

## The delaylog option and enhanced performance

The default VxFS logging mode, `mount -o delaylog`, increases performance by delaying the logging of some structural changes. However, `delaylog` does not provide the equivalent data integrity as the previously described modes because recent changes may be lost during a system failure. This option provides at least the same level of data accuracy that traditional UNIX file systems provide for system failures, along with fast file system recovery.

## Temporary file system mode

On most UNIX systems, temporary file system directories, such as `/tmp` and `/usr/tmp`, often hold files that do not need to be retained when the system reboots. The underlying file system does not need to maintain a high degree of structural integrity for these temporary directories. VxFS provides the `mount -o tmplog` option, which allows the user to achieve higher performance on temporary file systems by delaying the logging of most operations.

## Improved synchronous writes

VxFS provides superior performance for synchronous write applications. The `mount -o datainlog` option greatly improves the performance of small synchronous writes.

The `mount -o convosync=dsync` option improves the performance of applications that require synchronous data writes but not synchronous inode time updates.

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**Warning:** The use of the `-o convosync=dsync` option violates POSIX semantics.

---

## Support for large files

With VxFS, you can create, mount, and manage file systems containing large files (files larger than two gigabytes).

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**Warning:** Some applications and utilities may not work on large files.

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## Access Control Lists

An Access Control List (ACL) stores a series of entries that identify specific users or groups and their access privileges for a directory or file. A file may have its own ACL or may share an ACL with other files. ACLs have the advantage of specifying detailed access permissions for multiple users and groups. For VxFS file systems created with the Version 5, 6, 7, or 8 disk layouts, up to 1024 ACL entries can be specified. ACLs are also supported on cluster file systems.

See the `getacl(1)` and `setacl(1)` manual pages.

## Storage Checkpoints

To increase availability, recoverability, and performance, Veritas File System offers on-disk and online backup and restore capabilities that facilitate frequent and efficient backup strategies. Backup and restore applications can leverage a Storage



Checkpoint, a disk- and I/O-efficient copying technology for creating periodic frozen images of a file system. Storage Checkpoints present a view of a file system at a point in time, and subsequently identifies and maintains copies of the original file system blocks. Instead of using a disk-based mirroring method, Storage Checkpoints save disk space and significantly reduce I/O overhead by using the free space pool available to a file system.

Storage Checkpoint functionality is separately licensed.

See the *Veritas Storage Foundation Advanced Features Administrator's Guide*.

## FileSnaps

A FileSnap is a space-optimized copy of a file in the same name space, stored in the same file system. VxFS supports FileSnaps in the VxFS 5.1 SP1 release and later, and on file systems with disk layout Version 8 and later.

See the *Veritas Storage Foundation Advanced Features Administrator's Guide*.

See the `vxfilesnap(1)` manual page.

## Quotas

VxFS supports quotas, which allocate per-user quotas and limit the use of two principal resources: files and data blocks. You can assign quotas for each of these resources. Each quota consists of two limits for each resource: hard limit and soft limit.

The hard limit represents an absolute limit on data blocks or files. A user can never exceed the hard limit under any circumstances.

The soft limit is lower than the hard limit and can be exceeded for a limited amount of time. This allows users to exceed limits temporarily as long as they fall under those limits before the allotted time expires.

See [“About quota limits”](#) on page 78.

## Support for databases

Databases are usually created on file systems to simplify backup, copying, and moving tasks and are slower compared to databases on raw disks.

Using Quick I/O for Databases feature with VxFS lets systems retain the benefits of having a database on a file system without sacrificing performance. Veritas Quick I/O creates regular, preallocated files to use as character devices. Databases can be created on the character devices to achieve the same performance as databases created on raw disks.

Treating regular VxFS files as raw devices has the following advantages for databases:

- Commercial database servers such as Oracle Server can issue kernel supported asynchronous I/O calls (through the `asyncdsk` or `Posix AIO` interface) on these pseudo devices but not on regular files.

## Cluster file systems

Veritas Storage Foundation Cluster File System (SFCFS) allows clustered servers to mount and use a file system simultaneously as if all applications using the file system were running on the same server. The Veritas Volume Manager cluster functionality (CVM) makes logical volumes and raw device applications accessible through a cluster.

Beginning with SFCFS 5.0, SFCFS uses a symmetric architecture in which all nodes in the cluster can simultaneously function as metadata servers. SFCFS still has some remnants of the old master/slave or primary/secondary concept. The first server to mount each cluster file system becomes its primary; all other nodes in the cluster become secondaries. Applications access the user data in files directly from the server on which they are running. Each SFCFS node has its own intent log. File system operations, such as allocating or deleting files, can originate from any node in the cluster.

Installing VxFS and enabling the cluster feature does not create a cluster file system configuration. File system clustering requires other Veritas products to enable communication services and provide storage resources. These products are packaged with VxFS in the Storage Foundation Cluster File System to provide a complete clustering environment.

See the *Veritas Storage Foundation Cluster File System Administrator's Guide*.

To be a cluster mount, a file system must be mounted using the `mount -o cluster` option. File systems mounted without the `-o cluster` option are termed local mounts.

SFCFS functionality is separately licensed.

## Cross-platform data sharing

Cross-platform data sharing (CDS) allows data to be serially shared among heterogeneous systems where each system has direct access to the physical devices that hold the data. This feature can be used only in conjunction with Veritas Volume Manager (VxVM).

See the *Veritas Storage Foundation Cross-Platform Data Sharing Administrator's Guide*.

## File Change Log

The VxFS File Change Log (FCL) tracks changes to files and directories in a file system. The File Change Log can be used by applications such as backup products, webcrawlers, search and indexing engines, and replication software that typically scan an entire file system searching for modifications since a previous scan. FCL functionality is a separately licensed feature.

See [“About the File Change Log file”](#) on page 83.

## Multi-volume support

The multi-volume support (MVS) feature allows several volumes to be represented by a single logical object. All I/O to and from an underlying logical volume is directed by way of volume sets. This feature can be used only in conjunction with VxVM. MVS functionality is a separately licensed feature.

See [“About multi-volume support”](#) on page 90.

## SmartTier

The SmartTier option is built on multi-volume support technology. Using SmartTier, you can map more than one volume to a single file system. You can then configure policies that automatically relocate files from one volume to another, or relocate files by running file relocation commands. Having multiple volumes lets you determine where files are located, which can improve performance for applications that access specific types of files. SmartTier functionality is a separately licensed feature.

See the *Veritas Storage Foundation Advanced Features Administrator's Guide*.

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**Note:** In the previous VxFS 5.x releases, SmartTier was known as Dynamic Storage Tiering.

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## Thin Reclamation of a file system

Storage is allocated from a Thin Storage LUN when files are created and written to a file system. This storage is not given back to the Thin Storage LUN when a file is deleted or the file size is shrunk. As such, the file system must perform the explicit task of releasing the free storage to the Thin Storage LUN. This is performed by the Storage Foundation Thin Reclamation feature. Thin Reclamation is only supported on VxFS file systems mounted on a VxVM volume.

See the *Veritas Storage Foundation Advanced Features Administrator's Guide*.

## Partitioned directories

Normally, a large volume of parallel threads performing access and updates on a directory that commonly exist in an file system suffers from exponentially longer wait times for the threads. This feature creates partitioned directories to improve the directory performance of file systems. When any directory crosses the tunable threshold, this feature takes an exclusive lock on the directory inode and redistributes the entries into various respective hash directories. These hash directories are not visible in the name-space view of the user or operating system. For every new create, delete, or lookup thread, this feature performs a lookup for the respective hashed directory (depending on the target name) and performs the operation in that directory. This leaves the parent directory inode and its other hash directories unobstructed for access, which vastly improves file system performance.

This feature operates only on disk layout Version 8 or later file systems.

## Veritas File System performance enhancements

Traditional file systems employ block-based allocation schemes that provide adequate random access and latency for small files, but which limit throughput for larger files. As a result, they are less than optimal for commercial environments.

VxFS addresses this file system performance issue through an alternative allocation method and increased user control over allocation, I/O, and caching policies.

See [“Using Veritas File System”](#) on page 30.

VxFS provides the following performance enhancements:

- Data synchronous I/O
- Direct I/O and discovered direct I/O
- Support for file systems up to 256 terabytes
- Support for files up to 16 terabytes
- Enhanced I/O performance
- Caching advisories
- Enhanced directory features
- Explicit file alignment, extent size, and preallocation controls
- Tunable I/O parameters
- Tunable indirect data extent size
- Integration with VxVM™
- Support for large directories

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**Note:** VxFS reduces the file lookup time in directories with an extremely large number of files.

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## About enhanced I/O performance

VxFS provides enhanced I/O performance by applying an aggressive I/O clustering policy, integrating with VxVM, and allowing application specific parameters to be set on a per-file system basis.

See [“Enhanced I/O clustering”](#) on page 29.

See [“Veritas Volume Manager integration with Veritas File System for enhanced I/O performance”](#) on page 29.

See [“Application-specific parameters for enhanced I/O performance”](#) on page 29.

### Enhanced I/O clustering

I/O clustering is a technique of grouping multiple I/O operations together for improved performance. VxFS I/O policies provide more aggressive clustering processes than other file systems and offer higher I/O throughput when using large files. The resulting performance is comparable to that provided by raw disk.

### Veritas Volume Manager integration with Veritas File System for enhanced I/O performance

VxFS interfaces with VxVM to determine the I/O characteristics of the underlying volume and perform I/O accordingly. VxFS also uses this information when using `mkfs` to perform proper allocation unit alignments for efficient I/O operations from the kernel.

As part of VxFS/VxVM integration, VxVM exports a set of I/O parameters to achieve better I/O performance. This interface can enhance performance for different volume configurations such as RAID-5, striped, and mirrored volumes. Full stripe writes are important in a RAID-5 volume for strong I/O performance. VxFS uses these parameters to issue appropriate I/O requests to VxVM.

### Application-specific parameters for enhanced I/O performance

You can set application specific parameters on a per-file system basis to improve I/O performance.

- Discovered Direct I/O  
All sizes above this value would be performed as direct I/O.
- Maximum Direct I/O Size

This value defines the maximum size of a single direct I/O.  
See the `vxtunefs(1M)` and `tunefstab(4)` manual pages.

## Using Veritas File System

There are three main methods to use, manage, modify, and tune VxFS:

- See [“Veritas Enterprise Administrator Graphical User Interface”](#) on page 30.
- See [“Online system administration”](#) on page 31.
- See [“Application program interface”](#) on page 32.

## Veritas Enterprise Administrator Graphical User Interface

Enterprise Administrator (VEA) is a GUI-based application using the Java™ technology that consists of a server and a client. The server runs on a UNIX system that is running Volume Manager and VxFS. The client runs on any platform that supports the Java Runtime Environment.

You can perform the following administrative functions on local or remote systems using the GUI:

- Create a file system on a volume
- Create a file system on a volume set
- Remove a file system from the file system table
- Mount and unmounting a file system
- Defragment a file system
- Monitor file system capacity
- Create a snapshot copy of a file system
- Check a file system
- View file system properties
- Maintain the File Change Log
- Maintain Storage Checkpoints
- Use multi-volume file systems
- Set intent log options
- Unmount a file system from a cluster node
- Remove resource information for a cluster file system

See the *Veritas Enterprise Administrator Getting Started* manual.

See the VEA online help.

## Veritas Operations Manager

Symantec recommends use of Veritas Operations Manager to manage Storage Foundation and Cluster Server environments.

Veritas Operations Manager provides a centralized management console for Veritas Storage Foundation and High Availability products. You can use Veritas Operations Manager to monitor, visualize, and manage storage resources and generate reports. Veritas Operations Manager is not available on the Storage Foundation and High Availability Solutions release. You can download Veritas Operations Manager at no charge at <http://go.symantec.com/vom>.

Refer to the Veritas Operations Manager documentation for installation, upgrade, and configuration instructions.

## Online system administration

VxFS provides command line interface (CLI) operations that are described throughout this guide and in manual pages.

VxFS allows you to run a number of administration tasks while the file system is online. Two of the more important tasks include:

- Defragmentation
- File system resizing

### About defragmentation

Free resources are initially aligned and allocated to files in an order that provides optimal performance. On an active file system, the original order of free resources is lost over time as files are created, removed, and resized. The file system is spread farther along the disk, leaving unused gaps or fragments between areas that are in use. This process is known as fragmentation and leads to degraded performance because the file system has fewer options when assigning a free extent to a file (a group of contiguous data blocks).

VxFS provides the online administration utility `fsadm` to resolve the problem of fragmentation.

The `fsadm` utility defragments a mounted file system by performing the following actions:

- Removing unused space from directories

- Making all small files contiguous
- Consolidating free blocks for file system use

This utility can run on demand and should be scheduled regularly as a cron job.

## About file system resizing

A file system is assigned a specific size as soon as it is created; the file system may become too small or too large as changes in file system usage take place over time.

VxFS is capable of increasing or decreasing the file system size while in use. Many competing file systems can not do this. The VxFS utility `fsadm` can expand or shrink a file system without unmounting the file system or interrupting user productivity. However, to expand a file system, the underlying device on which it is mounted must be expandable.

VxVM facilitates expansion using virtual disks that can be increased in size while in use. The VxFS and VxVM packages complement each other to provide online expansion capability. Use the `vxresize` command when resizing both the volume and the file system. The `vxresize` command guarantees that the file system shrinks or grows along with the volume. You can also use the `vxassist` command combined with the `fsadm_vxfs` command for this purpose; however, Symantec recommends that you use the `vxresize` command instead.

See the `vxresize(1M)` manual page.

See the *Veritas Volume Manager Administrator's Guide*.

## Application program interface

Veritas File System Developer's Kit (SDK) provides developers with the information necessary to use the application programming interfaces (APIs) to modify and tune various features and components of File System.

See the *Veritas File System Programmer's Reference Guide*.

VxFS conforms to the System V Interface Definition (SVID) requirements and supports user access through the Network File System (NFS). Applications that require performance features not available with other file systems can take advantage of VxFS enhancements.

## Expanded application facilities

VxFS provides API functions frequently associated with commercial applications that make it possible to perform the following actions:



- Preallocate space for a file
- Specify a fixed extent size for a file
- Bypass the system buffer cache for file I/O
- Specify the expected access pattern for a file

Because these functions are provided using VxFS-specific IOCTL system calls, most existing UNIX system applications do not use them. The `cp`, `cpio`, and `mv` utilities use the functions to preserve extent attributes and allocate space more efficiently. The current attributes of a file can be listed using the `getext` or `ls` command. The functions can also improve performance for custom applications. For portability reasons, these applications must check which file system type they are using before using these functions.

# VxFS performance: creating, mounting, and tuning file systems

This chapter includes the following topics:

- [Creating a VxFS file system](#)
- [Mounting a VxFS file system](#)
- [Tuning the VxFS file system](#)
- [Monitoring free space](#)
- [Tuning I/O](#)

## Creating a VxFS file system

When you create a file system with the `mkfs` command, you can select the following characteristics:

- Block size  
See [“Block size”](#) on page 35.
- Intent log size  
See [“Intent log size”](#) on page 35.

## Block size

The unit of allocation in VxFS is an extent. Unlike some other UNIX file systems, VxFS does not make use of block fragments for allocation because storage is allocated in extents that consist of one or more blocks.

You specify the block size when creating a file system by using the `mkfs -o bsize` option. The block size cannot be altered after the file system is created. The smallest available block size for VxFS is 1K. The default block size is 1024 bytes for file systems smaller than 1 TB, and 8192 bytes for file systems 1 TB or larger.

Choose a block size based on the type of application being run. For example, if there are many small files, a 1K block size may save space. For large file systems, with relatively few files, a larger block size is more appropriate. Larger block sizes use less disk space in file system overhead, but consume more space for files that are not a multiple of the block size. The easiest way to judge which block sizes provide the greatest system efficiency is to try representative system loads against various sizes and pick the fastest.

For 64-bit kernels, the block size and disk layout version determine the maximum size of the file system you can create.

See [“About disk layouts”](#) on page 233.

## Intent log size

You specify the intent log size when creating a file system by using the `mkfs -o logsize` option. With the Version 6 and later disk layouts, you can dynamically increase or decrease the intent log size using the `log` option of the `fsadm` command. The `mkfs` utility uses a default intent log size of 16 megabytes for disk layout Versions 5 and 6. 64 megabytes is the default for Version 7 and later. The default size is sufficient for most workloads. If the system is used as an NFS server or for intensive synchronous write workloads, performance may be improved using a larger log size.

With larger intent log sizes, recovery time is proportionately longer and the file system may consume more system resources (such as memory) during normal operation.

There are several system performance benchmark suites for which VxFS performs better with larger log sizes. As with block sizes, the best way to pick the log size is to try representative system loads against various sizes and pick the fastest.

## Mounting a VxFS file system

In addition to the standard mount mode (`delaylog` mode), Veritas File System (VxFS) provides the following modes of operation:

- `log`
- `delaylog`
- `tmplog`
- `logsize`
- `nodatainlog`
- `blkclear`
- `mincache`
- `convosync`
- `ioerror`
- `largefiles|nolargefiles`
- `cio`
- `mmtlock|mmtunlock`
- `tranflush`

Caching behavior can be altered with the `mincache` option, and the behavior of `O_SYNC` and `D_SYNC` writes can be altered with the `convosync` option.

See the `fcntl(2)` manual page.

The `delaylog` and `tmplog` modes can significantly improve performance. The improvement over `log` mode is typically about 15 to 20 percent with `delaylog`; with `tmplog`, the improvement is even higher. Performance improvement varies, depending on the operations being performed and the workload. Read/write intensive loads should show less improvement, while file system structure intensive loads, such as `mkdir`, `create`, and `rename`, may show over 100 percent improvement. The best way to select a mode is to test representative system loads against the logging modes and compare the performance results.

Most of the modes can be used in combination. For example, a desktop machine might use both the `blkclear` and `mincache=closesync` modes.

The `mount` command automatically runs the VxFS `fsck` command to clean up the intent log if the `mount` command detects a dirty log in the file system. This functionality is only supported on file systems mounted on a Veritas Volume Manager (VxVM) volume.

See the `mount_vxfs(1M)` manual page.

## The log mode

In log mode, all system calls other than `write(2)`, `writew(2)`, and `pwrite(2)` are guaranteed to be persistent after the system call returns to the application.

The `rename(2)` system call flushes the source file to disk to guarantee the persistence of the file data before renaming it. In both the `log` and `delaylog` modes, the `rename` is also guaranteed to be persistent when the system call returns. This benefits shell scripts and programs that try to update a file atomically by writing the new file contents to a temporary file and then renaming it on top of the target file.

## The delaylog mode

The default logging mode is `delaylog`. In `delaylog` mode, the effects of most system calls other than `write(2)`, `writew(2)`, and `pwrite(2)` are guaranteed to be persistent approximately 3 seconds after the system call returns to the application. Contrast this with the behavior of most other file systems in which most system calls are not persistent until approximately 30 seconds or more after the call has returned. Fast file system recovery works with this mode.

The `rename(2)` system call flushes the source file to disk to guarantee the persistence of the file data before renaming it. In the `log` and `delaylog` modes, the `rename` is also guaranteed to be persistent when the system call returns. This benefits shell scripts and programs that try to update a file atomically by writing the new file contents to a temporary file and then renaming it on top of the target file.

## The tmplog mode

In `tmplog` mode, the effects of system calls have persistence guarantees that are similar to those in `delaylog` mode. In addition, enhanced flushing of delayed extending writes is disabled, which results in better performance but increases the chances of data being lost or uninitialized data appearing in a file that was being actively written at the time of a system failure. This mode is only recommended for temporary file systems. Fast file system recovery works with this mode.

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**Note:** The term "effects of system calls" refers to changes to file system data and metadata caused by the system call, excluding changes to `st_atime`.

See the `stat(2)` manual page.

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## Logging mode persistence guarantees

In all logging modes, VxFS is fully POSIX compliant. The effects of the `fsync(2)` and `fdatasync(2)` system calls are guaranteed to be persistent after the calls return. The persistence guarantees for data or metadata modified by `write(2)`, `writew(2)`, or `pwrite(2)` are not affected by the logging mount options. The effects of these system calls are guaranteed to be persistent only if the `O_SYNC`, `O_DSYNC`, `VX_DSYNC`, or `VX_DIRECT` flag, as modified by the `convosync=` mount option, has been specified for the file descriptor.

The behavior of NFS servers on a VxFS file system is unaffected by the `log` and `tmplog` mount options, but not `delaylog`. In all cases except for `tmplog`, VxFS complies with the persistency requirements of the NFS v2 and NFS v3 standard. Unless a UNIX application has been developed specifically for the VxFS file system in `log` mode, it expects the persistence guarantees offered by most other file systems and experiences improved robustness when used with a VxFS file system mounted in `delaylog` mode. Applications that expect better persistence guarantees than that offered by most other file systems can benefit from the `log`, `mincache=`, and `closesync` mount options. However, most commercially available applications work well with the default VxFS mount options, including the `delaylog` mode.

## The logiosize mode

The `logiosize=size` option enhances the performance of storage devices that employ a read-modify-write feature. If you specify `logiosize` when you mount a file system, VxFS writes the intent log in the least *size* bytes or a multiple of *size* bytes to obtain the maximum performance from such devices.

See the `mount_vxfs(1M)` manual page.

The values for *size* can be 1024, 2048, or 4096.

## The nodatainlog mode

Use the `nodatainlog` mode on systems with disks that do not support bad block revectoring. Usually, a VxFS file system uses the intent log for synchronous writes. The inode update and the data are both logged in the transaction, so a synchronous write only requires one disk write instead of two. When the synchronous write returns to the application, the file system has told the application that the data is already written. If a disk error causes the metadata update to fail, then the file must be marked bad and the entire file is lost.

If a disk supports bad block revectoring, then a failure on the data update is unlikely, so logging synchronous writes should be allowed. If the disk does not support bad

block revectoring, then a failure is more likely, so the `nodatainlog` mode should be used.

A `nodatainlog` mode file system is approximately 50 percent slower than a standard mode VxFS file system for synchronous writes. Other operations are not affected.

## The `blkclear` mode

The `blkclear` mode is used in increased data security environments. The `blkclear` mode guarantees that uninitialized storage never appears in files. The increased integrity is provided by clearing extents on disk when they are allocated within a file. This mode does not affect extending writes. A `blkclear` mode file system is approximately 10 percent slower than a standard mode VxFS file system, depending on the workload.

## The `mincache` mode

The `mincache` mode has the following suboptions:

- `mincache=closesync`
- `mincache=direct`
- `mincache=dsync`
- `mincache=unbuffered`
- `mincache=tmpcache`

The `mincache=closesync` mode is useful in desktop environments where users are likely to shut off the power on the machine without halting it first. In this mode, any changes to the file are flushed to disk when the file is closed.

To improve performance, most file systems do not synchronously update data and inode changes to disk. If the system crashes, files that have been updated within the past minute are in danger of losing data. With the `mincache=closesync` mode, if the system crashes or is switched off, only open files can lose data. A `mincache=closesync` mode file system could be approximately 15 percent slower than a standard mode VxFS file system, depending on the workload.

The following describes where to use the `mincache` modes:

- The `mincache=direct`, `mincache=unbuffered`, and `mincache=dsync` modes are used in environments where applications have reliability problems caused by the kernel buffering of I/O and delayed flushing of non-synchronous I/O.
- The `mincache=direct` and `mincache=unbuffered` modes guarantee that all non-synchronous I/O requests to files are handled as if the `VX_DIRECT` or `VX_UNBUFFERED` caching advisories had been specified.

- The `mincache=dsync` mode guarantees that all non-synchronous I/O requests to files are handled as if the `VX_DSYNC` caching advisory had been specified. Refer to the `vxfsio(7)` manual page for explanations of `VX_DIRECT`, `VX_UNBUFFERED`, and `VX_DSYNC`, as well as for the requirements for direct I/O.
- The `mincache=direct`, `mincache=unbuffered`, and `mincache=dsync` modes also flush file data on close as `mincache=closesync` does.

Because the `mincache=direct`, `mincache=unbuffered`, and `mincache=dsync` modes change non-synchronous I/O to synchronous I/O, throughput can substantially degrade for small to medium size files with most applications. Since the `VX_DIRECT` and `VX_UNBUFFERED` advisories do not allow any caching of data, applications that normally benefit from caching for reads usually experience less degradation with the `mincache=dsync` mode. `mincache=direct` and `mincache=unbuffered` require significantly less CPU time than buffered I/O.

If performance is more important than data integrity, you can use the `mincache=tmpcache` mode. The `mincache=tmpcache` mode disables special delayed extending write handling, trading off less integrity for better performance. Unlike the other `mincache` modes, `tmpcache` does not flush the file to disk the file is closed. When the `mincache=tmpcache` option is used, bad data can appear in a file that was being extended when a crash occurred.

## The convosync mode

The `convosync` (convert `osync`) mode has the following suboptions:

- `convosync=closesync`

---

**Note:** The `convosync=closesync` mode converts synchronous and data synchronous writes to non-synchronous writes and flushes the changes to the file to disk when the file is closed.

---

- `convosync=delay`
- `convosync=direct`
- `convosync=dsync`

---

**Note:** The `convosync=dsync` option violates POSIX guarantees for synchronous I/O.

---

- `convosync=unbuffered`



The `convosync=delay` mode causes synchronous and data synchronous writes to be delayed rather than to take effect immediately. No special action is performed when closing a file. This option effectively cancels any data integrity guarantees normally provided by opening a file with `O_SYNC`.

See the `open(2)`, `fcntl(2)`, and `vxfsio(7)` manual pages.

---

**Warning:** Be very careful when using the `convosync=closesync` or `convosync=delay` mode because they actually change synchronous I/O into non-synchronous I/O. Applications that use synchronous I/O for data reliability may fail if the system crashes and synchronously written data is lost.

---

The `convosync=dsync` mode converts synchronous writes to data synchronous writes.

As with `closesync`, the `direct`, `unbuffered`, and `dsync` modes flush changes to the file to disk when it is closed. These modes can be used to speed up applications that use synchronous I/O. Many applications that are concerned with data integrity specify the `O_SYNC` `fcntl` in order to write the file data synchronously. However, this has the undesirable side effect of updating inode times and therefore slowing down performance. The `convosync=dsync`, `convosync=unbuffered`, and `convosync=direct` modes alleviate this problem by allowing applications to take advantage of synchronous writes without modifying inode times as well.

Before using `convosync=dsync`, `convosync=unbuffered`, or `convosync=direct`, make sure that all applications that use the file system do not require synchronous inode time updates for `O_SYNC` writes.

## The `ioerror` mode

This mode sets the policy for handling I/O errors on a mounted file system. I/O errors can occur while reading or writing file data or metadata. The file system can respond to these I/O errors either by halting or by gradually degrading. The `ioerror` option provides five policies that determine how the file system responds to the various errors. All policies limit data corruption, either by stopping the file system or by marking a corrupted inode as bad.

The policies are the following:

- `disable`
- `nodisable`
- `wdisable`
- `mwdisable`

- `mdisable`

## The disable policy

If `disable` is selected, VxFS disables the file system after detecting any I/O error. You must then unmount the file system and correct the condition causing the I/O error. After the problem is repaired, run `fsck` and mount the file system again. In most cases, replay `fsck` to repair the file system. A full `fsck` is required only in cases of structural damage to the file system's metadata. Select `disable` in environments where the underlying storage is redundant, such as RAID-5 or mirrored disks.

## The nodisable policy

If `nodisable` is selected, when VxFS detects an I/O error, it sets the appropriate error flags to contain the error, but continues running. Note that the degraded condition indicates possible data or metadata corruption, not the overall performance of the file system.

For file data read and write errors, VxFS sets the `VX_DATAIOERR` flag in the super-block. For metadata read errors, VxFS sets the `VX_FULLFSCK` flag in the super-block. For metadata write errors, VxFS sets the `VX_FULLFSCK` and `VX_METAIOERR` flags in the super-block and may mark associated metadata as bad on disk. VxFS then prints the appropriate error messages to the console.

See [“File system response to problems”](#) on page 147.

You should stop the file system as soon as possible and repair the condition causing the I/O error. After the problem is repaired, run `fsck` and mount the file system again. Select `nodisable` if you want to implement the policy that most closely resembles the error handling policy of the previous VxFS release.

## The wdisable and mwdisable policies

If `wdisable` (write disable) or `mwdisable` (metadata-write disable) is selected, the file system is disabled or degraded, depending on the type of error encountered. Select `wdisable` or `mwdisable` for environments where read errors are more likely to persist than write errors, such as when using non-redundant storage. `mwdisable` is the default `ioerror` mount option for local mounts.

See the `mount_vxfs(1M)` manual page.

## The mdisable policy

If `mdisable` (metadata disable) is selected, the file system is disabled if a metadata read or write fails. However, the file system continues to operate if the failure is confined to data extents. `mdisable` is the default `ioerror` mount option for cluster mounts.

## The largefiles|nolargefiles option

VxFS supports files larger than 2 gigabytes. The maximum file size that can be created is 2 terabytes.

---

**Note:** Applications and utilities such as backup may experience problems if they are not aware of large files. In such a case, create your file system without large file capability.

---

See [“Creating a file system with large files”](#) on page 43.

See [“Mounting a file system with large files”](#) on page 43.

See [“Managing a file system with large files”](#) on page 44.

## Creating a file system with large files

To create a file system with a large file capability:

```
# mkfs -F vxfs -o largefiles special_device size
```

Specifying `largefiles` sets the `largefiles` flag. This lets the file system to hold files that are two gigabytes or larger. This is the default option.

To clear the flag and prevent large files from being created:

```
# mkfs -F vxfs -o nolargefiles special_device size
```

The `largefiles` flag is persistent and stored on disk.

## Mounting a file system with large files

If a mount succeeds and `nolargefiles` is specified, the file system cannot contain or create any large files. If a mount succeeds and `largefiles` is specified, the file system may contain and create large files.

The `mount` command fails if the specified `largefiles|nolargefiles` option does not match the on-disk flag.

Because the `mount` command defaults to match the current setting of the on-disk flag if specified without the `largefiles` or `nolargefiles` option, the best practice is not to specify either option. After a file system is mounted, you can use the `fsadm` utility to change the large files option.

## Managing a file system with large files

Managing a file system with large files includes the following tasks:

- Determining the current status of the large files flag
- Switching capabilities on a mounted file system
- Switching capabilities on an unmounted file system

To determine the current status of the `largefiles` flag, type either of the following commands:

```
# mkfs -F vxfs -m special_device
# fsadm -F vxfs mount_point | special_device
```

To switch capabilities on a mounted file system:

```
# fsadm -F vxfs -o [no]largefiles mount_point
```

To switch capabilities on an unmounted file system:

```
# fsadm -F vxfs -o [no]largefiles special_device
```

You cannot change a file system to `nolargefiles` if it contains large files.

See the `mount_vxfs(1M)`, `fsadm_vxfs(1M)`, and `mkfs_vxfs(1M)` manual pages.

## The cio option

The `cio` (Concurrent I/O) option specifies the file system to be mounted for concurrent readers and writers. Concurrent I/O is a separately licensed feature of VxFS. If `cio` is specified, but the license is not present, the `mount` command prints an error message and terminates the operation without mounting the file system. The `cio` option cannot be disabled through a remount. To disable the `cio` option, the file system must be unmounted and mounted again without the `cio` option.

---

**Note:** There is no separate license required for the `cio` option, it is a part of the “standard” license.

---

## The mntlock|mntunlock option

The `mntlock` option prevents a file system from being unmounted by an application. This option is useful for applications that do not want the file systems that the applications are monitoring to be improperly unmounted by other applications or administrators.

The `mntunlock` option of the `vxumount` command reverses the `mntlock` option if you previously locked the file system.

## Combining mount command options

Although mount options can be combined arbitrarily, some combinations do not make sense. The following examples provide some common and reasonable mount option combinations.

To mount a desktop file system using options:

```
# mount -F vxfs -o log,mincache=closesync /dev/dsk/c1t3d0 /mnt
```

This guarantees that when a file is closed, its data is synchronized to disk and cannot be lost. Thus, after an application has exited and its files are closed, no data is lost even if the system is immediately turned off.

To mount a temporary file system or to restore from backup:

```
# mount -F vxfs -o tmplog,convosync=delay,mincache=tmpcache \  
/dev/dsk/c1t3d0 /mnt
```

This combination might be used for a temporary file system where performance is more important than absolute data integrity. Any `O_SYNC` writes are performed as delayed writes and delayed extending writes are not handled. This could result in a file that contains corrupted data if the system crashes. Any file written 30 seconds or so before a crash may contain corrupted data or be missing if this mount combination is in effect. However, such a file system does significantly less disk writes than a log file system, and should have significantly better performance, depending on the application.

To mount a file system for synchronous writes:

```
# mount -F vxfs -o log,convosync=dsync /dev/dsk/c1t3d0 /mnt
```

This combination can be used to improve the performance of applications that perform `O_SYNC` writes, but only require data synchronous write semantics. Performance can be significantly improved if the file system is mounted using `convosync=dsync` without any loss of data integrity.

# Tuning the VxFS file system

This section describes the following kernel tunable parameters in VxFS:

- [Tuning inode table size](#)
- [Tuning performance optimization of inode allocation](#)
- [VxFS buffer cache high water mark](#)
- [Number of links to a file](#)
- [VxFS inode free time lag](#)
- [Partitioned directories](#)

## Tuning inode table size

VxFS caches inodes in an inode table. There is a dynamic tunable in VxFS called `vx_ninode` that determines the number of entries in the inode table. You can dynamically change the value of `vx_ninode` by using the `sam` or `kctune` commands.

See the `sam(1M)` and `kctune(1M)` manual pages.

This value is used to determine the number of entries in the VxFS inode table. By default, `vx_ninode` initializes at zero; the file system then computes a value based on the system memory size.

A VxFS file system can also obtain the value of `vx_ninode` from the system configuration file used for making the HP-UX kernel (`/stand/system` for example). To change the computed value of `vx_ninode`, you can add an entry to the `system` configuration file. For example:

```
tunable vx_ninode 1000000
```

This sets the inode table size to 1,000,000 inodes after making a new HP-UX kernel using `mk_kernel`.

Increasing the value of `vx_ninode` increases the inode table size immediately, allowing a higher number of inodes to be cached. Decreasing the value of `vx_ninode` decreases the inode table size to the specified value. After the tunable is decreased, VxFS attempts to free excess cached objects so that the resulting number of inodes in the table is less than or equal to the specified value of `vx_ninode`. If this attempt fails, the value of the `vx_ninode` tunable is not changed. In such a case, the `kctune` command can be specified with the `-h` option so that the new value of `vx_ninode` takes effect after a system reboot.

Be careful when changing the value of `vx_ninode`, as the value can affect file system performance. Typically, the default value determined by VxFS based on the amount

of system memory ensures good system performance across a wide range of applications. However, if it is determined that the default value is not suitable, `vx_ninode` can be set to an appropriate value based on the expected file system usage. The `vxfsstat` command can be used to monitor inode cache usage and statistics to determine the optimum value of `vx_ninode` for the system.

Changing the value of a tunable does not resize the internal hash tables and structures of the caches. These sizes are determined at system boot up based on either the system memory size, which is the default, or the value of the tunable if explicitly set, whichever is larger. Thus, dynamically increasing the tunable to a value that is more than two times either the default value or the user-defined value, if larger, may cause performance degradation unless the system is rebooted.

Decreasing the value of `vx_ninode` will not succeed if the doing so requires a change to internal hash tables, in which case the change is marked for the next boot automatically and will take effect on the subsequent boot. If the change to the internal hash tables is not required, VxFS frees the cached objects so that the total number of inodes in the cache is equal to or less than the specified `vx_ninode` value.

## Examples of changing the `vx_ninode` tunable value

The following are examples of changing the `vx_ninode` tunable value.

### Reporting the current value of `vx_ninode`

```
# kctune vx_ninode
```

This command displays the current value of `vx_ninode`.

### Setting `vx_ninode`

```
# kctune -s vx_ninode=10000
```

This command sets `vx_ninode` to 10000, the specified value.

### Restoring `vx_ninode` to its default value

```
# kctune -s vx_ninode=
```

This command restores `vx_ninode` to its default value by clearing the user-specified value. The default value is the value determined by VxFS to be optimal based on the amount of system memory, which is used if `vx_ninode` is not explicitly set.

## Delaying a change to vx\_ninode until after a reboot

```
# kctune -h -s vx_ninode=10000
```

If the `-h` option is specified, the specified value for `vx_ninode` does not take effect until after a system reboot.

## Tuning performance optimization of inode allocation

The `delicache_enable` tunable parameter specifies whether performance optimization of inode allocation and inode reuse during a new file creation is turned on or off. The `delicache_enable` tunable is not supported for cluster file systems. You can specify the following values for `delicache_enable`:

- 0 – Disables delicache optimization.
- 1 – Enables delicache optimization.

The default value of `delicache_enable` is 1 for local mounts and 0 for cluster file systems.

## VxFS buffer cache high water mark

VxFS maintains its own buffer cache in the kernel for frequently accessed file system metadata. This cache is different from the HP-UX kernel buffer cache that caches file data. The `vx_bc_bufhwm` dynamic, global, tunable parameter lets you change the VxFS buffer cache high water mark, that is, the maximum amount of memory that can be used to cache VxFS metadata.

The initial value of `vx_bc_bufhwm` is zero. When the operating system reboots, VxFS sets the value of `vx_bc_bufhwm` based on the amount of system memory. You can explicitly reset the value of `vx_bc_bufhwm` by changing the value of `vxfs_bc_bufhwm` using the `sam` or `kctune` commands.

See the `sam(1M)` and `kctune(1M)` manual pages.

You can also set the value by adding an entry to the system configuration file. For example, the following entry:

```
vxfs_bc_bufhwm vx_bc_bufhwm 300000
```

sets the high water mark to 300 megabytes. The change takes effect after you rebuild the HP-UX kernel using the `mk_kernel` command. You specify the `vx_bc_bufhwm` tunable in units of kilobytes. The minimum value is 6144.

Increasing the value of `vx_bc_bufhwm` increases the VxFS buffer cache immediately, allowing a greater amount of memory to be used to cache VxFS metadata.



Decreasing the value of `vx_bc_bufhwm` decreases the VxFS buffer cache to the specified value. This frees memory such that the amount of memory used for buffer cache is lower than the specified value of `vx_bc_bufhwm`.

Typically, the default value computed by VxFS based on the amount of system memory ensures good system performance across a wide range of applications. For application loads that cause frequent file system metadata changes on the system (for example, a high rate of file creation or deletion, or accessing large directories), changing the value of `vx_bc_bufhwm` may improve performance.

You can use the `vxfsstat` command to monitor buffer cache statistics and inode cache usage.

See the `vxfsstat(1M)` manual page.

## Number of links to a file

In VxFS, the number of possible links to a file is determined by the `vx_maxlink` global tunable. The default value of `vx_maxlink` is 32767, the maximum value is 65535. This is a static tunable.

You can set the value of `vx_maxlink` using the `sam` or `kctune` commands.

See the `sam(1M)` and `kctune(1M)` manual pages.

You can also add an entry to the system configuration file as shown in the following example:

```
vxfs_maxlink vx_maxlink 40000
```

This sets the value of `vx_maxlink` to 40,000 links.

## VxFS inode free time lag

In VxFS, an inode is put on a freelist if it is not being used. The memory space for this unused inode can be freed if it stays on the freelist for a specified amount of time. The `vx_ifree_timelag` tunable specifies the minimum amount of time an unused inode spends on a freelist before its memory space is freed.

The `vx_ifree_timelag` tunable is dynamic. Any changes to `vx_ifree_timelag` take effect immediately.

The default value of `vx_ifree_timelag` is 0. By setting `vx_ifree_timelag` to 0, the inode free time lag is autotuned to 600 seconds. Specifying negative one (-1) stops the freeing of inode space; no further inode allocations are freed until the value is changed back to a value other than negative one.

You can change the value of `vx_ifree_timelag` using the `sam` or `kctune` commands.

See the `sam(1M)` and `kctune(1M)` manual pages.

You can also add an entry to the system configuration file. The following example changes the value of `vx_ifree_timelag` to 2400 seconds:

```
# kctune -s vxfs_ifree_timelag=2400
```

---

**Note:** The default value of `vx_ifree_timelag` typically provides optimal VxFS performance. Be careful when adjusting the tunable because incorrect tuning can adversely affect system performance.

---

## Partitioned directories

You can enable or disable the partitioned directories feature by setting the `pdir_enable` tunable. Specifying a value of 1 enables partitioned directories, while specifying a value of 0 disables partitioned directories. The default value is 0.

You can set the `pdir_threshold` tunable to specify the threshold value in terms of directory size in bytes beyond which VxFS will partition a directory if you enabled partitioned directories. The default value is 32000.

The `-d` option of the `fsadm` command removes empty hidden directories from partitioned directories. If you disabled partitioned directories, the `fsadm -d` command also converts partitioned directories to regular directories.

The partitioned directories feature operates only on disk layout Version 8 or later file systems.

## Monitoring free space

In general, VxFS works best if the percentage of free space in the file system does not get below 10 percent. This is because file systems with 10 percent or more free space have less fragmentation and better extent allocation. Regular use of the `df` command to monitor free space is desirable.

See the `df_vxfs(1M)` manual page.

Full file systems may have an adverse effect on file system performance. Full file systems should therefore have some files removed, or should be expanded.

See the `fsadm_vxfs(1M)` manual page.

## Monitoring fragmentation

Fragmentation reduces performance and availability. Regular use of `fsadm`'s fragmentation reporting and reorganization facilities is therefore advisable.

The easiest way to ensure that fragmentation does not become a problem is to schedule regular defragmentation runs using the `cron` command.

Defragmentation scheduling should range from weekly (for frequently used file systems) to monthly (for infrequently used file systems). Extent fragmentation should be monitored with `fsadm` command.

To determine the degree of fragmentation, use the following factors:

- Percentage of free space in extents of less than 8 blocks in length
- Percentage of free space in extents of less than 64 blocks in length
- Percentage of free space in extents of length 64 blocks or greater

An unfragmented file system has the following characteristics:

- Less than 1 percent of free space in extents of less than 8 blocks in length
- Less than 5 percent of free space in extents of less than 64 blocks in length
- More than 5 percent of the total file system size available as free extents in lengths of 64 or more blocks

A badly fragmented file system has one or more of the following characteristics:

- Greater than 5 percent of free space in extents of less than 8 blocks in length
- More than 50 percent of free space in extents of less than 64 blocks in length
- Less than 5 percent of the total file system size available as free extents in lengths of 64 or more blocks

The optimal period for scheduling of extent reorganization runs can be determined by choosing a reasonable interval, scheduling `fsadm` runs at the initial interval, and running the extent fragmentation report feature of `fsadm` before and after the reorganization.

The “before” result is the degree of fragmentation prior to the reorganization. If the degree of fragmentation is approaching the figures for bad fragmentation, reduce the interval between `fsadm` runs. If the degree of fragmentation is low, increase the interval between `fsadm` runs.

The “after” result is an indication of how well the reorganizer has performed. The degree of fragmentation should be close to the characteristics of an unfragmented file system. If not, it may be a good idea to resize the file system; full file systems tend to fragment and are difficult to defragment. It is also possible that the

reorganization is not being performed at a time during which the file system in question is relatively idle.

Directory reorganization is not nearly as critical as extent reorganization, but regular directory reorganization improves performance. It is advisable to schedule directory reorganization for file systems when the extent reorganization is scheduled. The following is a sample script that is run periodically at 3:00 A.M. from `cron` for a number of file systems:

```
outfile=/usr/spool/fsadm/out.`/bin/date +%m%d`
for i in /home /home2 /project /db
do
    /bin/echo "Reorganizing $i"
    /bin/times fsadm -F vxfs -e -E -s $i
    /bin/times fsadm -F vxfs -s -d -D $i
done > $outfile 2>&1
```

## Thin Reclamation

Veritas File System (VxFS) supports reclamation of free storage on a Thin Storage LUN.

See [“Thin Reclamation of a file system”](#) on page 27.

See the *Veritas Storage Foundation Advanced Features Administrator's Guide*.

You reclaim free storage using the `fsadm` command or the `vxfs_ts_reclaim` API. You can perform the default reclamation or aggressive reclamation. If you used a file system for a long time and must perform reclamation on the file system, Symantec recommends that you run aggressive reclamation. Aggressive reclamation compacts the allocated blocks, which creates larger free blocks that can potentially be reclaimed.

You can specify the following thin reclamation options with the `fsadm` command:

`aggressive`      Initiates Thin Storage aggressive reclamation.

`analyse|analyze`      Initiates the analyze reclaim option.

`auto`              Initiates the auto reclaim option.

See the `fsadm_vxfs(1M)` and `vxfs_ts_reclaim(3)` manual pages.

Thin Reclamation is only supported on file systems mounted on a VxVM volume.

The following example performs default reclamation of free storage to the Thin Storage LUN on a VxFS file system mounted at `/mnt1`:

```
# fsadm -R /mnt1
```

The following example performs aggressive reclamation of free storage to the Thin Storage LUN on a VxFS file system mounted at `/mnt1`:

```
# fsadm -R -o aggressive /mnt1
```

After performing the reclaim operation, you can verify that the storage was reclaimed using the `vxdisk -o thin list` command.

Veritas File System also supports reclamation of a portion of the file system using the `vxfs_ts_reclaim()` API.

See the *Veritas File System Programmer's Reference Guide*.

---

**Note:** Thin Reclamation is a slow process and may take several hours to complete, depending on the file system size. Thin Reclamation is not guaranteed to reclaim 100% of the free space.

You can track the progress of the Thin Reclamation process by using the `vxtask list` command when using the Veritas Volume Manager (VxVM) command `vxdisk reclaim`.

See the `vxtask(1M)` and `vxdisk(1M)` manual pages.

You can administer Thin Reclamation using VxVM commands.

See the *Veritas Volume Manager Administrator's Guide*.

---

## Tuning I/O

The performance of a file system can be enhanced by a suitable choice of I/O sizes and proper alignment of the I/O requests based on the requirements of the underlying special device. VxFS provides tools to tune the file systems.

---

**Note:** The following tunables and the techniques work on a per file system basis. Use them judiciously based on the underlying device properties and characteristics of the applications that use the file system.

---

## Tuning VxFS I/O parameters

VxFS provides a set of tunable I/O parameters that control some of its behavior. These I/O parameters are useful to help the file system adjust to striped or RAID-5 volumes that could yield performance superior to a single disk. Typically, data

streaming applications that access large files see the largest benefit from tuning the file system.

## Veritas Volume Manager queries

Veritas Volume Manager (VxVM) receives the following queries during configuration:

- The file system queries VxVM to determine the geometry of the underlying volume and automatically sets the I/O parameters.

---

**Note:** When using file systems in multiple volume sets, VxFS sets the VxFS tunables based on the geometry of the first component volume (volume 0) in the volume set.

---

- The `mount` command queries VxVM when the file system is mounted and downloads the I/O parameters.

If the default parameters are not acceptable or the file system is being used without VxVM, then the `/etc/vx/tunefstab` file can be used to set values for I/O parameters. The `mount` command reads the `/etc/vx/tunefstab` file and downloads any parameters specified for a file system. The `tunefstab` file overrides any values obtained from VxVM. While the file system is mounted, any I/O parameters can be changed using the `vxtunefs` command which can have tunables specified on the command line or can read them from the `/etc/vx/tunefstab` file.

See the `vxtunefs(1M)` and `tunefstab(4)` manual pages.

The `vxtunefs` command can be used to print the current values of the I/O parameters.

To print the values, type the following command:

```
# vxtunefs -p /mnt1
```

The following is an example `tunefstab` file:

```
/dev/vx/dsk/userdg/netbackup
read_pref_io=128k,write_pref_io=128k,read_nstream=4,write_nstream=4
/dev/vx/dsk/userdg/metastave
read_pref_io=128k,write_pref_io=128k,read_nstream=4,write_nstream=4
/dev/vx/dsk/userdg/solbuild
read_pref_io=64k,write_pref_io=64k,read_nstream=4,write_nstream=4
/dev/vx/dsk/userdg/solrelease
read_pref_io=64k,write_pref_io=64k,read_nstream=4,write_nstream=4
/dev/vx/dsk/userdg/solpatch
read_pref_io=128k,write_pref_io=128k,read_nstream=4,write_nstream=4
```

## Tunable I/O parameters

Table 2-1 provides a list and description of these parameters.

**Table 2-1** Tunable VxFS I/O parameters

Parameter	Description
<code>read_pref_io</code>	The preferred read request size. The file system uses this in conjunction with the <code>read_nstream</code> value to determine how much data to read ahead. The default value is 64K.
<code>write_pref_io</code>	The preferred write request size. The file system uses this in conjunction with the <code>write_nstream</code> value to determine how to do flush behind on writes. The default value is 64K.
<code>read_nstream</code>	The number of parallel read requests of size <code>read_pref_io</code> to have outstanding at one time. The file system uses the product of <code>read_nstream</code> multiplied by <code>read_pref_io</code> to determine its read ahead size. The default value for <code>read_nstream</code> is 1.
<code>write_nstream</code>	The number of parallel write requests of size <code>write_pref_io</code> to have outstanding at one time. The file system uses the product of <code>write_nstream</code> multiplied by <code>write_pref_io</code> to determine when to do flush behind on writes. The default value for <code>write_nstream</code> is 1.

**Table 2-1** Tunable VxFS I/O parameters (*continued*)

Parameter	Description
<code>default_indir_size</code>	On VxFS, files can have up to ten direct extents of variable size stored in the inode. After these extents are used up, the file must use indirect extents which are a fixed size that is set when the file first uses indirect extents. These indirect extents are 8K by default. The file system does not use larger indirect extents because it must fail a write and return <code>ENOSPC</code> if there are no extents available that are the indirect extent size. For file systems with many large files, the 8K indirect extent size is too small. The files that get into indirect extents use many smaller extents instead of a few larger ones. By using this parameter, the default indirect extent size can be increased so large that files in indirects use fewer larger extents. The tunable <code>default_indir_size</code> should be used carefully. If it is set too large, then writes fail when they are unable to allocate extents of the indirect extent size to a file. In general, the fewer and the larger the files on a file system, the larger the <code>default_indir_size</code> can be set. This parameter should generally be set to some multiple of the <code>read_pref_io</code> parameter. <code>default_indir_size</code> is not applicable on Version 4 disk layouts.
<code>discovered_direct_iosz</code>	Any file I/O requests larger than <code>discovered_direct_iosz</code> are handled as discovered direct I/O. A discovered direct I/O is unbuffered similar to direct I/O, but it does not require a synchronous commit of the inode when the file is extended or blocks are allocated. For larger I/O requests, the CPU time for copying the data into the page cache and the cost of using memory to buffer the I/O data becomes more expensive than the cost of doing the disk I/O. For these I/O requests, using discovered direct I/O is more efficient than regular I/O. The default value of this parameter is 256K.



**Table 2-1** Tunable VxFS I/O parameters (*continued*)

Parameter	Description
<code>fcl_keeptime</code>	<p>Specifies the minimum amount of time, in seconds, that the VxFS File Change Log (FCL) keeps records in the log. When the oldest 8K block of FCL records have been kept longer than the value of <code>fcl_keeptime</code>, they are purged from the FCL and the extents nearest to the beginning of the FCL file are freed. This process is referred to as "punching a hole." Holes are punched in the FCL file in 8K chunks.</p> <p>If the <code>fcl_maxalloc</code> parameter is set, records are purged from the FCL if the amount of space allocated to the FCL exceeds <code>fcl_maxalloc</code>, even if the elapsed time the records have been in the log is less than the value of <code>fcl_keeptime</code>. If the file system runs out of space before <code>fcl_keeptime</code> is reached, the FCL is deactivated.</p> <p>Either or both of the <code>fcl_keeptime</code> or <code>fcl_maxalloc</code> parameters must be set before the File Change Log can be activated. <code>fcl_keeptime</code> does not apply to disk layout Versions 1 through 5.</p>
<code>fcl_maxalloc</code>	<p>Specifies the maximum amount of space that can be allocated to the VxFS File Change Log (FCL). The FCL file is a sparse file that grows as changes occur in the file system. When the space allocated to the FCL file reaches the <code>fcl_maxalloc</code> value, the oldest FCL records are purged from the FCL and the extents nearest to the beginning of the FCL file are freed. This process is referred to as "punching a hole." Holes are punched in the FCL file in 8K chunks. If the file system runs out of space before <code>fcl_maxalloc</code> is reached, the FCL is deactivated.</p> <p>The minimum value of <code>fcl_maxalloc</code> is 4 MB. The default value is <code>fs_size/33</code>.</p> <p>Either or both of the <code>fcl_maxalloc</code> or <code>fcl_keeptime</code> parameters must be set before the File Change Log can be activated. <code>fcl_maxalloc</code> does not apply to disk layout Versions 1 through 5.</p>

**Table 2-1** Tunable VxFS I/O parameters (*continued*)

Parameter	Description
<code>fcl_winterval</code>	<p>Specifies the time, in seconds, that must elapse before the VxFS File Change Log (FCL) records a data overwrite, data extending write, or data truncate for a file. The ability to limit the number of repetitive FCL records for continuous writes to the same file is important for file system performance and for applications processing the FCL. <code>fcl_winterval</code> is best set to an interval less than the shortest interval between reads of the FCL by any application. This way all applications using the FCL can be assured of finding at least one FCL record for any file experiencing continuous data changes.</p> <p><code>fcl_winterval</code> is enforced for all files in the file system. Each file maintains its own time stamps, and the elapsed time between FCL records is per file. This elapsed time can be overridden using the VxFS FCL sync public API.</p> <p>See the <code>vxfs_fcl_sync(3)</code> manual page.</p> <p><code>fcl_winterval</code> does not apply to disk layout Versions 1 through 5.</p>
<code>hsm_write_prealloc</code>	<p>For a file managed by a hierarchical storage management (HSM) application, <code>hsm_write_prealloc</code> preallocates disk blocks before data is migrated back into the file system. An HSM application usually migrates the data back through a series of writes to the file, each of which allocates a few blocks. By setting <code>hsm_write_prealloc(hsm_write_prealloc=1)</code>, a sufficient number of disk blocks are allocated on the first write to the empty file so that no disk block allocation is required for subsequent writes. This improves the write performance during migration.</p> <p>The <code>hsm_write_prealloc</code> parameter is implemented outside of the DMAPI specification, and its usage has limitations depending on how the space within an HSM-controlled file is managed. It is advisable to use <code>hsm_write_prealloc</code> only when recommended by the HSM application controlling the file system.</p>

**Table 2-1** Tunable VxFS I/O parameters (*continued*)

Parameter	Description
<code>initial_extent_size</code>	<p>Changes the default initial extent size. VxFS determines, based on the first write to a new file, the size of the first extent to be allocated to the file. Normally the first extent is the smallest power of 2 that is larger than the size of the first write. If that power of 2 is less than 8K, the first extent allocated is 8K. After the initial extent, the file system increases the size of subsequent extents with each allocation.</p> <p>See <code>max_seqio_extent_size</code>.</p> <p>Since most applications write to files using a buffer size of 8K or less, the increasing extents start doubling from a small initial extent. <code>initial_extent_size</code> can change the default initial extent size to be larger, so the doubling policy starts from a much larger initial size and the file system does not allocate a set of small extents at the start of file. Use this parameter only on file systems that have a very large average file size. On these file systems it results in fewer extents per file and less fragmentation. <code>initial_extent_size</code> is measured in file system blocks.</p>
<code>inode_aging_count</code>	<p>Specifies the maximum number of inodes to place on an inode aging list. Inode aging is used in conjunction with file system Storage Checkpoints to allow quick restoration of large, recently deleted files. The aging list is maintained in first-in-first-out (fifo) order up to maximum number of inodes specified by <code>inode_aging_count</code>. As newer inodes are placed on the list, older inodes are removed to complete their aging process. For best performance, it is advisable to age only a limited number of larger files before completion of the removal process. The default maximum number of inodes to age is 2048.</p>
<code>max_buf_data_size</code>	<p>The maximum buffer size allocated for file data; either 8K bytes or 64K bytes. Use the larger value for workloads where large reads/writes are performed sequentially. Use the smaller value on workloads where the I/O is random or is done in small chunks. 8K bytes is the default value.</p>

**Table 2-1** Tunable VxFS I/O parameters (*continued*)

Parameter	Description
<code>inode_aging_size</code>	Specifies the minimum size to qualify a deleted inode for inode aging. Inode aging is used in conjunction with file system Storage Checkpoints to allow quick restoration of large, recently deleted files. For best performance, it is advisable to age only a limited number of larger files before completion of the removal process. Setting the size too low can push larger file inodes out of the aging queue to make room for newly removed smaller file inodes.
<code>max_direct_iosz</code>	The maximum size of a direct I/O request that are issued by the file system. If a larger I/O request comes in, then it is broken up into <code>max_direct_iosz</code> chunks. This parameter defines how much memory an I/O request can lock at once, so it should not be set to more than 20 percent of memory.
<code>max_diskq</code>	Limits the maximum disk queue generated by a single file. When the file system is flushing data for a file and the number of pages being flushed exceeds <code>max_diskq</code> , processes are blocked until the amount of data being flushed decreases. Although this does not limit the actual disk queue, it prevents flushing processes from making the system unresponsive. The default value is 1 MB.
<code>max_seqio_extent_size</code>	Increases or decreases the maximum size of an extent. When the file system is following its default allocation policy for sequential writes to a file, it allocates an initial extent which is large enough for the first write to the file. When additional extents are allocated, they are progressively larger because the algorithm tries to double the size of the file with each new extent. As such, each extent can hold several writes worth of data. This is done to reduce the total number of extents in anticipation of continued sequential writes. When the file stops being written, any unused space is freed for other files to use. Normally, this allocation stops increasing the size of extents at 262144 blocks, which prevents one file from holding too much unused space. <code>max_seqio_extent_size</code> is measured in file system blocks. The default and minimum value of this parameter is 2048 blocks.

**Table 2-1** Tunable VxFS I/O parameters (*continued*)

Parameter	Description
<code>qio_cache_enable</code>	Enables or disables caching on Quick I/O files. The default behavior is to disable caching. To enable caching, set <code>qio_cache_enable</code> to 1. On systems with large memories, the database cannot always use all of the memory as a cache. By enabling file system caching as a second level cache, performance may be improved. If the database is performing sequential scans of tables, the scans may run faster by enabling file system caching so the file system performs aggressive read-ahead on the files.
<code>read_ahead</code>	<p>The default for all VxFS read operations is to perform sequential read ahead. You can specify the <code>read_ahead</code> cache advisory to implement the VxFS enhanced read ahead functionality. This allows read aheads to detect more elaborate patterns (such as increasing or decreasing read offsets or multithreaded file accesses) in addition to simple sequential reads. You can specify the following values for <code>read_ahead</code>:</p> <ul style="list-style-type: none"> <li>0—Disables read ahead functionality</li> <li>1—Retains traditional sequential read ahead behavior</li> <li>2—Enables enhanced read ahead for all reads</li> </ul> <p>The default is 1—VxFS detects only sequential patterns.</p> <p><code>read_ahead</code> detects patterns on a per-thread basis, up to a maximum determined by <code>vx_era_nthreads</code> parameter. The default number of threads is 5, but you can change the default value by setting the <code>vx_era_nthreads</code> parameter in the <code>/etc/system</code> configuration file.</p>
<code>thin_friendly_alloc</code>	Enables or disables thin friendly allocations. Specifying a value of 1 enables thin friendly allocations, while specifying a value of 0 disables thin friendly allocations. The default value is 1 for <code>thinrc1m</code> volumes, and 0 for all other volume types. You must turn on <code>delicache_enable</code> before you can activate this feature.

**Table 2-1** Tunable VxFS I/O parameters (*continued*)

Parameter	Description
<code>write_throttle</code>	<p>The <code>write_throttle</code> parameter is useful in special situations where a computer system has a combination of a large amount of memory and slow storage devices. In this configuration, sync operations, such as <code>fsync()</code>, may take long enough to complete that a system appears to hang. This behavior occurs because the file system is creating dirty pages (in-memory updates) faster than they can be asynchronously flushed to disk without slowing system performance.</p> <p>Lowering the value of <code>write_throttle</code> limits the number of dirty pages per file that a file system generates before flushing the pages to disk. After the number of dirty pages for a file reaches the <code>write_throttle</code> threshold, the file system starts flushing pages to disk even if free memory is still available.</p> <p>The default value of <code>write_throttle</code> is zero, which puts no limit on the number of dirty pages per file. If non-zero, VxFS limits the number of dirty pages per file to <code>write_throttle</code> pages.</p> <p>The default value typically generates a large number of dirty pages, but maintains fast user writes. Depending on the speed of the storage device, if you lower <code>write_throttle</code>, user write performance may suffer, but the number of dirty pages is limited, so sync operations completes much faster.</p> <p>Because lowering <code>write_throttle</code> may in some cases delay write requests (for example, lowering <code>write_throttle</code> may increase the file disk queue to the <code>max_diskq</code> value, delaying user writes until the disk queue decreases), it is advisable not to change the value of <code>write_throttle</code> unless your system has a combination of large physical memory and slow storage devices.</p>

## File system tuning guidelines

If the file system is being used with VxVM, it is advisable to let the VxFS I/O parameters be set to default values based on the volume geometry.

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**Note:** VxFS does not query VxVM with multiple volume sets. To improve I/O performance when using multiple volume sets, use the `vxtunefs` command.

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If the file system is being used with a hardware disk array or volume manager other than VxVM, try to align the parameters to match the geometry of the logical disk. With striping or RAID-5, it is common to set `read_pref_io` to the stripe unit size and `read_nstream` to the number of columns in the stripe. For striped arrays, use the same values for `write_pref_io` and `write_nstream`, but for RAID-5 arrays, set `write_pref_io` to the full stripe size and `write_nstream` to 1.

For an application to do efficient disk I/O, it should use the following formula to issue read requests:

- `read requests = read_nstream X by read_pref_io`

Generally, any multiple or factor of `read_nstream` multiplied by `read_pref_io` should be a good size for performance. For writing, the same rule of thumb applies to the `write_pref_io` and `write_nstream` parameters. When tuning a file system, the best thing to do is try out the tuning parameters under a real life workload.

If an application is performing sequential I/O to large files, the application should try to issue requests larger than `discovered_direct_iosz`. This causes the I/O requests to be performed as discovered direct I/O requests, which are unbuffered like direct I/O but do not require synchronous inode updates when extending the file. If the file is larger than can fit in the cache, using unbuffered I/O avoids removing useful data out of the cache and lessens CPU overhead.

# Extent attributes

This chapter includes the following topics:

- [About extent attributes](#)
- [Commands related to extent attributes](#)

## About extent attributes

Veritas File System (VxFS) allocates disk space to files in groups of one or more adjacent blocks called extents. VxFS defines an application interface that allows programs to control various aspects of the extent allocation for a given file. The extent allocation policies associated with a file are referred to as extent attributes.

The VxFS `getext` and `setext` commands let you view or manipulate file extent attributes.

The two basic extent attributes associated with a file are its reservation and its fixed extent size. You can preallocate space to the file by manipulating a file's reservation, or override the default allocation policy of the file system by setting a fixed extent size.

Other policies determine the way these attributes are expressed during the allocation process.

You can specify the following criteria:

- The space reserved for a file must be contiguous
- No allocations will be made for a file beyond the current reservation
- An unused reservation will be released when the file is closed
- Space will be allocated, but no reservation will be assigned
- The file size will be changed to incorporate the allocated space immediately



Some of the extent attributes are persistent and become part of the on-disk information about the file, while other attributes are temporary and are lost after the file is closed or the system is rebooted. The persistent attributes are similar to the file's permissions and are written in the inode for the file. When a file is copied, moved, or archived, only the persistent attributes of the source file are preserved in the new file.

See [“Other controls”](#) on page 66.

In general, the user will only set extent attributes for reservation. Many of the attributes are designed for applications that are tuned to a particular pattern of I/O or disk alignment.

See the `setext(1M)` manual page.

See [“About Veritas File System I/O”](#) on page 70.

## Reservation: preallocating space to a file

VxFS makes it possible to preallocate space to a file at the time of the request rather than when data is written into the file. This space cannot be allocated to other files in the file system. VxFS prevents any unexpected out-of-space condition on the file system by ensuring that a file's required space will be associated with the file before it is required.

A persistent reservation is not released when a file is truncated. The reservation must be cleared or the file must be removed to free the reserved space.

## Fixed extent size

The VxFS default allocation policy uses a variety of methods to determine how to make an allocation to a file when a write requires additional space. The policy attempts to balance the two goals of optimum I/O performance through large allocations and minimal file system fragmentation. VxFS accomplishes these goals by allocating from space available in the file system that best fits the data.

Setting a fixed extent size overrides the default allocation policies for a file and always serves as a persistent attribute. Be careful to choose an extent size appropriate to the application when using fixed extents. An advantage of the VxFS extent-based allocation policies is that they rarely use indirect blocks compared to block based file systems; VxFS eliminates many instances of disk access that stem from indirect references. However, a small extent size can eliminate this advantage.

Files with large extents tend to be more contiguous and have better I/O characteristics. However, the overall performance of the file system degrades because the unused space fragments free space by breaking large extents into

smaller pieces. By erring on the side of minimizing fragmentation for the file system, files may become so non-contiguous that their I/O characteristics would degrade.

Fixed extent sizes are particularly appropriate in the following situations:

- If a file is large and contiguous, a large fixed extent size can minimize the number of extents in the file.

Custom applications may also use fixed extent sizes for specific reasons, such as the need to align extents to cylinder or striping boundaries on disk.

## Other controls

The auxiliary controls on extent attributes determine the following conditions:

- Whether allocations are aligned
- Whether allocations are contiguous
- Whether the file can be written beyond its reservation
- Whether an unused reservation is released when the file is closed
- Whether the reservation is a persistent attribute of the file
- When the space reserved for a file will actually become part of the file

### Alignment

Specific alignment restrictions coordinate a file's allocations with a particular I/O pattern or disk alignment. Alignment can only be specified if a fixed extent size has also been set. Setting alignment restrictions on allocations is best left to well-designed applications.

See the `setext(1M)` manual page.

See [“About Veritas File System I/O”](#) on page 70.

### Contiguity

A reservation request can specify that its allocation remain contiguous (all one extent). Maximum contiguity of a file optimizes its I/O characteristics.

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**Note:** Fixed extent sizes or alignment cause a file system to return an error message reporting insufficient space if no suitably sized (or aligned) extent is available. This can happen even if the file system has sufficient free space and the fixed extent size is large.

---

## Write operations beyond reservation

A reservation request can specify that no allocations can take place after a write operation fills the last available block in the reservation. This request can be used a way similar to the function of the `ulimit` command to prevent a file's uncontrolled growth.

## Reservation trimming

A reservation request can specify that any unused reservation be released when the file is closed. The file is not completely closed until all processes open against the file have closed it.

## Reservation persistence

A reservation request can ensure that the reservation does not become a persistent attribute of the file. The unused reservation is discarded when the file is closed.

## Including reservation in the file

A reservation request can make sure the size of the file is adjusted to include the reservation. Normally, the space of the reservation is not included in the file until an extending write operation requires it. A reservation that immediately changes the file size can generate large temporary files. Unlike a `ftruncate` operation that increases the size of a file, this type of reservation does not perform zeroing of the blocks included in the file and limits this facility to users with appropriate privileges. The data that appears in the file may have been previously contained in another file. For users who do not have the appropriate privileges, there is a variant request that prevents such users from viewing uninitialized data.

# Commands related to extent attributes

The VxFS commands for manipulating extent attributes are `setext` and `getext`; they allow the user to set up files with a given set of extent attributes or view any attributes that are already associated with a file.

See the `setext(1M)` and `getext(1M)` manual pages.

The VxFS-specific commands `vxdump` and `vxrestore` preserve extent attributes when backing up, restoring, moving, or copying files.

Most of these commands include a command line option (`-e`) for maintaining extent attributes on files. This option specifies dealing with a VxFS file that has extent attribute information including reserved space, a fixed extent size, and extent alignment. The extent attribute information may be lost if the destination file system

does not support extent attributes, has a different block size than the source file system, or lacks free extents appropriate to satisfy the extent attribute requirements.

The `-e` option takes any of the following keywords as an argument:

<code>warn</code>	Issues a warning message if extent attribute information cannot be maintained (the default)
<code>force</code>	Fails the copy if extent attribute information cannot be maintained
<code>ignore</code>	Ignores extent attribute information entirely

## Example of setting an extent attribute

The following example creates a file named `file1` and preallocates 2 GB of disk space for the file.

### To set an extent attribute

- 1 Create the file `file1`:

```
# touch file1
```

- 2 Preallocate 2 GB of disk space for the file `file1`:

```
# setext -F vxfs -r 2g -f chgsize file1
```

Since the example specifies the `-f chgsize` option, VxFS immediately incorporates the reservation into the file and updates the file's inode with size and block count information that is increased to include the reserved space. Only users with root privileges can use the `-f chgsize` option.

## Example of getting an extent attribute

The following example gets the extent attribute information of a file named `file1`.

### To get an extent attribute's information

- ◆ Get the extent attribute information for the file `file1`:

```
# getext -F vxfs file1
file1: Bsize 1024 Reserve 36 Extent Size 3 align noextend
```

The file `file1` has a block size of 1024 bytes, 36 blocks reserved, a fixed extent size of 3 blocks, and all extents aligned to 3 block boundaries. The file size cannot be increased after the current reservation is exhausted. Reservations and fixed extent sizes are allocated in units of the file system block size.

## Failure to preserve extent attributes

Whenever a file is copied, moved, or archived using commands that preserve extent attributes, there is nevertheless the possibility of losing the attributes.

Such a failure might occur for one of the following reasons:

- The file system receiving a copied, moved, or restored file from an archive is not a VxFS type. Since other file system types do not support the extent attributes of the VxFS file system, the attributes of the source file are lost during the migration.
- The file system receiving a copied, moved, or restored file is a VxFS type but does not have enough free space to satisfy the extent attributes. For example, consider a 50K file and a reservation of 1 MB. If the target file system has 500K free, it could easily hold the file but fail to satisfy the reservation.
- The file system receiving a copied, moved, or restored file from an archive is a VxFS type but the different block sizes of the source and target file system make extent attributes impossible to maintain. For example, consider a source file system of block size 1024, a target file system of block size 4096, and a file that has a fixed extent size of 3 blocks (3072 bytes). This fixed extent size adapts to the source file system but cannot translate onto the target file system.

The same source and target file systems in the preceding example with a file carrying a fixed extent size of 4 could preserve the attribute; a 4 block (4096 byte) extent on the source file system would translate into a 1 block extent on the target.

On a system with mixed block sizes, a copy, move, or restoration operation may or may not succeed in preserving attributes. It is recommended that the same block size be used for all file systems on a given system.

# Veritas File System I/O

This chapter includes the following topics:

- [About Veritas File System I/O](#)
- [Buffered and Direct I/O](#)
- [Concurrent I/O](#)
- [Cache advisories](#)
- [Freezing and thawing a file system](#)
- [Getting the I/O size](#)
- [Enabling and disabling Concurrent I/O for a DB2 database](#)

## About Veritas File System I/O

VxFS processes two basic types of file system I/O:

- Sequential
- Random or I/O that is not sequential

For sequential I/O, VxFS employs a read-ahead policy by default when the application is reading data. For writing, it allocates contiguous blocks if possible. In most cases, VxFS handles I/O that is sequential through buffered I/O. VxFS handles random or nonsequential I/O using direct I/O without buffering.

VxFS provides a set of I/O cache advisories for use when accessing files.

See the *Veritas File System Programmer's Reference Guide*.

See the `vxfsio(7)` manual page.

## Buffered and Direct I/O

VxFS responds with read-ahead for sequential read I/O. This results in buffered I/O. The data is prefetched and retained in buffers for the application. The data buffers are commonly referred to as VxFS buffer cache. This is the default VxFS behavior.

VxFS responds with read-ahead for sequential read I/O. This results in buffered I/O. The data is prefetched and retained in buffers for the application. This is the default VxFS behavior.

On the other hand, direct I/O does not buffer the data when the I/O to the underlying device is completed. This saves system resources like memory and CPU usage. Direct I/O is possible only when alignment and sizing criteria are satisfied.

See [“Direct I/O requirements”](#) on page 72.

All of the supported platforms have a VxFS buffered cache. Each platform also has either a page cache or its own buffer cache. These caches are commonly known as the file system caches.

Each of the supported platforms has either a page cache or its own buffer cache. These caches are commonly known as the file system caches.

Direct I/O does not use these caches. The memory used for direct I/O is discarded after the I/O is complete,

## Direct I/O

Direct I/O is an unbuffered form of I/O. If the `VX_DIRECT` advisory is set, the user is requesting direct data transfer between the disk and the user-supplied buffer for reads and writes. This bypasses the kernel buffering of data, and reduces the CPU overhead associated with I/O by eliminating the data copy between the kernel buffer and the user's buffer. This also avoids taking up space in the buffer cache that might be better used for something else. The direct I/O feature can provide significant performance gains for some applications.

Direct I/O is an unbuffered form of I/O. If the `VX_DIRECT` advisory is set, the user is requesting direct data transfer between the disk and the user-supplied buffer for reads and writes. This bypasses the kernel buffering of data, and reduces the CPU overhead associated with I/O by eliminating the data copy between the kernel buffer and the user's buffer. This also avoids taking up space in the page cache that might be better used for something else. The direct I/O feature can provide significant performance gains for some applications.

The direct I/O and `VX_DIRECT` advisories are maintained on a per-file-descriptor basis.

JFS (base VxFS) includes direct I/O without a license.

## Direct I/O requirements

For an I/O operation to be performed as direct I/O, it must meet certain alignment criteria. The alignment constraints are usually determined by the disk driver, the disk controller, and the system memory management hardware and software.

The requirements for direct I/O are as follows:

- The starting file offset must be aligned to a 512-byte boundary.
- The ending file offset must be aligned to a 512-byte boundary, or the length must be a multiple of 512 bytes.
- The memory buffer must start on an 8-byte boundary.
- The starting file offset must be aligned to a 1024-byte boundary.
- The ending file offset must be aligned to a 1024-byte boundary, or the length must be a multiple of 1024 bytes.
- The memory buffer must start on an 4-byte boundary.

## Direct I/O versus synchronous I/O

Because direct I/O maintains the same data integrity as synchronous I/O, it can be used in many applications that currently use synchronous I/O. If a direct I/O request does not allocate storage or extend the file, the inode is not immediately written.

## Direct I/O CPU overhead

The CPU cost of direct I/O is about the same as a raw disk transfer. For sequential I/O to very large files, using direct I/O with large transfer sizes can provide the same speed as buffered I/O with much less CPU overhead.

If the file is being extended or storage is being allocated, direct I/O must write the inode change before returning to the application. This eliminates some of the performance advantages of direct I/O.

## Discovered Direct I/O

Discovered Direct I/O is a file system tunable that is set using the `vxtunefs` command. When the file system gets an I/O request larger than the `discovered_direct_iosz`, it tries to use direct I/O on the request. For large I/O sizes, Discovered Direct I/O can perform much better than buffered I/O.



Discovered Direct I/O behavior is similar to direct I/O and has the same alignment constraints, except writes that allocate storage or extend the file size do not require writing the inode changes before returning to the application.

See “[Tuning I/O](#)” on page 53.

Discovered direct I/O requires a full feature license.

## Unbuffered I/O

If the `VX_UNBUFFERED` advisory is set, I/O behavior is the same as direct I/O with the `VX_DIRECT` advisory set, so the alignment constraints that apply to direct I/O also apply to unbuffered I/O. For unbuffered I/O, however, if the file is being extended, or storage is being allocated to the file, inode changes are not updated synchronously before the write returns to the user. The `VX_UNBUFFERED` advisory is maintained on a per-file-descriptor basis.

See “[Tuning I/O](#)” on page 53.

## Data synchronous I/O

If the `VX_DSYNC` advisory is set, the user is requesting data synchronous I/O. In synchronous I/O, the data is written, and the inode is written with updated times and, if necessary, an increased file size. In data synchronous I/O, the data is transferred to disk synchronously before the write returns to the user. If the file is not extended by the write, the times are updated in memory, and the call returns to the user. If the file is extended by the operation, the inode is written before the write returns.

The direct I/O and `VX_DSYNC` advisories are maintained on a per-file-descriptor basis.

### Data synchronous I/O vs. synchronous I/O

Like direct I/O, the data synchronous I/O feature can provide significant application performance gains. Because data synchronous I/O maintains the same data integrity as synchronous I/O, it can be used in many applications that currently use synchronous I/O. If the data synchronous I/O does not allocate storage or extend the file, the inode is not immediately written. The data synchronous I/O does not have any alignment constraints, so applications that find it difficult to meet the alignment constraints of direct I/O should use data synchronous I/O.

If the file is being extended or storage is allocated, data synchronous I/O must write the inode change before returning to the application. This case eliminates the performance advantage of data synchronous I/O.

# Concurrent I/O

Concurrent I/O (`VX_CONCURRENT`) allows multiple processes to read from or write to the same file without blocking other `read(2)` or `write(2)` calls. POSIX semantics requires `read` and `write` calls to be serialized on a file with other `read` and `write` calls. With POSIX semantics, a `read` call either reads the data before or after the `write` call occurred. With the `VX_CONCURRENT` advisory set, the `read` and `write` operations are not serialized as in the case of a character device. This advisory is generally used by applications that require high performance for accessing data and do not perform overlapping writes to the same file. It is the responsibility of the application or the running threads to coordinate the `write` activities to the same file when using Concurrent I/O.

Concurrent I/O can be enabled in the following ways:

- By specifying the `VX_CONCURRENT` advisory flag for the file descriptor in the `VX_SETCACHE` `ioctl` command. Only the `read(2)` and `write(2)` calls occurring through this file descriptor use concurrent I/O. The `read` and `write` operations occurring through other file descriptors for the same file will still follow the POSIX semantics.  
See `vxfsio(7)` manual page.
- By using the `cio` mount option. The `read(2)` and `write(2)` operations occurring on all of the files in this particular file system will use concurrent I/O.  
See [“The cio option”](#) on page 44.  
See the `mount_vxfs(1M)` manual page.

Concurrent I/O is a separately licensed feature.

## Cache advisories

VxFS allows an application to set cache advisories for use when accessing files. VxFS cache advisories enable applications to help monitor the buffer cache and provide information on how better to tune the buffer cache to improve performance gain.

The basic function of the cache advisory is to let you know whether you could have avoided a later re-read of block X if the buffer cache had been a little larger. Conversely, the cache advisory can also let you know that you could safely reduce the buffer cache size without putting block X into jeopardy.

VxFS allows an application to set cache advisories for use when accessing files. VxFS cache advisories enable applications to help monitor the page cache and provide information on how better to tune the page cache to improve performance gain.

The basic function of the cache advisory is to let you know whether you could have avoided a later re-read of block X if the buffer cache had been a little larger. Conversely, the cache advisory can also let you know that you could safely reduce the page cache size without putting block X into jeopardy.

These advisories are in memory only and do not persist across reboots. Some advisories are currently maintained on a per-file, not a per-file-descriptor, basis. Only one set of advisories can be in effect for all accesses to the file. If two conflicting applications set different advisories, both must use the advisories that were last set.

All advisories are set using the `VX_SETCACHE` ioctl command. The current set of advisories can be obtained with the `VX_GETCACHE` ioctl command.

See the `vxfsio(7)` manual page.

## Freezing and thawing a file system

Freezing a file system is a necessary step for obtaining a stable and consistent image of the file system at the volume level. Consistent volume-level file system images can be obtained and used with a file system snapshot tool. The freeze operation flushes all buffers and pages in the file system cache that contain dirty metadata and user data. The operation then suspends any new activity on the file system until the file system is thawed.

The `VX_FREEZE` ioctl command is used to freeze a file system. Freezing a file system temporarily blocks all I/O operations to a file system and then performs a sync on the file system. When the `VX_FREEZE` ioctl is issued, all access to the file system is blocked at the system call level. Current operations are completed and the file system is synchronized to disk.

When the file system is frozen, any attempt to use the frozen file system, except for a `VX_THAW` ioctl command, is blocked until a process executes the `VX_THAW` ioctl command or the time-out on the freeze expires.

## Getting the I/O size

VxFS provides the `VX_GET_IOPARAMETERS` ioctl to get the recommended I/O sizes to use on a file system. This ioctl can be used by the application to make decisions about the I/O sizes issued to VxFS for a file or file device.

See the `vxtunefs(1M)` and `vxfsio(7)` manual pages.

See “[Tuning I/O](#)” on page 53.

# Enabling and disabling Concurrent I/O for a DB2 database

Concurrent I/O is not turned on by default and must be enabled manually. You must manually disable Concurrent I/O if you choose not to use it in the future.

## Enabling Concurrent I/O

Because you do not need to extend name spaces and present the files as devices, you can enable Concurrent I/O on regular files.

Before enabling Concurrent I/O, review the following information:

- |               |   |
|---------------|---|
| Prerequisites | <ul style="list-style-type: none"><li>■ To use the Concurrent I/O feature, the file system must be a VxFS file system.</li><li>■ Make sure the mount point on which you plan to mount the file system exists.</li><li>■ Make sure the DBA can access the mount point.</li></ul> |
|---------------|---|

## Enabling Concurrent I/O on a file system using mount with the -o cio option

You can enable Concurrent I/O by using `mount` with the `-o cio` option.

To enable Concurrent I/O on a file system using mount with the `-o cio` option

- ◆ Mount the file system using the `-o cio` option:

```
# /usr/sbin/mount -F vxfs -o cio special /mount_point
```

- *special* is a block special device
- */mount\_point* is the directory where the file system will be mounted.

For example, to mount a file system named `/datavol` on a mount point named `/db2data`:

```
# /usr/sbin/mount -F vxfs -o cio /dev/vx/dsk/db2dg/datavol \  
/db2data
```

## Enabling Concurrent I/O on a DB2 tablespace

Alternately, you can enable Concurrent I/O on a new DB2 tablespace by using the `db2 -v` command.

**To enable Concurrent I/O on a new DB2 tablespace**

- 1 Use the `db2 -v "create regular tablespace..."` command with the `no file system caching` option when you create the new tablespace.
- 2 Set all other parameters according to your system requirements.

**To enable Concurrent I/O on an existing DB2 tablespace**

- ◆ Use the DB2 `no file system caching` option:

```
# db2 -v "alter tablespace tablespace_name no file system caching"
```

*tablespace\_name* is the name of the tablespace for which you are enabling Concurrent I/O.

**To verify that Concurrent I/O has been set for a particular DB2 tablespace**

- 1 Use the DB2 `get snapshot` option to check for Concurrent I/O:

```
# db2 -v "get snapshot for tablespaces on dbname"
```

*dbname* is the database name.

- 2 Find the tablespace that you want to check and look for the `File system caching` attribute. If you see `File system caching = No`, then Concurrent I/O is enabled.

## Disabling Concurrent I/O

If you must disable Concurrent I/O, unmount the VxFS file system and mount it again without the mount option.

**To disable Concurrent I/O on a file system using the mount command**

- 1 Shutdown the DB2 instance.
- 2 Unmount the file system using the `umount` command.
- 3 Mount the file system again using the `mount` command without using the `-o cio` option.

# Quotas

This chapter includes the following topics:

- [About quota limits](#)
- [About quota files on Veritas File System](#)
- [About quota commands](#)
- [Using quotas](#)

## About quota limits

Veritas File System (VxFS) supports user quotas. The quota system limits the use of two principal resources of a file system: files and data blocks. For each of these resources, you can assign quotas to individual users to limit their usage.

You can set the following kinds of limits for each of the two resources:

hard limit	An absolute limit that cannot be exceeded under any circumstances.
soft limit	Must be lower than the hard limit, and can be exceeded, but only for a limited time. The time limit can be configured on a per-file system basis only. The VxFS default limit is seven days.

Soft limits are typically used when a user must run an application that could generate large temporary files. In this case, you can allow the user to exceed the quota limit for a limited time. No allocations are allowed after the expiration of the time limit. Use the `edquota` command to set limits.

See [“Using quotas”](#) on page 79.

Although file and data block limits can be set individually for each user, the time limits apply to the file system as a whole. The quota limit information is associated with user IDs and is stored in a user quota file.

See [“About quota files on Veritas File System”](#) on page 79.

The quota soft limit can be exceeded when VxFS preallocates space to a file. Quota limits cannot exceed two terabytes on a Version 5 disk layout.

See [“About extent attributes”](#) on page 64.

## About quota files on Veritas File System

A quotas file (named `quotas`) must exist in the root directory of a file system for any of the quota commands to work. The files in the file system's mount point are referred to as the external quotas file. VxFS also maintains an internal quotas file for its own use.

The quota administration commands read and write to the external quotas file to obtain or change usage limits. VxFS uses the internal file to maintain counts of data blocks and inodes used by each user. When quotas are turned on, the quota limits are copied from the external quotas file into the internal quotas file. While quotas are on, all the changes in the usage information and changes to quotas are registered in the internal quotas file. When quotas are turned off, the contents of the internal quotas file are copied into the external quotas file so that all data between the two files is synchronized.

## About quota commands

Most of the quotas commands in VxFS are similar to BSD quotas commands. In general, quota administration for VxFS is performed using commands similar to HFS quota commands. The VxFS mount command supports a special mount option (`-o quotas`), that can be used to turn on quotas at mount time.

For additional information on the quota commands, see the corresponding manual pages. In general, quota administration for VxFS is similar to that of BSD quotas.

---

**Note:** When VxFS file systems are exported via NFS, the VxFS quota commands on the NFS client cannot query or edit quotas. You can use the VxFS quota commands on the server to query or edit quotas.

---

## Using quotas

The VxFS quota commands are used to manipulate quotas.

## Turning on quotas

To use the quota functionality on a file system, quotas must be turned on. You can turn quotas on at mount time or after a file system is mounted.

### To turn on quotas

- ◆ To turn on user quotas for a VxFS file system, enter:

```
# quotaon /mount_point
```

## Turning on quotas at mount time

Quotas can be turned on with the `mount` command when you mount a file system.

### To turn on quotas at mount time

- ◆ To turn on user quotas for a file system at mount time, enter:

```
# mount -F vxfs -o quota special /mount_point
```

## Editing user quotas

You can set up user quotas using the `edquota` command. You must have superuser privileges to edit quotas.

`edquota` creates a temporary file for the given user; this file contains on-disk quotas for each mounted file system that has a quotas file. It is not necessary that quotas be turned on for `edquota` to work. However, the quota limits are applicable only after quotas are turned on for a given file system.

### To edit quotas

- ◆ Use the `edquota` command to edit quotas:

```
# edquota username
```

## Modifying time limits

The soft and hard limits can be modified or assigned values. For any user, usage can never exceed the hard limit after quotas are turned on.

Modified time limits apply to the entire file system and cannot be set selectively for each user.



**To modify time limits**

- ◆ Specify the `-t` option to modify time limits for any user:

```
# edquota -t
```

## Viewing disk quotas and usage

Use the `quota` command to view a user's disk quotas and usage on VxFS file systems.

**To display disk quotas and usage**

- ◆ To display a user's quotas and disk usage on all mounted VxFS file systems where the `quotas` file exists, enter:

```
# quota -v username
```

## Displaying blocks owned by users

Use the `quot` command to display the number of blocks owned by each user in a file system.

**To display the number of blocks owned by users**

- ◆ To display the number of files and the space owned by each user, enter:

```
# quot -f filesystem
```

## Turning off quotas

Use the `vxquotaoff` command to turn off quotas.

**To turn off quotas**

- ◆ To turn off quotas for a mounted file system, enter:

```
# quotaoff /mount_point
```

# File Change Log

This chapter includes the following topics:

- [About File Change Log](#)
- [About the File Change Log file](#)
- [File Change Log administrative interface](#)
- [File Change Log programmatic interface](#)
- [Summary of API functions](#)
- [Reverse path name lookup](#)

## About File Change Log

The VxFS File Change Log (FCL) tracks changes to files and directories in a file system.

Applications that typically use the FCL are usually required to:

- scan an entire file system or a subset
- discover changes since the last scan

These applications may include: backup utilities, webcrawlers, search engines, and replication programs.

---

**Note:** The FCL tracks when the data has changed and records the change type, but does not track the actual data changes. It is the responsibility of the application to examine the files to determine the changed data.

---

FCL functionality is a separately licensable feature.

See the *Veritas Storage Foundation Release Notes*.

# About the File Change Log file

File Change Log records file system changes such as creates, links, unlinks, renaming, data appended, data overwritten, data truncated, extended attribute modifications, holes punched, and miscellaneous file property updates.

---

**Note:** FCL is supported only on disk layout Version 6 and later.

---

FCL stores changes in a sparse file in the file system namespace. The FCL file is located in `mount_point/lost+found/changelog`. The FCL file behaves like a regular file, but some operations are prohibited. The standard system calls `open(2)`, `lseek(2)`, `read(2)` and `close(2)` can access the data in the FCL, while the `write(2)`, `mmap(2)` and `rename(2)` calls are not allowed.

---

**Warning:** Although some standard system calls are currently supported, the FCL file might be pulled out of the namespace in future VxFS release and these system calls may no longer work. It is recommended that all new applications be developed using the programmatic interface.

---

The FCL log file contains both the information about the FCL, which is stored in the FCL superblock, and the changes to files and directories in the file system, which is stored as FCL records.

See [“File Change Log programmatic interface”](#) on page 86.

In 4.1, the structure of the File Change Log file was exposed through the `/opt/VRTS/include/sys/fs/fcl.h` header file. In this release, the internal structure of the FCL file is opaque. The recommended mechanism to access the FCL is through the API described by the `/opt/VRTSfssdk/5.1.100.000/include/vxfsutil.h` header file.

The `/opt/VRTS/include/sys/fs/fcl.h` header file is included in this release to ensure that applications accessing the FCL with the 4.1 header file do not break. New applications should use the new FCL API described in `/opt/VRTSfssdk/5.1.100.000/include/vxfsutil.h`. Existing applications should also be modified to use the new FCL API.

To provide backward compatibility for the existing applications, this release supports multiple FCL versions. Users have the flexibility of specifying the FCL version for new FCLs. The default FCL version is 4.

See the `fcladm(1M)` man page.

# File Change Log administrative interface

The FCL can be set up and tuned through the `fcladm` and `vxtunefs VxFS` administrative commands.

See the `fcladm(1M)` and `vxtunefs(1M)` manual pages.

The FCL keywords for `fcladm` are as follows:

<code>clear</code>	Disables the recording of the audit, open, close, and statistical events after it has been set.
<code>dump</code>	Creates a regular file image of the FCL file that can be downloaded to an off-host processing system. This file has a different format than the FCL file.
<code>on</code>	Activates the FCL on a mounted file system. VxFS 5.0 and later releases support either FCL Versions 3 or 4. If no version is specified, the default is Version 4. Use <code>fcladm on</code> to specify the version.
<code>print</code>	Prints the contents of the FCL file starting from the specified offset.
<code>restore</code>	Restores the FCL file from the regular file image of the FCL file created by the <code>dump</code> keyword.
<code>rm</code>	Removes the FCL file. You must first deactivate the FCL with the <code>off</code> keyword, before you can remove the FCL file.
<code>set</code>	Enables the recording of events specified by the 'eventlist' option. See the <code>fcladm(1M)</code> manual page.
<code>state</code>	Writes the current state of the FCL to the standard output.
<code>sync</code>	Brings the FCL to a stable state by flushing the associated data of an FCL recording interval.

The FCL tunable parameters for `vxtunefs` are as follows:

<code>fcl_keeptime</code>	<p>Specifies the duration in seconds that FCL records stay in the FCL file before they can be purged. The first records to be purged are the oldest ones, which are located at the beginning of the file. Additionally, records at the beginning of the file can be purged if allocation to the FCL file exceeds <code>fcl_maxalloc</code> bytes. The default value of <code>fcl_keeptime</code> is 0. If the <code>fcl_maxalloc</code> parameter is set, records are purged from the FCL file if the amount of space allocated to the FCL file exceeds <code>fcl_maxalloc</code>. This is true even if the elapsed time the records have been in the log is less than the value of <code>fcl_keeptime</code>.</p>
<code>fcl_maxalloc</code>	<p>Specifies the maximum number of spaces in bytes to be allocated to the FCL file. When the space allocated exceeds <code>fcl_maxalloc</code>, a hole is punched at the beginning of the file. As a result, records are purged and the first valid offset (<code>fc_foff</code>) is updated. In addition, <code>fcl_maxalloc</code> may be violated if the oldest record has not reached <code>fcl_keeptime</code>.</p> <p>The minimum value of <code>fcl_maxalloc</code> is 4 MB. The default value is <code>fs_size/33</code>.</p>
<code>fcl_winterval</code>	<p>Specifies the time in seconds that must elapse before the FCL records an overwrite, extending write, or a truncate. This helps to reduce the number of repetitive records in the FCL. The <code>fcl_winterval</code> timeout is per inode. If an inode happens to go out of cache and returns, its write interval is reset. As a result, there could be more than one write record for that file in the same write interval. The default value is 3600 seconds.</p>
<code>fcl_ointerval</code>	<p>The time interval in seconds within which subsequent opens of a file do not produce an additional FCL record. This helps to reduce the number of repetitive records logged in the FCL file. If the tracking of access information is also enabled, a subsequent file open even within the <code>fcl_ointerval</code> may produce a record, if it is opened by a different user. Similarly, if the inode is bumped out of cache, this may also produce more than one record within the same open interval.</p> <p>The default value is 600 sec.</p>

Either or both `fcl_maxalloc` and `fcl_keeptime` must be set to activate the FCL feature. The following are examples of using the `fcladm` command.

To activate FCL for a mounted file system, type the following:

```
# fcladm on mount_point
```

To deactivate the FCL for a mounted file system, type the following:

```
# fcladm off mount_point
```

To remove the FCL file for a mounted file system, on which FCL must be turned off, type the following:

```
# fcladm rm mount_point
```

To obtain the current FCL state for a mounted file system, type the following:

```
# fcladm state mount_point
```

To enable tracking of the file opens along with access information with each event in the FCL, type the following:

```
# fcladm set fileopen,accessinfo mount_point
```

To stop tracking file I/O statistics in the FCL, type the following:

```
# fcladm clear filestats mount_point
```

Print the on-disk FCL super-block in text format to obtain information about the FCL file by using offset 0. Because the FCL on-disk super-block occupies the first block of the FCL file, the first and last valid offsets into the FCL file can be determined by reading the FCL super-block and checking the `fc_foff` field. Enter:

```
# fcladm print 0 mount_point
```

To print the contents of the FCL in text format, of which the offset used must be 32-byte aligned, enter:

```
# fcladm print offset mount_point
```

## File Change Log programmatic interface

VxFS provides an enhanced API to simplify reading and parsing the FCL file in two ways:

### Simplified reading

The API simplifies user tasks by reducing additional code needed to parse FCL file entries. In 4.1, to obtain event information such as a remove or link, the user was required to write additional code to get the name of the removed or linked file. In this release, the API allows the user to directly read an assembled record. The API also allows the user to specify a filter to indicate a subset of the event records of interest.

**Backward compatibility** Providing API access for the FCL feature allows backward compatibility for applications. The API allows applications to parse the FCL file independent of the FCL layout changes. Even if the hidden disk layout of the FCL changes, the API automatically translates the returned data to match the expected output record. As a result, the user does not need to modify or recompile the application due to changes in the on-disk FCL layout.

The following sample code fragment reads the FCL superblock, checks that the state of the FCL is `VX_FCLS_ON`, issues a call to `vxfs_fcl_sync` to obtain a finishing offset to read to, determines the first valid offset in the FCL file, then reads the entries in 8K chunks from this offset. The section process fcl entries is what an application developer must supply to process the entries in the FCL file.

```
#include <stdint.h>
#include <stdio.h>
#include <stdlib.h>
#include <sys/types.h>
#include <sys/fcntl.h>
#include <errno.h>
#include <fcl.h>
#include <vxfsutil.h>
#define FCL_READSZ 8192
char* fclname = "/mnt/lost+found/changelog";
int read_fcl(fclname) char* fclname;
{
    struct fcl_sb fclsb;
    uint64_t off, lastoff;
    size_t size;
    char buf[FCL_READSZ], *bufp = buf;
    int fd;
    int err = 0;
    if ((fd = open(fclname, O_RDONLY)) < 0) {
        return ENOENT;
    }
    if ((off = lseek(fd, 0, SEEK_SET)) != 0) {
        close(fd);
        return EIO;
    }
    size = read(fd, &fclsb, sizeof (struct fcl_sb));
    if (size < 0) {
        close(fd);
        return EIO;
    }
}
```

```

    }
    if (fclsb.fc_state == VX_FCLS_OFF) {
        close(fd);
        return 0;
    }
    if (err = vxfs_fcl_sync(fclname, &lastoff)) {
        close(fd);
        return err;
    }
    if ((off = lseek(fd, off_t, uint64_t)) != uint64_t) {
        close(fd);
        return EIO;
    }
    while (off < lastoff) {
        if ((size = read(fd, bufp, FCL_READSZ)) <= 0) {
            close(fd);
            return errno;
        }
        /* process fcl entries */
        off += size;
    }
    close(fd);
    return 0;
}

```

## Summary of API functions

The following is a brief summary of File Change Log API functions:

<code>vxfs_fcl_close()</code>	Closes the FCL file and cleans up resources associated with the handle.
<code>vxfs_fcl_cookie()</code>	Returns an opaque structure that embeds the current FCL activation time and the current offset. This cookie can be saved and later passed to <code>vxfs_fcl_seek()</code> function to continue reading from where the application last stopped.
<code>vxfs_fcl_getinfo()</code>	Returns information such as the state and version of the FCL file.
<code>vxfs_fcl_open()</code>	Opens the FCL file and returns a handle that can be used for further operations.
<code>vxfs_fcl_read()</code>	Reads FCL records of interest into a buffer specified by the user.



`vxfs_fcl_seek()` Extracts data from the specified cookie and then seeks to the specified offset.

`vxfs_fcl_seektime()` Seeks to the first record in the FCL after the specified time.

## Reverse path name lookup

The reverse path name lookup feature obtains the full path name of a file or directory from the inode number of that file or directory. The inode number is provided as an argument to the `vxlsino` administrative command, or the `vxfs_inotopath_gen(3)` application programming interface library function.

The reverse path name lookup feature can be useful for a variety of applications, such as for clients of the VxFS File Change Log feature, in backup and restore utilities, and for replication products. Typically, these applications store information by inode numbers because a path name for a file or directory can be very long, thus the need for an easy method of obtaining a path name.

An inode is a unique identification number for each file in a file system. An inode contains the data and metadata associated with that file, but does not include the file name to which the inode corresponds. It is therefore relatively difficult to determine the name of a file from an inode number. The `ncheck` command provides a mechanism for obtaining a file name from an inode identifier by scanning each directory in the file system, but this process can take a long period of time. The VxFS reverse path name lookup feature obtains path names relatively quickly.

---

**Note:** Because symbolic links do not constitute a path to the file, the reverse path name lookup feature cannot track symbolic links to files.

---

Because of the possibility of errors with processes renaming or unlinking and creating new files, it is advisable to perform a `lookup` or `open` with the path name and verify that the inode number matches the path names obtained.

See the `vxlsino(1M)`, `vxfs_inotopath_gen(3)`, and `vxfs_inotopath(3)` manual pages.

# Multi-volume file systems

This chapter includes the following topics:

- [About multi-volume support](#)
- [About volume types](#)
- [Features implemented using multi-volume support](#)
- [About volume sets](#)
- [Creating multi-volume file systems](#)
- [Converting a single volume file system to a multi-volume file system](#)
- [Adding a volume to and removing a volume from a multi-volume file system](#)
- [Volume encapsulation](#)
- [Reporting file extents](#)
- [Load balancing](#)
- [Converting a multi-volume file system to a single volume file system](#)

## About multi-volume support

VxFS provides support for multi-volume file systems when used in conjunction with the Veritas Volume Manager. Using multi-volume support (MVS), a single file system can be created over multiple volumes, each volume having its own properties. For example, it is possible to place metadata on mirrored storage while placing file data on better-performing volume types such as RAID-1+0 (striped and mirrored). The volume must be in the same disk group as the volume set, and it cannot already be a member of another volume set.

The MVS feature also allows file systems to reside on different classes of devices, so that a file system can be supported from both inexpensive disks and from expensive arrays. Using the MVS administrative interface, you can control which data goes on which volume types.

---

**Note:** Multi-volume support is available only on file systems using disk layout Version 6 or later.

See [“About disk layouts”](#) on page 233.

---

See [“About volume types”](#) on page 91.

See [“Features implemented using multi-volume support”](#) on page 92.

See [“Creating multi-volume file systems”](#) on page 95.

See [“Converting a single volume file system to a multi-volume file system”](#) on page 96.

See [“Adding a volume to and removing a volume from a multi-volume file system”](#) on page 98.

See [“Volume encapsulation”](#) on page 99.

See [“Reporting file extents”](#) on page 101.

See [“Load balancing”](#) on page 103.

See [“Converting a multi-volume file system to a single volume file system”](#) on page 105.

See [“Volume availability”](#) on page 92.

## About volume types

VxFS utilizes two types of volumes, one of which contains only data, referred to as `dataonly`, and the other of which can contain metadata or data, referred to as `metadataok`.

Data refers to direct extents, which contain user data, of regular files and named data streams in a file system.

Metadata refers to all extents that are not regular file or named data stream extents. This includes certain files that appear to be regular files, but are not, such as the File Change Log file.

A volume availability flag is set to specify if a volume is `dataonly` or `metadataok`. The volume availability flag can be set, cleared, and listed with the `fsvoladm` command.

See the `fsvoladm(1M)` manual page.

## Features implemented using multi-volume support

The following features can be implemented using multi-volume support:

- Controlling where files are stored can be selected at multiple levels so that specific files or file hierarchies can be assigned to different volumes. This functionality is available in the Veritas File System SmartTier feature.
- Placing the VxFS intent log on its own volume to minimize disk head movement and thereby increase performance.  
This functionality can be used to migrate from the Veritas QuickLog™ feature.
- Separating Storage Checkpoints so that data allocated to a Storage Checkpoint is isolated from the rest of the file system.
- Separating metadata from file data.
- Encapsulating volumes so that a volume appears in the file system as a file. This is particularly useful for databases that are running on raw volumes.
- Guaranteeing that a dataonly volume being unavailable does not cause a metadataok volume to be unavailable.

To use the multi-volume file system features, Veritas Volume Manager must be installed and the volume set feature must be accessible. The volume set feature is separately licensed.

## Volume availability

MVS guarantees that a dataonly volume being unavailable does not cause a metadataok volume to be unavailable. This allows you to mount a multi-volume file system even if one or more component dataonly volumes are missing.

The volumes are separated by whether metadata is allowed on the volume. An I/O error on a dataonly volume does not affect access to any other volumes. All VxFS operations that do not access the missing `dataonly` volume function normally.

Some VxFS operations that do not access the missing `dataonly` volume and function normally include the following:

- Mounting the multi-volume file system, regardless if the file system is read-only or read/write.
- Kernel operations.
- Performing a `fsck` replay. Logged writes are converted to normal writes if the corresponding volume is `dataonly`.

- Performing a full `fsck`.
- Using all other commands that do not access data on a missing volume.

Some operations that could fail if a `dataonly` volume is missing include:

- Reading or writing file data if the file's data extents were allocated from the missing `dataonly` volume.
- Using the `vxdump` command.

Volume availability is supported only on a file system with disk layout Version 7 or later.

---

**Note:** Do not mount a multi-volume system with the `ioerror=disable` or `ioerror=wdisable` mount options if the volumes have different availability properties. Symantec recommends the `ioerror=mdisable` mount option both for cluster mounts and for local mounts.

---

## About volume sets

Veritas Volume Manager exports a data object called a volume set. A volume set is a container for one or more volumes, each of which can have its own geometry. Unlike the traditional Volume Manager volume, which can be used for raw I/O access or to contain a file system, a volume set can only be used to contain a VxFS file system.

The Volume Manager `vxvset` command is used to create and manage volume sets. Volume sets cannot be empty. When the last entry is removed, so is the volume set.

## Creating and managing volume sets

The following command examples show how to create and manage volume sets.

See the *Veritas Volume Manager Administrator's Guide*, `vxassist`(1M) manual page, and `vxvset`(1M) manual page.

## To create and manage volume sets

- 1 Create a new volume set from `vol1`:

```
# vxassist -g dg1 make vol1 10m
# vxvset -g dg1 make myvset vol1
```

- 2 Create two new volumes and add them to the volume set:

```
# vxassist -g dg1 make vol2 50m
# vxassist -g dg1 make vol3 50m
# vxvset -g dg1 addvol myvset vol2
# vxvset -g dg1 addvol myvset vol3
```

- 3 List the component volumes of the previously created volume set:

```
# vxvset -g dg1 list myvset
```

VOLUME	INDEX	LENGTH	STATE	CONTEXT
vol1	0	20480	ACTIVE	-
vol2	1	102400	ACTIVE	-
vol3	2	102400	ACTIVE	-

- 4 Use the `ls` command to see that when a volume set is created, the volumes contained by the volume set are removed from the namespace and are instead accessed through the volume set name:

```
# ls -l /dev/vx/rdisk/rootdg/myvset
crw----- 1 root  root  108,70009 May 21 15:37
                                         /dev/vx/rdisk/rootdg/myvset
```

- 5 Create a volume, add it to the volume set, and use the `ls` command to see that when a volume is added to the volume set, it is no longer visible in the namespace:

```
# vxassist -g dg1 make vol4 50m
# ls -l /dev/vx/rdisk/rootdg/vol4
crw----- 1 root  root  108,70012 May 21 15:43
                                         /dev/vx/rdisk/rootdg/vol4
# vxvset -g dg1 addvol myvset vol4
# ls -l /dev/vx/rdisk/rootdg/vol4
/dev/vx/rdisk/rootdg/vol4: No such file or directory
```

# Creating multi-volume file systems

When a multi-volume file system is created, all volumes are `dataonly`, except volume zero, which is used to store the file system's metadata. The volume availability flag of volume zero cannot be set to `dataonly`.

As metadata cannot be allocated from `dataonly` volumes, enough metadata space should be allocated using `metadataok` volumes. The "file system out of space" error occurs if there is insufficient metadata space available, even if the `df` command shows that there is free space in the file system. The `fsvoladm` command can be used to see the free space in each volume and set the availability flag of the volume.

Unless otherwise specified, VxFS commands function the same on multi-volume file systems as the commands do on single-volume file systems.

See ["Example of creating a multi-volume file system"](#) on page 95.

## Example of creating a multi-volume file system

The following procedure is an example of creating a multi-volume file system.

### To create a multi-volume file system

- 1 After a volume set is created, create a VxFS file system by specifying the volume set name as an argument to `mkfs`:

```
# mkfs -F vxfs /dev/vx/rdisk/rootdg/myvset
version 7 layout
327680 sectors, 163840 blocks of size 1024,
log size 1024 blocks largefiles supported
```

After the file system is created, VxFS allocates space from the different volumes within the volume set.

- 2 List the component volumes of the volume set using of the `fsvoladm` command:

```
# mount -F vxfs /dev/vx/dsk/rootdg/myvset /mnt1
# fsvoladm list /mnt1
```

devid	size	used	avail	name
0	10240	1280	8960	vol1
1	51200	16	51184	vol2
2	51200	16	51184	vol3
3	51200	16	51184	vol4

- 3 Add a new volume by adding the volume to the volume set, then adding the volume to the file system:

```
# vxassist -g dg1 make vol5 50m
# vxvset -g dg1 addvol myvset vol5
# fsvoladm add /mnt1 vol5 50m
# fsvoladm list /mnt1
```

devid	size	used	avail	name
0	10240	1300	8940	vol1
1	51200	16	51184	vol2
2	51200	16	51184	vol3
3	51200	16	51184	vol4
4	51200	16	51184	vol5

- 4 List the volume availability flags using the `fsvoladm` command:

```
# fsvoladm queryflags /mnt1
```

volname	flags
vol1	metadataok
vol2	dataonly
vol3	dataonly
vol4	dataonly
vol5	dataonly

- 5 Increase the metadata space in the file system using the `fsvoladm` command:

```
# fsvoladm clearflags dataonly /mnt1 vol2
# fsvoladm queryflags /mnt1
```

volname	flags
vol1	metadataok
vol2	metadataok
vol3	dataonly
vol4	dataonly
vol5	dataonly

## Converting a single volume file system to a multi-volume file system

The following procedure converts a traditional, single volume file system, `/mnt1`, on a single volume `vol1` in the diskgroup `dg1` to a multi-volume file system.



## To convert a single volume file system

- 1 Determine the version of the volume's diskgroup:

```
# vxdg list dg1 | grep version: | awk '{ print $2 }'  
105
```

- 2 If the version is less than 110, upgrade the diskgroup:

```
# vxdg upgrade dg1
```

- 3 Determine the disk layout version of the file system:

```
# vxupgrade /mnt1  
Version 6
```

If the disk layout version is 6, upgrade to Version 7:

```
# vxupgrade -n 7 /mnt1
```

If the disk layout version is less than 6, upgrade to Version 7. For example, if the disk layout version is 5, upgrade to Version 7 as follows:

```
# vxupgrade -n 6 /mnt1  
# vxupgrade -n 7 /mnt1
```

- 4 Unmount the file system:

```
# umount /mnt1
```

- 5 Convert the volume into a volume set:

```
# vxvset -g dg1 make vset1 vol1
```

Edit the `/etc/fstab` file to replace the volume device name, `vol1`, with the volume set name, `vset1`.

- 6 Mount the file system:

```
# mount -F vxfs /dev/vx/dsk/dg1/vset1 /mnt1
```

- 7 As necessary, create and add volumes to the volume set:

```
# vxassist -g dg1 make vol2 256M
# vxvset -g dg1 addvol vset1 vol2
```

- 8 Set the placement class tags on all volumes that do not have a tag:

```
# vxassist -g dg1 settag vol1 vxfs.placement_class.tier1
# vxassist -g dg1 settag vol2 vxfs.placement_class.tier2
```

## Adding a volume to and removing a volume from a multi-volume file system

You can add volumes to and remove volumes from a multi-volume file system using the `fsvoladm` command.

See [“Adding a volume to a multi-volume file system”](#) on page 98.

See [“Removing a volume from a multi-volume file system”](#) on page 98.

See [“Forcibly removing a volume”](#) on page 99.

See [“Moving volume 0”](#) on page 99.

### Adding a volume to a multi-volume file system

Use the `fsvoladm add` command to add a volume to a multi-volume file system.

**To add a volume to a multi-volume file system**

- ◆ Add a new volume to a multi-volume file system:

```
# fsvoladm add /mnt1 vol2 256m
```

### Removing a volume from a multi-volume file system

Use the `fsvoladm remove` command to remove a volume from a multi-volume file system. The `fsvoladm remove` command fails if the volume being removed is the only volume in any allocation policy.

**To remove a volume from a multi-volume file system**

- ◆ Remove a volume from a multi-volume file system:

```
# fsvoladm remove /mnt1 vol2
```

## Forcibly removing a volume

If you must forcibly remove a volume from a file system, such as if a volume is permanently destroyed and you want to clean up the dangling pointers to the lost volume, use the `fsck -o zapvol=volname` command. The `zapvol` option performs a full file system check and zaps all inodes that refer to the specified volume. The `fsck` command prints the inode numbers of all files that the command destroys; the file names are not printed. The `zapvol` option only affects regular files if used on a `dataonly` volume. However, it could destroy structural files if used on a `metadataok` volume, which can make the file system unrecoverable. Therefore, the `zapvol` option should be used with caution on `metadataok` volumes.

## Moving volume 0

Volume 0 in a multi-volume file system cannot be removed from the file system, but you can move volume 0 to different storage using the `vxassist move` command. The `vxassist` command creates any necessary temporary mirrors and cleans up the mirrors at the end of the operation.

### To move volume 0

- ◆ Move volume 0:

```
# vxassist -g mydg move vol1 \!mydg
```

## Volume encapsulation

Multi-volume support enables the ability to encapsulate an existing raw volume and make the volume contents appear as a file in the file system.

Encapsulating a volume involves the following actions:

- Adding the volume to an existing volume set.
- Adding the volume to the file system using `fsvoladm`.

See [“Encapsulating a volume”](#) on page 99.

See [“Deencapsulating a volume”](#) on page 101.

## Encapsulating a volume

The following example illustrates how to encapsulate a volume.

## To encapsulate a volume

### 1 List the volumes:

```
# vxvset -g dg1 list myvset
VOLUME    INDEX    LENGTH    STATE    CONTEXT
vol1       0         102400    ACTIVE   -
vol2       1         102400    ACTIVE   -
```

The volume set has two volumes.

### 2 Create a third volume and copy the passwd file to the third volume:

```
# vxassist -g dg1 make dbvol 100m
# dd if=/etc/passwd of=/dev/vx/rdisk/rootdg/dbvol count=1
1+0 records in
1+0 records out
```

The third volume will be used to demonstrate how the volume can be accessed as a file, as shown later.

### 3 Create a file system on the volume set:

```
# mkfs -F vxfs /dev/vx/rdisk/rootdg/myvset
version 7 layout
204800 sectors, 102400 blocks of size 1024,
log size 1024 blocks
largefiles supported
```

### 4 Mount the volume set:

```
# mount -F vxfs /dev/vx/dsk/rootdg/myvset /mnt1
```

### 5 Add the new volume to the volume set:

```
# vxvset -g dg1 addvol myvset dbvol
```

## 6 Encapsulate dbvol:

```
# fsvoladm encapsulate /mnt1/dbfile dbvol 100m
# ls -l /mnt1/dbfile
-rw----- 1 root other 104857600 May 22 11:30 /mnt1/dbfile
```

## 7 Examine the contents of dbfile to see that it can be accessed as a file:

```
# head -2 /mnt1/dbfile
root:x:0:1:Super-User:/:/sbin/sh
daemon:x:1:1:/:/
```

The passwd file that was written to the raw volume is now visible in the new file.

---

**Note:** If the encapsulated file is changed in any way, such as if the file is extended, truncated, or moved with an allocation policy or resized volume, or the volume is encapsulated with a bias, the file cannot be de-encapsulated.

---

# Deencapsulating a volume

The following example illustrates how to deencapsulate a volume.

## To deencapsulate a volume

### 1 List the volumes:

```
# vxvset -g dg1 list myvset
VOLUME    INDEX    LENGTH    STATE    CONTEXT
vol1       0         102400    ACTIVE   -
vol2       1         102400    ACTIVE   -
dbvol      2         102400    ACTIVE   -
```

The volume set has three volumes.

### 2 Deencapsulate dbvol:

```
# fsvoladm deencapsulate /mnt1/dbfile
```

# Reporting file extents

MVS feature provides the capability for file-to-volume mapping and volume-to-file mapping via the `fsmmap` and `fsvmap` commands. The `fsmmap` command reports the

volume name, logical offset, and size of data extents, or the volume name and size of indirect extents associated with a file on a multi-volume file system. The `fsvmap` command maps volumes to the files that have extents on those volumes.

See the `fsmmap(1M)` and `fsvmap(1M)` manual pages.

The `fsmmap` command requires `open()` permission for each file or directory specified. Root permission is required to report the list of files with extents on a particular volume.

See [“Examples of reporting file extents”](#) on page 102.

## Examples of reporting file extents

The following examples show typical uses of the `fsmmap` and `fsvmap` commands.

### Using the `fsmmap` command

- ◆ Use the `find` command to descend directories recursively and run `fsmmap` on the list of files:

```
# find . | fsmmap -
Volume  Extent Type  File
vol2    Data             ./file1
vol1    Data             ./file2
```

### Using the fsvmap command

- 1 Report the extents of files on multiple volumes:

```
# fsvmap /dev/vx/rdsk/fstest/testvset vol1 vol2
vol1 /.
vol1 /ns2
vol1 /ns3
vol1 /file1
vol2 /file1
vol2 /file2
```

- 2 Report the extents of files that have either data or metadata on a single volume in all Storage Checkpoints, and indicate if the volume has file system metadata:

```
# fsvmap -mvC /dev/vx/rdsk/fstest/testvset vol1
Meta Structural vol1 //volume has filesystem metadata//
Data UNNAMED vol1 /.
Data UNNAMED vol1 /ns2
Data UNNAMED vol1 /ns3
Data UNNAMED vol1 /file1
Meta UNNAMED vol1 /file1
```

## Load balancing

An allocation policy with the balance allocation order can be defined and assigned to files that must have their allocations distributed at random between a set of specified volumes. Each extent associated with these files are limited to a maximum size that is defined as the required chunk size in the allocation policy. The distribution of the extents is mostly equal if none of the volumes are full or disabled.

Load balancing allocation policies can be assigned to individual files or for all files in the file system. Although intended for balancing data extents across volumes, a load balancing policy can be assigned as a metadata policy if desired, without any restrictions.

---

**Note:** If a file has both a fixed extent size set and an allocation policy for load balancing, certain behavior can be expected. If the chunk size in the allocation policy is greater than the fixed extent size, all extents for the file are limited by the chunk size. For example, if the chunk size is 16 MB and the fixed extent size is 3 MB, then the largest extent that satisfies both the conditions is 15 MB. If the fixed extent size is larger than the chunk size, all extents are limited to the fixed extent size. For example, if the chunk size is 2 MB and the fixed extent size is 3 MB, then all extents for the file are limited to 3 MB.

---

See [“Defining and assigning a load balancing allocation policy”](#) on page 104.

See [“Rebalancing extents”](#) on page 104.

## Defining and assigning a load balancing allocation policy

The following example defines a load balancing policy and assigns the policy to the file, `/mnt/file.db`.

### To define and assign the policy

- 1 Define the policy by specifying the `-o balance` and `-c` options:

```
# fsapadm define -o balance -c 2m /mnt loadbal vol1 vol2 vol3 vol4
```

- 2 Assign the policy:

```
# fsapadm assign /mnt/filedb loadbal meta
```

## Rebalancing extents

Extents can be rebalanced by strictly enforcing the allocation policy. Rebalancing is generally required when volumes are added or removed from the policy or when the chunk size is modified. When volumes are removed from the volume set, any extents on the volumes being removed are automatically relocated to other volumes within the policy.

The following example redefines a policy that has four volumes by adding two new volumes, removing an existing volume, and enforcing the policy for rebalancing.



### To rebalance extents

- 1 Define the policy by specifying the `-o balance` and `-c` options:

```
# fsapadm define -o balance -c 2m /mnt loadbal vol1 vol2 vol4 \
vol5 vol6
```

- 2 Enforce the policy:

```
# fsapadm enforcefile -f strict /mnt/filedb
```

## Converting a multi-volume file system to a single volume file system

Because data can be relocated among volumes in a multi-volume file system, you can convert a multi-volume file system to a traditional, single volume file system by moving all file system data onto a single volume. Such a conversion is useful to users who would like to try using a multi-volume file system or SmartTier, but are not committed to using a multi-volume file system permanently.

There are three restrictions to this operation:

- The single volume must be the first volume in the volume set
- The first volume must have sufficient space to hold all of the data and file system metadata
- The volume cannot have any allocation policies that restrict the movement of data

See [“Converting to a single volume file system”](#) on page 105.

## Converting to a single volume file system

The following procedure converts an existing multi-volume file system, `/mnt1`, of the volume set `vset1`, to a single volume file system, `/mnt1`, on volume `vol1` in diskgroup `dg1`.

---

**Note:** Steps 5, 6, 7, and 8 are optional, and can be performed if you prefer to remove the wrapper of the volume set object.

---

### Converting to a single volume file system

- 1 Determine if the first volume in the volume set, which is identified as device number 0, has the capacity to receive the data from the other volumes that will be removed:

```
# df /mnt1
/mnt1    (/dev/vx/dsk/dg1/vol1):16777216 blocks   3443528 files
```

- 2 If the first volume does not have sufficient capacity, grow the volume to a sufficient size:

```
# fsvoladm resize /mnt1 vol1 150g
```

- 3 Remove all existing allocation policies:

```
# fsppadm unassign /mnt1
```

- 4 Remove all volumes except the first volume in the volume set:

```
# fsvoladm remove /mnt1 vol2
# vxvset -g dg1 rmvol vset1 vol2
# fsvoladm remove /mnt1 vol3
# vxvset -g dg1 rmvol vset1 vol3
```

Before removing a volume, the file system attempts to relocate the files on that volume. Successful relocation requires space on another volume, and no allocation policies can be enforced that pin files to that volume. The time for the command to complete is proportional to the amount of data that must be relocated.

- 5 Unmount the file system:

```
# umount /mnt1
```

- 6 Remove the volume from the volume set:

```
# vxvset -g dg1 rmvol vset1 vol1
```

Edit the `/etc/fstab` file to replace the volume set name, `vset1`, with the volume device name, `vol1`.

- 7 Mount the file system:

```
# mount -F vxfs /dev/vx/dsk/dg1/vol1 /mnt1
```

# Using Veritas Extension for Oracle Disk Manager

This chapter includes the following topics:

- [About Oracle Disk Manager](#)
- [About Oracle Disk Manager and Storage Foundation Cluster File System](#)
- [About Oracle Disk Manager and Oracle Managed Files](#)
- [Setting up Veritas Extension for Oracle Disk Manager](#)
- [Preparing existing database storage for Oracle Disk Manager](#)
- [Converting Quick I/O files to Oracle Disk Manager files](#)
- [Verifying that Oracle Disk Manager is configured](#)
- [Disabling the Oracle Disk Manager feature](#)
- [Using Cached ODM](#)

## About Oracle Disk Manager

Veritas Extension for Oracle Disk Manager is specifically designed for Oracle10g or later to enhance file management and disk I/O throughput. The features of Oracle Disk Manager are best suited for databases that reside in a file system contained in Veritas File System. Oracle Disk Manager allows Oracle10g or later users to improve database throughput for I/O intensive workloads with special I/O optimization.

Veritas Extension for Oracle Disk Manager supports Oracle Resilvering. With Oracle Resilvering, the storage layer receives information from the Oracle database as to

which regions or blocks of a mirrored datafile to resync after a system crash. Oracle Resilvering avoids overhead from the VxVM DRL, which increases performance.

Oracle Disk Manager reduces administrative overhead by providing enhanced support for Oracle Managed Files. Veritas Extension for Oracle Disk Manager has Quick I/O-like capabilities, but is transparent to the user. Unlike Veritas Quick I/O, files managed using Veritas Extension for Oracle Disk Manager do not require special file naming conventions. The Oracle Disk Manager interface uses regular database files. If you are upgrading to Oracle10g or later, you should convert from Quick I/O to Oracle Disk Manager.

Database administrators can choose the datafile type used with the Oracle product. Historically, choosing between file system files and raw devices was based on manageability and performance. The exception to this is a database intended for use with Oracle Parallel Server, which requires raw devices on most platforms. If performance is not as important as administrative ease, file system files are typically the preferred file type. However, while an application may not have substantial I/O requirements when it is first implemented, I/O requirements may change. If an application becomes dependent upon I/O throughput, converting datafiles from file system to raw devices is often necessary.

Oracle Disk Manager was designed to work with Oracle10g or later to provide both performance and manageability. Oracle Disk Manager provides support for Oracle's file management and I/O calls for database storage on VxFS file systems and on raw volumes or partitions. This feature is provided as a dynamically-loaded shared library with which Oracle binds when it is loaded. The Oracle Disk Manager library works with an Oracle Disk Manager driver that is loaded in the kernel to perform its functions.

If you are upgrading to Oracle10g or later, you should convert from Quick I/O to Oracle Disk Manager.

The benefits of using Oracle Disk Manager are as follows:

- True kernel asynchronous I/O for files and raw devices
- Reduced system call overhead
- Improved file system layout by preallocating contiguous files on a VxFS file system
- Performance on file system files that is equal to raw devices
- Transparent to users
- Contiguous datafile allocation

## How Oracle Disk Manager improves database performance

Oracle Disk Manager improves database I/O performance to VxFS file systems by:

- Supporting kernel asynchronous I/O
- Supporting direct I/O and avoiding double buffering
- Avoiding kernel write locks on database files
- Supporting many concurrent I/Os in one system call
- Avoiding duplicate opening of files per Oracle instance
- Allocating contiguous datafiles

### About kernel asynchronous I/O support

Asynchronous I/O performs non-blocking system level reads and writes, allowing the system to perform multiple I/O requests simultaneously. Kernel asynchronous I/O is better than library asynchronous I/O because the I/O is queued to the disk device drivers in the kernel, minimizing context switches to accomplish the work.

### About direct I/O support and avoiding double buffering

I/O on files using `read()` and `write()` system calls typically results in data being copied twice: once between the user and kernel space, and the other between kernel space and the disk. In contrast, I/O on raw devices is copied directly between user space and disk, saving one level of copying. As with I/O on raw devices, Oracle Disk Manager I/O avoids the extra copying. Oracle Disk Manager bypasses the system cache and accesses the files with the same efficiency as raw devices. Avoiding double buffering reduces the memory overhead on the system. Eliminating the copies from kernel to user address space significantly reduces kernel mode processor utilization, freeing more processor cycles to execute the application code.

### About avoiding kernel write locks on database files

When database I/O is performed by way of the `write()` system call, each system call acquires and releases a kernel write lock on the file. This lock prevents simultaneous write operations on the same file. Because database systems usually implement their own locks for managing concurrent access to files, write locks unnecessarily serialize I/O writes. Oracle Disk Manager bypasses file system locking and lets the database server control data access.

### About supporting many concurrent I/Os in one system call

When performing asynchronous I/O, an Oracle process may try to issue additional I/O requests while collecting completed I/Os, or it may try to wait for particular I/O

requests synchronously, as it can do no other work until the I/O is completed. The Oracle process may also try to issue requests to different files. All this activity can be accomplished with one system call when Oracle uses the Oracle Disk Manager I/O interface. This interface reduces the number of system calls performed to accomplish the same work, reducing the number of user space/kernel space context switches.

### **About avoiding duplicate file open calls**

Oracle Disk Manager allows files to be opened once, providing a “file identifier.” This is called “identifying” the files. The same file identifiers can be used by any other processes in the Oracle instance. The file status is maintained by the Oracle Disk Manager driver in the kernel. The reduction in file open calls reduces processing overhead at process initialization and termination, and it reduces the number of file status structures required in the kernel.

### **About allocating contiguous datafiles**

Oracle Disk Manager can improve performance for queries, such as sort and parallel queries, that use temporary tablespaces. Without Oracle Disk Manager, Oracle does not initialize the datafiles for the temporary tablespaces. Therefore, the datafiles become sparse files and are generally fragmented. Sparse or fragmented files lead to poor query performance. When using Oracle Disk Manager, the datafiles are initialized for the temporary tablespaces and are allocated in a contiguous fashion, so that they are not sparse.

## **About Oracle Disk Manager and Storage Foundation Cluster File System**

Oracle Disk Manager supports access to clustered files in the SFCFS environment. With a Veritas Storage Foundation Cluster File System license, ODM supports SFCFS files in a serially-exclusive mode which allows access to each SFCFS file by one node at a time, but does not allow simultaneous access from multiple nodes.

See the `mount_odm(1)` man page for more information on its cluster support modes.

## **About Oracle Disk Manager and Oracle Managed Files**

Oracle10g or later offers a feature known as Oracle Managed Files (OMF). OMF manages datafile attributes such as file names, file location, storage attributes, and whether or not the file is in use by the database. OMF is only supported for

databases that reside in file systems. OMF functionality is greatly enhanced by Oracle Disk Manager.

OMF is a file management feature that:

- Eliminates the task of providing unique file names
- Offers dynamic space management by way of the tablespace auto-extend functionality of Oracle10g or later

The main requirement for OMF is that the database be placed in file system files. There are additional prerequisites imposed upon the file system itself.

OMF should only be used in file systems that reside within striped logical volumes, which support dynamic file system growth. File systems intended for OMF use must also support large, extensible files in order to facilitate tablespace auto-extension. Raw partitions cannot be used for OMF.

By default, OMF datafiles are created with auto-extensibility. This attribute reduces capacity planning associated with maintaining existing databases and implementing new applications. Due to disk fragmentation that occurs as the tablespace grows over time, database administrators have been somewhat cautious when considering auto-extensible tablespaces. Oracle Disk Manager eliminates this concern.

When Oracle Disk Manager is used in conjunction with OMF, special care is given within Veritas Extension for Disk Manager to ensure that contiguous disk space is allocated to datafiles, including space allocated to a tablespace when it is auto-extended. The table and index scan throughput does not decay as the tablespace grows.

## How Oracle Disk Manager works with Oracle Managed Files

The following example illustrates the relationship between Oracle Disk Manager and Oracle Managed Files (OMF). The example shows the `init.ora` contents and the command for starting the database instance. To simplify Oracle UNDO management, the new Oracle10g or later `init.ora` parameter `UNDO_MANAGEMENT` is set to `AUTO`. This is known as System-Managed Undo.

---

**Note:** Before building an OMF database, you need the appropriate `init.ora` default values. These values control the location of the `SYSTEM` tablespace, online redo logs, and control files after the `CREATE DATABASE` statement is executed.

---

```
$ cat initPROD.ora
UNDO_MANAGEMENT = AUTO
DB_CREATE_FILE_DEST = '/PROD'
DB_CREATE_ONLINE_LOG_DEST_1 = '/PROD'
```

```
db_block_size = 4096
db_name = PROD
$ sqlplus /nolog
SQL> connect / as sysdba
SQL> startup nomount pfile= initPROD.ora
```

The Oracle instance starts.

```
Total System Global Area 93094616 bytes
Fixed Size 279256 bytes
Variable Size 41943040 bytes
Database Buffers 50331648 bytes
Redo Buffers 540672 bytes
```

To implement a layout that places files associated with the `EMP_TABLE` tablespace in a directory separate from the `EMP_INDEX` tablespace, use the `ALTER SYSTEM` statement. This example shows how OMF handles file names and storage clauses and paths. The layout allows you to think of the tablespaces as objects in a file system as opposed to a collection of datafiles. Since OMF uses the Oracle Disk Manager file resize function, the tablespace files are initially created with the default size of 100 MB and ODM increases the size as needed. Use the `MAXSIZE` attribute to limit growth.

The following example shows the commands for creating an OMF database and for creating the `EMP_TABLE` and `EMP_INDEX` tablespaces in their own locale:

```
SQL> create database PROD;
```

---

**Note:** The directory must exist for OMF to work, so the `SQL*Plus HOST` command is used to create the directories:

---

The database is created.

```
SQL> HOST mkdir /PROD/EMP_TABLE;
SQL> ALTER SYSTEM SET DB_CREATE_FILE_DEST = '/PROD/EMP_TABLE';
```

The system is altered.

```
SQL> create tablespace EMP_TABLE DATAFILE AUTOEXTEND ON MAXSIZE \
500M;
```

A tablespace is created.

```
SQL> ALTER SYSTEM SET DB_CREATE_FILE_DEST = '/PROD/EMP_INDEX';
```

The system is altered.



```
SQL> create tablespace EMP_INDEX DATAFILE AUTOEXTEND ON MAXSIZE \
100M;
```

A tablespace is created.

Use the `ls` command to show the newly created database:

```
$ ls -lFR
total 638062
drwxr-xr-x 2 oracle10g dba 96 May  3 15:43 EMP_INDEX/
drwxr-xr-x 2 oracle10g dba 96 May  3 15:43 EMP_TABLE/
-rw-r--r-- 1 oracle10g dba 104858112 May  3 17:28 ora_1_BEhYgc0m.log
-rw-r--r-- 1 oracle10g dba 104858112 May  3 17:27 ora_2_BEhYu4NA.log
-rw-r--r-- 1 oracle10g dba 806912 May  3 15:43 ora_BEahlfUX.ctl
-rw-r--r-- 1 oracle10g dba 10489856 May  3 15:43 ora_sys_undo_BEajPSVq.dbf
-rw-r--r-- 1 oracle10g dba 104861696 May  3 15:4 ora_system_BEaiFE8v.dbf
-rw-r--r-- 1 oracle10g dba 186 May  3 15:03 PROD.ora

./EMP_INDEX:
total 204808
-rw-r--r-- 1 oracle10g dba 104861696 May  3 15:43
ora_emp_inde_BEakGfun.dbf

./EMP_TABLE:
total 204808
-rw-r--r-- 1 oracle10g dba 104861696 May  3 15:43
ora_emp_tabl_BEak1LqK.dbf
```

## Setting up Veritas Extension for Oracle Disk Manager

Before setting up Veritas Extension for Oracle Disk Manager, the following conditions must be met:

- |               |   |
|---------------|---|
| Prerequisites | <ul style="list-style-type: none"><li>■ Oracle10g, or later, must be installed on your system.</li><li>■ If Cached Quick I/O is available, do not enable Oracle Disk Manager when Cached Quick I/O is enabled for datafiles.</li></ul>  |
| Usage Notes   | <ul style="list-style-type: none"><li>■ When the Quick I/O feature is available, Oracle Disk Manager uses the Quick I/O driver to perform asynchronous I/O. Do not turn off the Quick I/O mount option, which is the default.</li></ul> |

## Linking the Veritas extension for Oracle Disk Manager library into Oracle home

If the Veritas extension for Oracle Disk Manager library is not linked into Oracle home, perform the following procedure. The steps vary depending on the Oracle version.

To link the Veritas extension for Oracle Disk Manager library into Oracle home for Oracle 11g

- 1 Shut down the database instance before linking the Oracle Disk Manager library.
- 2 Use the `mv` and `ln` commands.

For HP-UX PA, enter:

```
# mv ${ORACLE_HOME}/lib/libodm11.sl \  
${ORACLE_HOME}/lib/libodm11.sl.orig  
# ln -s /opt/VRTSodm/lib/libodm.sl \  
${ORACLE_HOME}/lib/libodm11.sl
```

For HP-UX IA, enter:

```
# mv ${ORACLE_HOME}/lib/libodm11.so \  
${ORACLE_HOME}/lib/libodm11.so.orig  
# ln -s /opt/VRTSodm/lib/libodm.sl \  
${ORACLE_HOME}/lib/libodm11.so
```

- 3 Start the database instance after linking the Oracle Disk Manager library.

### To link the Veritas extension for Oracle Disk Manager library into Oracle home for Oracle 10g

- 1 Shut down the database instance before linking the Oracle Disk Manager library.
- 2 Use the `mv` and `ln` commands:

For HP-UX PA, enter:

```
# mv ${ORACLE_HOME}/lib/libodm10.sl \  
${ORACLE_HOME}/lib/libodm10.sl.orig  
# ln -s /opt/VRTSodm/lib/libodm.sl \  
${ORACLE_HOME}/lib/libodm10.sl
```

For HP-UX IA, enter:

```
# mv ${ORACLE_HOME}/lib/libodm10.so \  
${ORACLE_HOME}/lib/libodm10.so.orig  
# ln -s /opt/VRTSodm/lib/libodm.sl \  
${ORACLE_HOME}/lib/libodm10.so
```

- 3 Start the database instance after linking the Oracle Disk Manager library.

## Preparing existing database storage for Oracle Disk Manager

Non-Quick I/O files in a VxFS file system work with Oracle Disk Manager without any changes. The files are found and identified for Oracle Disk Manager I/O by default. To take full advantage of Oracle Disk Manager datafiles, files should not be fragmented.

If you are using Quick I/O files in a VxFS file system and you want to move to Oracle Disk Manager, convert the Quick I/O files to normal files using the `qio_convertdbfiles -u` command.

You must be running Oracle10g or later to use Oracle Disk Manager.

## Converting Quick I/O files to Oracle Disk Manager files

If you plan to run the Veritas product with Oracle10g or later, and you have been using Quick I/O files, Symantec recommends that you convert your Quick I/O files to regular files. This should be done after you upgrade.

---

**Note:** If you are running an earlier version of Oracle (Oracle 8.x or lower), you should not convert your Quick I/O files because Oracle Disk Manager is for Oracle10g or later only.

The Oracle Disk Manager uses the Quick I/O driver to perform asynchronous I/O, do not turn off the Quick I/O mount option, which is the default.

---

#### To convert Quick I/O files to Oracle Disk Manager files

- 1 As Oracle DBA, run `qio_getdbfiles` to retrieve a list of all datafiles.

```
$ /opt/VRTS/bin/qio_getdbfiles -T ora -a
```

The list is compiled in a file named `mkqio.dat`.

- 2 Shutdown the database.
- 3 As Oracle DBA, run `qio_convertdbfiles` in the directory containing the `mkqio.dat` file. The `qio_convertdbfiles` script converts all Quick I/O files to ODM files.

```
$ /opt/VRTS/bin/qio_convertdbfiles -T ora -u
```

- 4 Restart the database instance.

## Verifying that Oracle Disk Manager is configured

Before verifying that Oracle Disk Manager is configured, make sure that the following conditions are met:

- |               |  |
|---------------|--|
| Prerequisites | <ul style="list-style-type: none"><li>■ <code>/opt/VRTSodm/lib/libodm.sl</code> must exist.</li><li>■ The VRTSdbed license must be valid.</li><li>■ The VRTSodm package must be installed.</li></ul> |
|---------------|--|

**To verify that Oracle Disk Manager is configured**

- 1 Verify that the ODM feature is included in the license:

```
# /opt/VRTS/bin/vxlicrep | grep ODM
```

The output verifies that ODM is enabled.

---

**Note:** Verify that the license key containing the ODM feature is not expired. If the license key has expired, you will not be able to use the ODM feature.

---

- 2 Check that the `VRTSodm` package is installed:

```
(root@slias19) [/] swlist VRTSodm
# Initializing...
# Contacting target "slias19"...
#
# Target:  slias19:/
#

# VRTSodm                5.0.31.5.%20090322 Veritas Oracle Disk Manager
VRTSodm.ODM-KRN          5.0.31.5.%20090322 Veritas ODM kernel files
VRTSodm.ODM-MAN          5.0.31.5.%20090322 Veritas ODM manual pages
VRTSodm.ODM-RUN          5.0.31.5.%20090322 Veritas ODM commands
```

- 3 Check that `libodm.sl` is present.

```
# ls -lL /opt/VRTSodm/lib/libodm.sl
-rw-r--r-- 1 root sys 14336 Apr 25 18:42
/opt/VRTSodm/lib/libodm.sl
```

**To verify that Oracle Disk Manager is running**

- 1 Start the Oracle database.
- 2 Check that the instance is using the Oracle Disk Manager function:

```
# cat /dev/odm/stats
# echo $?
0
```

- 3 Verify that the Oracle Disk Manager is loaded:

```
# /usr/sbin/kcmodule -P state odm  
state loaded
```

- 4 In the alert log, verify the Oracle instance is running. The log should contain output similar to the following:

```
Oracle instance running with ODM: Veritas 5.1.100.00 ODM Library,  
Version 2.0
```

## Disabling the Oracle Disk Manager feature

Since the Oracle Disk Manager feature uses regular files, you can access these files as regular VxFS files as soon as the feature is disabled.

---

**Note:** To convert to VxFS with Quick I/O, disable Oracle Disk Manager using the following procedure, then convert the files to Quick I/O files.

See [“Converting Quick I/O files to Oracle Disk Manager files”](#) on page 115.

Before disabling the Oracle Disk Manager feature, you may want to back up your files.

---

**To disable the Oracle Disk Manager feature in an Oracle instance**

- 1 Shut down the database instance.
- 2 Use the `rm` and `ln` commands to remove the link to the Oracle Disk Manager Library.

For Oracle 11g, enter:

```
# rm ${ORACLE_HOME}/lib/libodm11.sl
# ln -s ${ORACLE_HOME}/lib/libodmd11.sl \
${ORACLE_HOME}/lib/libodm11.sl
```

For Oracle 10g, enter:

```
# rm ${ORACLE_HOME}/lib/libodm10.sl
# ln -s ${ORACLE_HOME}/lib/libodmd10.sl \
${ORACLE_HOME}/lib/libodm10.sl

# rm ${ORACLE_HOME}/lib/libodm9.sl
# ln -s ${ORACLE_HOME}/lib/libodmd9.sl \
${ORACLE_HOME}/lib/libodm9.sl
```

For HP-UX IA

For Oracle 11g, enter:

```
# rm ${ORACLE_HOME}/lib/libodm11.so
# ln -s ${ORACLE_HOME}/lib/libodmd11.sl \
${ORACLE_HOME}/lib/libodm11.so
```

For Oracle 10g, enter:

```
# rm ${ORACLE_HOME}/lib/libodm10.so
# ln -s ${ORACLE_HOME}/lib/libodmd10.sl \
${ORACLE_HOME}/lib/libodm10.so

# rm ${ORACLE_HOME}/lib/libodm9.so
# ln -s ${ORACLE_HOME}/lib/libodmd9.sl \
${ORACLE_HOME}/lib/libodm9.so
```

- 3 Restart the database instance.

## Using Cached ODM

ODM I/O normally bypasses the file system cache and directly reads from and writes to disk. Cached ODM enables some I/O to use caching and read ahead,

which can improve ODM I/O performance. Cached ODM performs a conditional form of caching that is based on per-I/O hints from Oracle. The hints indicate what Oracle does with the data. ODM uses these hints to perform caching and read ahead for some reads, but ODM avoids caching other reads, even for the same file.

You can enable cached ODM for local mount files and cluster mount files.

See [“Enabling Cached ODM for file systems”](#) on page 120.

Cached ODM can be configured in two ways. The primary configuration method is to turn caching on or off for all I/O on a per-file basis. The secondary configuration method is to adjust the ODM cachemap. The cachemap maps file type and I/O type combinations into caching advisories.

See [“Modifying Cached ODM settings for individual files”](#) on page 120.

See [“Adding Cached ODM settings via the cachemap”](#) on page 121.

## Enabling Cached ODM for file systems

Cached ODM is initially disabled on a file system. You enable Cached ODM for a file system by setting the `odm_cache_enable` option of the `vxtunefs` command after the file system is mounted.

See the `vxtunefs(1M)` manual page.

---

**Note:** The `vxtunefs` command enables conditional caching for all of the ODM files on the file system.

---

### To enable Cached ODM for a file system

- 1 Enable Cached ODM on the VxFS file system `/database01`:

```
# vxtunefs -s -o odm_cache_enable=1 /database01
```

- 2 Optionally, you can make this setting persistent across mounts by adding a file system entry in the file `/etc/vx/tunefstab`:

```
/dev/vx/dsk/datadg/database01 odm_cache_enable=1
```

See the `tunefstab(4)` manual page.

## Modifying Cached ODM settings for individual files

You can use the `odmadm setcachefile` command to override the cachemap for a specific file so that ODM caches either all or none of the I/O to the file. The caching



state can be ON, OFF, or DEF (default). The DEF caching state is conditional caching, meaning that for each I/O, ODM consults the cachemap and determines whether the specified file type and I/O type combination should be cached. The ON caching state causes the specified file always to be cached, while the OFF caching state causes the specified file never to be cached.

See the `odmadm(1M)` manual page.

---

**Note:** The cache advisories operate only if Cached ODM is enabled for the file system. If the `odm_cache_enable` flag is zero, Cached ODM is OFF for all of the files in that file system, even if the individual file cache advisory for a file is ON.

---

#### To enable unconditional caching on a file

- ◆ Enable unconditional caching on the file `/mnt1/file1`:

```
# odmadm setcachefile /mnt1/file1=on
```

With this command, ODM caches all reads from `file1`.

#### To disable caching on a file

- ◆ Disable caching on the file `/mnt1/file1`:

```
# odmadm setcachefile /mnt1/file1=off
```

With this command, ODM does not cache reads from `file1`.

#### To check on the current cache advisory settings for a file

- ◆ Check the current cache advisory settings of the files `/mnt1/file1` and `/mnt2/file2`:

```
# odmadm getcachefile /mnt1/file1 /mnt2/file2
/mnt1/file1,ON
/mnt2/file2,OFF
```

#### To reset all files to the default cache advisory

- ◆ Reset all files to the default cache advisory:

```
# odmadm resetcachefiles
```

## Adding Cached ODM settings via the cachemap

You can use the `odmadm setcachemap` command to configure the cachemap. The cachemap maps file type and I/O type combinations to caching advisories. ODM

uses the cachemap for all files that have the default conditional cache setting. Such files are those for which caching has not been turned on or off by the `odmadm setcachefile` command.

See the `odmadm(1M)` manual page.

By default, the cachemap is empty, but you can add caching advisories by using the `odmadm setcachemap` command.

#### To add caching advisories to the cachemap

- ◆ Add a caching advisory to the cachemap:

```
# odmadm setcachemap data/data_read_seq=cache,readahead
```

With this example command, ODM uses caching and readahead for I/O to online log files (`data`) that have the `data_read_seq` I/O type. You can view the valid file type and I/O type values from the output of the `odmadm getcachemap` command.

See the `odmadm(1M)` manual page.

## Making the caching settings persistent across mounts

By default, the Cached ODM settings are not persistent across mounts. You can make the settings persistent by creating the `/etc/vx/odmadm` file and listing the caching advisory settings in the file

#### To make the caching setting persistent across mounts

- ◆ Create the `/etc/vx/odmadm` file to list files and their caching advisories. In the following example of the `/etc/vx/odmadm` file, if you mount the `/dev/vx/dsk/rootdg/voll` device at `/mnt1`, `odmadm` turns off caching for `/mnt1/oradata/file1`:

```
setcachemap data/read_data_header=cache
setcachemap all/datapump=cache,readahead
device /dev/vx/dsk/rootdg/voll
setcachefile oradata/file1=off
```

# Quick Reference

This appendix includes the following topics:

- [Command summary](#)
- [Online manual pages](#)
- [Creating a VxFS file system](#)
- [Converting a file system to VxFS](#)
- [Mounting a file system](#)
- [Unmounting a file system](#)
- [Displaying information on mounted file systems](#)
- [Identifying file system types](#)
- [Resizing a file system](#)
- [Using quotas](#)

## Command summary

Symbolic links to all VxFS command executables are installed in the `/opt/VRTS/bin` directory. Add this directory to the end of your `PATH` environment variable to access the commands.

[Table A-1](#) describes the VxFS-specific commands.

**Table A-1** VxFS commands

Command	Description
<code>df</code>	Reports the number of free disk blocks and inodes for a VxFS file system.

Table A-1 VxFS commands (*continued*)

Command	Description
diskusg	Generates VxFS disk accounting data by user ID.
extendfs	Extends the size of a VxFS file system.
fcldadm	Administers VxFS File Change Logs.
ff	Lists file names and inode information for a VxFS file system.
fiostat	Administers file I/O statistics
fsadm	Resizes or defragments a VxFS file system.
fsapadm	Administers VxFS allocation policies.
fscat	Cats a VxFS file system.
fscdsadm	Performs online CDS operations.
fscdsconv	Performs offline CDS migration tasks on VxFS file systems.
fscdstask	Performs various CDS operations.
fsck	Checks and repairs a VxFS file system.
fsckpt_restore	Restores file systems from VxFS Storage Checkpoints.
fsckptadm	Administers VxFS Storage Checkpoints.
fsclustadm	Manages cluster-mounted VxFS file systems.
fsdb	Debugs VxFS file systems.
fsfreeze	Freezes VxFS file systems and executes a user command on the file systems.
fsmap	Displays VxFS file system extent information.
fsmigadm	Administers file system online migrations.
fspadm	Administers VxFS placement policies.
fspmk	Creates placement policies.
fstag	Creates, deletes, or lists file tags.
fstyp	Returns the type of file system on a specified disk partition.
fsvmap	Maps volumes of VxFS file systems to files.

Table A-1 VxFS commands (*continued*)

Command	Description
<code>fsvoladm</code>	Administers VxFS volumes.
<code>glmconfig</code>	Configures Group Lock Managers (GLM).
<code>glmdump</code>	Reports stuck Group Lock Managers (GLM) locks in a cluster file system.
<code>glmstat</code>	Group Lock Managers (GLM) statistics gathering utility.
<code>mkdstfs</code>	SmartTier file system creation utility.
<code>mkfs</code>	Constructs a VxFS file system.
<code>mount</code>	Mounts a VxFS file system.
<code>ncheck</code>	Generates path names from inode numbers for a VxFS file system.
<code>newfs</code>	Creates a new VxFS file system.
<code>qioadmin</code>	Administers VxFS Quick I/O for Databases cache.
<code>qiomkfile</code>	Creates a VxFS Quick I/O device file. This functionality is available only with the Veritas Quick I/O for Databases feature.
<code>qiostat</code>	Displays statistics for VxFS Quick I/O for Databases. This functionality is available only with the Veritas Quick I/O for Databases feature.
<code>quot</code>	Summarizes ownership on a VxFS file system.
<code>quotacheck</code>	Checks VxFS file system quota consistency.
<code>rvxdump</code>	Incrementally dumps file systems.
<code>rvxrestore</code>	Restores a file system incrementally.
<code>setext</code>	Sets extent attributes on a file in a VxFS file system.
<code>vxdump</code>	Incrementally dumps file systems.
<code>vxenablef</code>	Enables specific VxFS features.
<code>vxfilesnap</code>	Makes a copy-on-write copy of a file in a VxFS file system.
<code>vxfsconvert</code>	Converts an unmounted file system to VxFS or upgrades a VxFS disk layout version.
<code>vxfsstat</code>	Displays file system statistics.
<code>vxlsino</code>	Looks up VxFS reverse path names.

Table A-1 VxFS commands (*continued*)

Command	Description
<code>vxrestore</code>	Restores a file system incrementally.
<code>vxtunefs</code>	Tunes a VxFS file system.
<code>vxumount</code>	Unmounts a VxFS file system.
<code>vxupgrade</code>	Upgrades the disk layout of a mounted VxFS file system.

## Online manual pages

This release includes the following online manual pages as part of the `VRTSvxfs` package. These are installed in the appropriate directories under `/opt/VRTS/man` (add this to your `MANPATH` environment variable), but does not update the `windex` database. To ensure that new VxFS manual pages display correctly, update the `windex` database after installing `VRTSvxfs`.

See the `catman(1M)` manual page.

[Table A-2](#) describes the VxFS-specific section 1 manual pages.

Table A-2 Section 1 manual pages

Section 1	Description
<code>fiostat</code>	Administers file I/O statistics.
<code>fsmap</code>	Displays VxFS file system extent information.
<code>getext</code>	Gets extent attributes for a VxFS file system.
<code>qioadmin</code>	Administers VxFS Quick I/O for Databases cache. This functionality is available only with the Veritas Quick I/O for Databases feature.
<code>qiomkfile</code>	Creates a VxFS Quick I/O device file. This functionality is available only with the Veritas Quick I/O for Databases feature.
<code>qiostat</code>	Displays statistics for VxFS Quick I/O for Databases. This functionality is available only with the Veritas Quick I/O for Databases feature.
<code>setext</code>	Sets extent attributes on a file in a VxFS file system.
<code>vxfilesnap</code>	Makes a copy-on-write copy of a file in a VxFS file system.

[Table A-3](#) describes the VxFS-specific section 1M manual pages.

Table A-3 Section 1M manual pages

Section 1M	Description
df_vxfs	Reports the number of free disk blocks and inodes for a VxFS file system.
extendfs_vxfs	Extends the size of a VxFS file system.
fcladm	Administers VxFS File Change Logs.
ff_vxfs	Lists file names and inode information for a VxFS file system.
fsadm_vxfs	Resizes or reorganizes a VxFS file system.
fsapadm	Administers VxFS allocation policies.
fscat_vxfs	Cats a VxFS file system.
fscdsadm	Performs online CDS operations.
fscdsconv	Performs offline CDS migration tasks on VxFS file systems.
fscdstask	Performs various CDS operations.
fsck_vxfs	Checks and repairs a VxFS file system.
fsckptadm	Administers VxFS Storage Checkpoints.
fsckpt_restore	Restores file systems from VxFS Storage Checkpoints.
fsclustadm	
fsdb_vxfs	Debugs VxFS file systems.
fsfreeze	Freezes VxFS file systems and executes a user command on the file systems.
fsmigadm	Administers file system online migrations.
fspadm	Administers VxFS placement policies.
fsvmap	Maps volumes of VxFS file systems to files.
fsvoladm	Administers VxFS volumes.
glmconfig	Configures Group Lock Managers (GLM). This functionality is available only with the Veritas Cluster File System product.
glmdump	Reports stuck Group Lock Managers (GLM) locks in a cluster file system.
mkdstfs	SmartTier file system creation utility.
mkfs_vxfs	Constructs a VxFS file system.

**Table A-3** Section 1M manual pages (*continued*)

Section 1M	Description
<code>mount_vxfs</code>	Mounts a VxFS file system.
<code>ncheck_vxfs</code>	Generates path names from inode numbers for a VxFS file system.
<code>newfs_vxfs</code>	Creates a new VxFS file system.
<code>quot</code>	Summarizes ownership on a VxFS file system.
<code>quotacheck_vxfs</code>	Checks VxFS file system quota consistency.
<code>vxdiskusg</code>	Generates VxFS disk accounting data by user ID.
<code>vxdump</code>	Incrementally dumps file systems.
<code>vxenablef</code>	Enables specific VxFS features.
<code>vxfsconvert</code>	Converts an unmounted file system to VxFS or upgrades a VxFS disk layout version.
<code>vxfsstat</code>	Displays file system statistics.
<code>vxlsino</code>	Looks up VxFS reverse path names.
<code>vxrestore</code>	Restores a file system incrementally.
<code>vxtunefs</code>	Tunes a VxFS file system.
<code>vxupgrade</code>	Upgrades the disk layout of a mounted VxFS file system.
<code>vxumount</code>	Unmounts a VxFS file system.

[Table A-4](#) describes the VxFS-specific section 3 manual pages.

**Table A-4** Section 3 manual pages

Section 3	Description
<code>fsckpt_cntl</code>	Performs control functions and Storage Checkpoint state changes.
<code>fsckpt_create</code>	Creates a Storage Checkpoint associated with a file system handle.
<code>fsckpt_createall</code>	Creates a Storage Checkpoint associated with a list of file system handles.
<code>fsckpt_fbmap</code>	Retrieves the block map from a Storage Checkpoint file.
<code>fsckpt_fclos</code>	Closes a Storage Checkpoint file.
<code>fsckpt_finfo</code>	Returns the status information from a Storage Checkpoint file.



Table A-4 Section 3 manual pages (*continued*)

Section 3	Description
<code>fsckpt_fopen</code>	Opens a Storage Checkpoint file.
<code>fsckpt_fpromote</code>	Promotes a file from a Storage Checkpoint into another fileset.
<code>fsckpt_fsclose</code>	Closes a mount point opened for Storage Checkpoint management.
<code>fsckpt_fsopen</code>	Opens a mount point for Storage Checkpoint management.
<code>fsckpt_info</code>	Returns status information on a Storage Checkpoint.
<code>fsckpt_intro</code>	Introduces the VxFS file system Storage Checkpoint API.
<code>fsckpt_mkprimary</code>	Makes a Storage Checkpoint in a VxFS file system the primary fileset for that file system.
<code>fsckpt_opts_create</code>	Creates a Storage Checkpoint associated with a file system handle.
<code>fsckpt_opts_createall</code>	Creates a Storage Checkpoint associated with a list of file system handles.
<code>fsckpt_remove</code>	Removes a Storage Checkpoint from a file system handle.
<code>fsckpt_rename</code>	Renames a Storage Checkpoint from a file system handle.
<code>fsckpt_sa_info</code>	Returns status information on a Storage Checkpoint within a VxFS file system on a block special device.
<code>fsckpt_setqlimit</code> <code>fsckpt_getqlimit</code>	Sets or gets Storage Checkpoint quota limits.
<code>fsckpt_setquota</code>	Turns Storage Checkpoint quotas on or off.
<code>vxfs_ap_alloc2</code>	Allocates an <code>fsap_info2</code> structure.
<code>vxfs_ap_assign_ckpt</code>	Assigns an allocation policy to file data and metadata in a Storage Checkpoint.
<code>vxfs_ap_assign_ckptchain</code>	Assigns an allocation policy for all of the Storage Checkpoints of a VxFS file system.
<code>vxfs_ap_assign_ckptdef</code>	Assigns a default allocation policy for new Storage Checkpoints of a VxFS file system.
<code>vxfs_ap_assign_file</code>	Assigns an allocation policy for file data and metadata.
<code>vxfs_ap_assign_file_pat</code>	Assigns a pattern-based allocation policy for a directory.

Table A-4 Section 3 manual pages (*continued*)

Section 3	Description
<code>vxfs_ap_assign_fs</code>	Assigns an allocation policy for all file data and metadata within a specified file system.
<code>vxfs_ap_assign_fs_pat</code>	Assigns an pattern-based allocation policy for a file system.
<code>vxfs_ap_define</code>	Defines a new allocation policy.
<code>vxfs_ap_define2</code>	Defines a new allocation policy.
<code>vxfs_ap_enforce_ckpt</code>	Reorganizes blocks in a Storage Checkpoint to match a specified allocation policy.
<code>vxfs_ap_enforce_ckptchain</code>	Enforces the allocation policy for all of the Storage Checkpoints of a VxFS file system.
<code>vxfs_ap_enforce_file</code>	Ensures that all blocks in a specified file match the file allocation policy.
<code>vxfs_ap_enforce_file2</code>	Reallocates blocks in a file to match allocation policies.
<code>vxfs_ap_enforce_range</code>	Reallocates blocks in a file within a specified range to match allocation policies.
<code>vxfs_ap_enumerate</code>	Returns information about all allocation policies.
<code>vxfs_ap_enumerate2</code>	Returns information about all allocation policies.
<code>vxfs_ap_free2</code>	Frees one or more <code>fsap_info2</code> structures.
<code>vxfs_ap_query</code>	Returns information about a specific allocation policy.
<code>vxfs_ap_query2</code>	Returns information about a specific allocation policy.
<code>vxfs_ap_query_ckpt</code>	Returns information about allocation policies for each Storage Checkpoint.
<code>vxfs_ap_query_ckptdef</code>	Retrieves the default allocation policies for new Storage Checkpoints of a VxFS file system
<code>vxfs_ap_query_file</code>	Returns information about allocation policies assigned to a specified file.
<code>vxfs_ap_query_file_pat</code>	Returns information about the pattern-based allocation policy assigned to a directory.
<code>vxfs_ap_query_fs</code>	Retrieves allocation policies assigned to a specified file system.
<code>vxfs_ap_query_fs_pat</code>	Returns information about the pattern-based allocation policy assigned to a file system.
<code>vxfs_ap_remove</code>	Deletes a specified allocation policy.

Table A-4 Section 3 manual pages (*continued*)

Section 3	Description
<code>vxfs_fcl_sync</code>	Sets a synchronization point in the VxFS File Change Log.
<code>vxfs_fiostats_dump</code>	Returns file and file range I/O statistics.
<code>vxfs_fiostats_getconfig</code>	Gets file range I/O statistics configuration values.
<code>vxfs_fiostats_set</code>	Turns on and off file range I/O statistics and resets statistics counters.
<code>vxfs_get_iooffsets</code>	Obtains VxFS inode field offsets.
<code>vxfs_inotopath</code>	Returns path names for a given inode number.
<code>vxfs_inostat</code>	Gets the file statistics based on the inode number.
<code>vxfs_inotofd</code>	Gets the file descriptor based on the inode number.
<code>vxfs_nattr_check</code> <code>vxfs_nattr_fcheck</code>	Checks for the existence of named data streams.
<code>vxfs_nattr_link</code>	Links to a named data stream.
<code>vxfs_nattr_open</code>	Opens a named data stream.
<code>vxfs_nattr_rename</code>	Renames a named data stream.
<code>vxfs_nattr_unlink</code>	Removes a named data stream.
<code>vxfs_nattr_utimes</code>	Sets access and modification times for named data streams.
<code>vxfs_vol_add</code>	Adds a volume to a multi-volume file system.
<code>vxfs_vol_clearflags</code>	Clears specified flags on volumes in a multi-volume file system.
<code>vxfs_vol_deencapsulate</code>	De-encapsulates a volume from a multi-volume file system.
<code>vxfs_vol_encapsulate</code>	Encapsulates a volume within a multi-volume file system.
<code>vxfs_vol_encapsulate_bias</code>	Encapsulates a volume within a multi-volume file system.
<code>vxfs_vol_enumerate</code>	Returns information about the volumes within a multi-volume file system.
<code>vxfs_vol_queryflags</code>	Queries flags on volumes in a multi-volume file system.
<code>vxfs_vol_remove</code>	Removes a volume from a multi-volume file system.
<code>vxfs_vol_resize</code>	Resizes a specific volume within a multi-volume file system.
<code>vxfs_vol_setflags</code>	Sets specified flags on volumes in a multi-volume file system.

Table A-4 Section 3 manual pages (*continued*)

Section 3	Description
<code>vxfs_vol_stat</code>	Returns free space information about a component volume within a multi-volume file system.

Table A-5 describes the VxFS-specific section 4 manual pages.

Table A-5 Section 4 manual pages

Section 4	Description
<code>fs_vxfs</code>	Provides the format of a VxFS file system volume.
<code>inode_vxfs</code>	Provides the format of a VxFS file system inode.
<code>tunefstab</code>	Describes the VxFS file system tuning parameters table.

Table A-6 describes the VxFS-specific section 7 manual pages.

Table A-6 Section 7 manual pages

Section 7	Description
<code>vxfsio</code>	Describes the VxFS file system control functions.

## Creating a VxFS file system

The `mkfs` command creates a VxFS file system by writing to a special character device file. The special character device is a location or character device node of a particular storage device. The `mkfs` command builds a file system with a root directory and a `lost+found` directory.

Before running `mkfs`, you must create the target device. Refer to your operating system documentation for more information. If you are using a logical device (such as a VxVM volume), see the VxVM documentation for instructions on device initialization.

See the `mkfs(1M)` and `mkfs_vxfs(1M)` manual pages.

### To create a file system

- ◆ Use the `mkfs` command to create a file system:

```
mkfs [-F vxfs] [-m] [generic_options] [-o specific_options] \
special [size]
```

<code>-F vxfs</code>	Specifies the VxFS file system type.
<code>-m</code>	Displays the command line that was used to create the file system. The file system must already exist. This option enables you to determine the parameters used to construct the file system.
<i>generic_options</i>	Options common to most other file system types.
<code>-o specific_options</code>	Options specific to VxFS.
<code>-o N</code>	Displays the geometry of the file system and does not write to the device.
<code>-o largefiles</code>	Allows users to create files larger than two gigabytes. The default option is largefiles.
<i>special</i>	Specifies the special device file location or character device node of a particular storage device.
<i>size</i>	Specifies the number of 1024-byte sectors in the file system. If <i>size</i> is not specified, <code>mkfs</code> determines the size of the special device.

## Example of creating a file system

The following example creates a VxFS file system of 12288 sectors in size on a VxVM volume.

### To create a VxFS file system

- 1 Create the file system:

```
# mkfs -F vxfs /dev/vx/rdisk/diskgroup/volume 12288
version 7 layout
262144 sectors, 262144 blocks of size 1024, log size 1024 blocks
largefiles supported
```

- 2 Mount the newly created file system.

```
# mount -F vxfs /dev/vx/rdisk/diskgroup/volume /mnt1
```

# Converting a file system to VxFS

The `vxfsconvert` command can be used to convert a HFS file system to a VxFS file system.

See the `vxfsconvert(1M)` manual page.

To convert a HFS file system to a VxFS file system

- ◆ Use the `vxfsconvert` command to convert a HFS file system to VxFS:

```
vxfsconvert [-l logsize] [-s size] [-efnNvyY] special
```

<code>-e</code>	Estimates the amount of space required to complete the conversion.
<code>-f</code>	Displays the list of supported file system types.
<code>-l logsize</code>	Specifies the size of the file system intent log.
<code>-n N</code>	Assumes a no response to all questions asked by <code>vxfsconvert</code> .
<code>-s siz</code>	Directs <code>vxfsconvert</code> to use free disk space past the current end of the file system to store VxFS metadata.
<code>-v</code>	Specifies verbose mode.
<code>-y Y</code>	Assumes a yes response to all questions asked by <code>vxfsconvert</code> .
<code>special</code>	Specifies the name of the character (raw) device that contains the file system to convert.

## Example of converting a file system

The following example converts a HFS file system to a VxFS file system with an intent log size of 4096 blocks.

To convert a HFS file system to a VxFS file system

- ◆ Convert the file system:

```
# vxfsconvert -l 4096 /dev/vx/rdisk/diskgroup/volume
```

## Mounting a file system

You can mount a VxFS file system by using the `mount` command. If you enter this command, the generic `mount` command parses the arguments and the `-F fstype` option executes the `mount` command specific to that file system type. For VxFS and

Veritas-installed products, the generic `mount` command executes the VxFS `mount` command from the directory `/sbin/fs/vxfs`. If the `-F` option is not supplied, the command searches the file `/etc/fstab` for a file system and an `fstype` matching the special file or mount point provided. If no file system type is specified, `mount` uses the default file system type (VxFS).

The `mount` command automatically runs the VxFS `fsck` command to clean up the intent log if the `mount` command detects a dirty log in the file system. This functionality is only supported on file systems mounted on a Veritas Volume Manager (VxVM) volume.

To mount a file system

- ◆ Use the `mount` command to mount a file system:

```
mount [-F vxfs] [generic_options] [-r] [-o specific_options] \
special mount_point
```

<i>vxfs</i>	File system type.
<i>generic_options</i>	Options common to most other file system types.
<i>specific_options</i>	Options specific to VxFS.
<code>-o ckpt=ckpt_name</code>	Mounts a Storage Checkpoint.
<code>-o cluster</code>	Mounts a file system in shared mode. Available only with the VxFS cluster file system feature.
<i>special</i>	A VxFS block special device.
<i>mount_point</i>	Directory on which to mount the file system.
<code>-r</code>	Mounts the file system as read-only.

Mount options

The `mount` command has numerous options to tailor a file system for various functions and environments.

The following table lists some of the *specific\_options*:

Security feature	If security is important, use <code>blkclear</code> to ensure that deleted files are completely erased before the space is reused.
------------------	--

Support for large files	If you specify the <code>largefiles</code> option, you can create files larger than two gigabytes on the file system. The default option is <code>largefiles</code> .
Support for cluster file systems	If you specify the <code>cluster</code> option, the file system is mounted in shared mode. Cluster file systems depend on several other Veritas products that must be correctly configured before a complete clustering environment is enabled.
Using Storage Checkpoints	The <code>ckpt=checkpoint_name</code> option mounts a Storage Checkpoint of a mounted file system that was previously created by the <code>fsckptadm</code> command.
Using databases	If you are using databases with VxFS and if you have installed a license key for the Veritas Quick I/O for Databases feature, the <code>mount</code> command enables Quick I/O by default (the same as specifying the <code>qio</code> option). The <code>noqio</code> option disables Quick I/O. If you do not have Quick I/O, <code>mount</code> ignores the <code>qio</code> option. Alternatively, you can increase database performance using the <code>mount</code> option <code>convosync=direct</code> , which utilizes direct I/O.
News file systems	If you are using <code>cnews</code> , use <code>delaylog</code> (or <code>tmplog</code> ), <code>mincache=closesync</code> because <code>cnews</code> does an <code>fsync()</code> on each news file before marking it received. The <code>fsync()</code> is performed synchronously as required, but other options are delayed.
Temporary file systems	For a temporary file system such as <code>/tmp</code> , where performance is more important than data integrity, use <code>tmplog,mincache=tmpcache</code> .
Locking a file system	If you specify the <code>mntlock</code> option, you can lock a file system to disallow unmounting the file system except if the <code>mntunlock</code> option is specified. The <code>mntlock</code> is useful for applications for which you do not want the file systems that the applications are monitoring to be improperly unmounted by other applications or administrators.

See [“Mounting a VxFS file system”](#) on page 36.

See the `fstab(4)`, `fsckptadm(1M)`, `mount(1M)`, and `mount_vxfs(1M)` manual pages.

## Example of mounting a file system

The following example mounts the file system `/dev/vx/dsk/fsvol/vol1` on the `/mnt1` directory with read/write access and delayed logging.



### To mount the file system

- ◆ Mount the file system:

```
# mount -F vxfs -o delaylog /dev/vx/dsk/fsvol/vol1 /mnt1
```

## Editing the fstab file

You can edit the `/etc/fstab` file to mount a file system automatically at boot time.

You must specify the following:

- The special block device name to mount
- The mount point
- The file system type (vxfs)
- The mount options
- The backup frequency
- Which `fscck` pass looks at the file system

Each entry must be on a single line.

See the `fstab(4)` manual page.

The following is a typical `fstab` file with the new file system on the last line:

```
# System /etc/fstab file.  Static
# information about the file systems
# See fstab(4) and sam(1M) for further
# details on configuring devices.
/dev/vg00/lvol3      /      vxfs delaylog 0 1
/dev/vg00/lvol1      /stand hfs defaults 0 1
/dev/vg00/lvol4      /tmp   vxfs delaylog 0 2
/dev/vg00/lvol5      /home  vxfs delaylog 0 2
/dev/vg00/lvol6      /opt   vxfs delaylog 0 2
/dev/vg00/lvol7      /usr   vxfs delaylog 0 2
/dev/vg00/lvol8      /var   vxfs delaylog 0 2
/dev/vx/dsk/fsvol    /mnt1  vxfs delaylog 0 2
```

## Unmounting a file system

Use the `umount` command to unmount a currently mounted file system.

See the `vxumount(1M)` manual page.

### To unmount a file system

- ◆ Use the `umount` command to unmount a file system:

```
vxumount [-o [force]] {special|mount_point}
```

Specify the file system to be unmounted as a *mount\_point* or *special*. *special* is the VxFS block special device on which the file system resides.

## Example of unmounting a file system

The following are examples of unmounting file systems.

### To unmount the file system `/dev/vx/dsk/fsvol/vol1`

- ◆ Unmount the file system:

```
# umount /dev/vx/dsk/fsvol/vol1
```

### To unmount all file systems not required by the system

- ◆ Unmount the file system mounted at `/mnt1`:

```
# vxumount /mnt1
```

## Displaying information on mounted file systems

Use the `mount` command to display a list of currently mounted file systems.

See the `mount(1M)` and `mount_vxfs(1M)` manual pages.

### To view the status of mounted file systems

- ◆ Use the `mount` command to view the status of mounted file systems:

```
mount -v
```

This shows the file system type and `mount` options for all mounted file systems. The `-v` option specifies verbose mode.

## Example of displaying information on mounted file systems

The following example shows the result of invoking the `mount` command without options.

### To display information on mounted file systems

- ◆ Invoke the `mount` command without options:

```
# mount
/dev/vg00/lvol3 on / type vxfs ioerror=mwdisable,delaylog \
Wed Jun 5 3:23:40 2004
/dev/vg00/lvol8 on /var type vxfs ioerror=mwdisable,delaylog \
Wed Jun 5 3:23:56 2004
/dev/vg00/lvol7 on /usr type vxfs ioerror=mwdisable,delaylog \
Wed Jun 5 3:23:56 2004
/dev/vg00/lvol6 on /tmp type vxfs ioerror=mwdisable,delaylog \
Wed Jun 5 3:23:56 2004
/dev/vg00/lvol5 on /opt type vxfs ioerror=mwdisable,delaylog \
Wed Jun 5 3:23:57 2004
/dev/vg00/lvol11 on /stand type hfs defaults on \
Thu Jun 6 4:17:20 2004
/dev/vgdb/lvol13 on /oracle type vxfs \
ioerror=mwdisable,delaylog Thu Jun 6 4:17:20 2004
/dev/vg00/lvol4 on /home type vxfs \
ioerror=mwdisable,delaylog on Thu Jun 6 4:17:20 2004
/dev/vgdb/lvol9 on /bench type vxfs \
ioerror=mwdisable,delaylog on Thu Jun 6 4:17:11 2004
```

## Identifying file system types

Use the `fstyp` command to determine the file system type for a specified file system. This is useful when a file system was created elsewhere and you want to know its type.

See the `fstyp(1M)` manual page.

### To determine a file system's type

- ◆ Use the `fstyp` command to determine a file system's type:

```
fstyp -v special
```

*special*      The character (raw) device.

`-v`            Specifies verbose mode.

## Example of determining a file system's type

The following example uses the `fstyp` command to determine the file system type of the `/dev/vx/dsk/fsvol/vol1` device.

To determine the file system's type

- ◆ Use the `fstyp` command to determine the file system type of the device `/dev/vx/dsk/fsvol/vol1`:

```
# fstyp -v /dev/vx/dsk/fsvol/vol1
```

The output indicates that the file system type is vxfs, and displays file system information similar to the following:

```
vxfs version: 6  f_bsize: 8192  f_frsize: 1024  f_blocks: 1027432
f_bfree: 1026075  f_bavail: 961946  f_files: 256548  f_ffree: 256516
f_favail: 256516  f_fsid: 520114176  f_basetype: vxfs  f_namemax: 254
f_magic: a501fcf5  f_featurebits: 0  f_flag: 0  f_fsindex: 7
f_size: 4194304
```

## Resizing a file system

You can extend or shrink mounted VxFS file systems using the `fsadm` command. Use the `extendfs` command to extend the size of an unmounted file system. A file system using the Version 4 disk layout can be up to two terabytes in size. A file system using the Version 5 disk layout can be up to 32 terabytes in size. A file system using the Version 6 or later disk layout can be up to 8 exabytes in size. The size to which a Version 5 or later disk layout file system can be increased depends on the file system block size.

See [“About disk layouts”](#) on page 233.

See the `extendfs(1M)` and `fsadm_vxfs(1M)` manual pages.

## Extending a file system using fsadm

If a VxFS file system is not large enough, you can increase its size. The size of the file system is specified in units of 1024-byte blocks (or sectors).

The device must have enough space to contain the larger file system.

See the `format(1M)` manual page.

See the *Veritas Volume Manager Administrator's Guide*.

### To extend a VxFS file system

- ◆ Use the `fsadm` command to extend a VxFS file system:

```
fsadm [-F vxfs] [-b newsize] [-r rawdev] \  
mount_point
```

<i>vxfs</i>	The file system type.
<i>newsize</i>	The size to which the file system will increase. The default units is sectors, but you can specify <i>k</i> or <i>K</i> for kilobytes, <i>m</i> or <i>M</i> for megabytes, or <i>g</i> or <i>G</i> for gigabytes.
<i>mount_point</i>	The file system's mount point.
<i>-r rawdev</i>	Specifies the path name of the raw device if there is no entry in <code>/etc/fstab</code> and <code>fsadm</code> cannot determine the raw device.

### Examples of extending a file system

The following example extends a file system mounted at `/mnt1` to 22528 sectors.

#### To extend a file system to 22528 sectors

- ◆ Extend the VxFS file system mounted on `/mnt1` to 22528 sectors:

```
# fsadm -F vxfs -b 22528 /mnt1
```

The following example extends a file system mounted at `/mnt1` to 500 gigabytes.

#### To extend a file system to 500 gigabytes

- ◆ Extend the VxFS file system mounted on `/mnt1` to 500 gigabytes:

```
# fsadm -F vxfs -b 500g /mnt1
```

## Shrinking a file system

You can decrease the size of the file system using `fsadm`, even while the file system is mounted.

---

**Warning:** After this operation, there is unused space at the end of the device. You can then resize the device, but be careful not to make the device smaller than the new size of the file system.

---

### To decrease the size of a VxFS file system

- ◆ Use the `fsadm` command to decrease the size of a VxFS file system:

```
fsadm [-F vxfs] [-b newsize] [-r rawdev] mount_point
```

<i>vxfs</i>	The file system type.
<i>newsize</i>	The size to which the file system will shrink. The default units is sectors, but you can specify <i>k</i> or <i>K</i> for kilobytes, <i>m</i> or <i>M</i> for megabytes, or <i>g</i> or <i>G</i> for gigabytes.
<i>mount_point</i>	The file system's mount point.
<i>-r rawdev</i>	Specifies the path name of the raw device if there is no entry in <code>/etc/fstab</code> and <code>fsadm</code> cannot determine the raw device.

### Examples of shrinking a file system

The following example shrinks a VxFS file system mounted at `/mnt1` to 20480 sectors.

#### To shrink a file system to 20480 sectors

- ◆ Shrink a VxFS file system mounted at `/mnt1` to 20480 sectors:

```
# fsadm -F vxfs -b 20480 /mnt1
```

The following example shrinks a file system mounted at `/mnt1` to 450 gigabytes.

#### To shrink a file system to 450 gigabytes

- ◆ Shrink the VxFS file system mounted on `/mnt1` to 450 gigabytes:

```
# fsadm -F vxfs -b 450g /mnt1
```

## Reorganizing a file system

You can reorganize or compact a fragmented file system using `fsadm`, even while the file system is mounted. This may help shrink a file system that could not previously be decreased.

### To reorganize a VxFS file system

- ◆ Use the `fsadm` command to reorganize a VxFS file system:

```
fsadm [-F vxfs] [-e] [-d] [-E] [-D] [-r rawdev] mount_point
```

<code>vxfs</code>	The file system type.
<code>-d</code>	Reorders directory entries to put subdirectory entries first, then all other entries in decreasing order of time of last access. Also compacts directories to remove free space.
<code>-D</code>	Reports on directory fragmentation.
<code>-e</code>	Minimizes file system fragmentation. Files are reorganized to have the minimum number of extents.
<code>-E</code>	Reports on extent fragmentation.
<code>mount_point</code>	The file system's mount point.
<code>-r rawdev</code>	Specifies the path name of the raw device if there is no entry in <code>/etc/fstab</code> and <code>fsadm</code> cannot determine the raw device.

## Example of reorganizing a file system

The following example reorganizes the file system mounted at `/mnt1`.

### To reorganize a VxFS file system

- ◆ Reorganize the VxFS file system mounted at `/mnt1`:

```
# fsadm -F vxfs -EeDd /mnt1
```

## Extending a file system using `extendfs`

If a VxFS file system is not mounted, you can use the `extendfs` command to increase the size of the file system.

### To extend a VxFS file system

- ◆ Use the `extendfs` command to extend a VxFS file system:

```
extendfs [-F vxfs] [-q] [-v] [-s size] special
```

<code>vxfs</code>	The file system type
<code>-q</code>	Displays the size of special without resizing it
<code>-v</code>	Specifies verbose mode
<code>-s size</code>	Specifies the number of blocks to add to the file system (maximum if not specified)

*special*                      Either a logical volume or a disk partition

---

**Note:** If the file system resides on a volume set, the `extendfs` command fails. Use the `fsvoladm` command to extend a multi-volume file system. See the `fsvoladm(1M)` manual page.

---

## Example of extending a VxFS file system

The following example extends a VxFS file system on a VxVM volume.

### To increase the capacity of a file system

- 1 Unmount the file system:

```
# umount /mnt1
```

- 2 Extend the file system by adding 10485760 blocks:

```
# extendfs -F vxfs -s 10485760 /dev/vx/rdisk/sdg/vol1
```

- 3 Mount the file system:

```
# mount -F vxfs /dev/vx/rdisk/sdg/vol1 /mnt1
```

## Using quotas

You can use quotas to allocate per-user quotas on VxFS file systems.

See [“Using quotas”](#) on page 79.

See the `edquota(1M)`, `quota(1M)`, `quotaon(1M)`, and `quotaoff(1M)` manual pages.

## Turning on quotas

You can enable quotas at mount time or after a file system is mounted. The root directory of the file system must contain a file named `quotas` that is owned by root.



### To turn on quotas

- 1 Turn on quotas for a mounted file system:

```
quotaon mount_point
```

- 2 Mount a file system and turn on quotas at the same time:

```
mount -F vxfs -o quota special mount_point
```

If the root directory does not contain a quotas file, the `mount` command succeeds, but quotas are not turned on.

## Example of turning on quotas for a mounted file system

The following example creates a quotas file and turns on quotas for a VxFS file system mounted at `/mnt`.

### To turn on quotas for a mounted file system

- ◆ Create a quotas file if it does not already exist and turn on quotas for a VxFS file system mounted at `/mnt`:

```
# touch /mnt/quotas
# quotaon /mnt
```

## Example of turning on quotas at mount time

The following example turns on quotas when the `/dev/vx/dsk/fsvol/voll` file system is mounted.

### To turn on quotas for a file system at mount time

- ◆ Turn on quotas at mount time by specifying the `-o quota` option:

```
# mount -F vxfs -o quota /dev/vx/dsk/fsvol/voll /mnt
```

## Setting up user quotas

You can set user quotas with the `edquota` command if you have superuser privileges. User quotas can have a soft limit and hard limit. You can modify the limits or assign them specific values. Users are allowed to exceed the soft limit, but only for a specified time. Disk usage can never exceed the hard limit. The default time limit for exceeding the soft limit is seven days on VxFS file systems.

`edquota` creates a temporary file for a specified user. This file contains on-disk quotas for each mounted VxFS file system that has a quotas file. The temporary file has one or more lines similar to the following:

```
fs /mnt blocks (soft = 0, hard = 0) inodes (soft=0, hard=0)
fs /mnt1 blocks (soft = 100, hard = 200) inodes (soft=10, hard=20)
```

Quotas do not need to be turned on for `edquota` to work. However, the quota limits apply only after quotas are turned on for a given file system.

`edquota` has an option to modify time limits. Modified time limits apply to the entire file system; you cannot set time limits for an individual user.

#### To set up user quotas

- 1 Invoke the quota editor:

```
edquota username
```

- 2 Modify the time limit:

```
edquota -t
```

## Viewing quotas

The superuser or individual user can view disk quotas and usage on VxFS file systems using the `quota` command. This command displays the user's quotas and disk usage on all mounted VxFS file systems where the quotas file exists. You will see all established quotas regardless of whether or not the quotas are actually turned on.

#### To view quotas for a specific user

- ◆ Use the `quota` command to view quotas for a specific user:

```
quota -v username
```

## Turning off quotas

You can turn off quotas for a mounted file system using the `quotaoff` command.

#### To turn off quotas for a file system

- ◆ Turn off quotas for a file system:

```
quotaoff mount_point
```

# Diagnostic messages

This appendix includes the following topics:

- [File system response to problems](#)
- [About kernel messages](#)
- [Kernel messages](#)
- [About unique message identifiers](#)
- [Unique message identifiers](#)
- [Dewey kernel messages](#)
- [Dewey UMI messages](#)

## File system response to problems

When the file system encounters problems, it responds in one of the following ways:

- |                        |  |
|------------------------|--|
| Marking an inode bad   | Inodes can be marked bad if an inode update or a directory-block update fails. In these types of failures, the file system does not know what information is on the disk, and considers all the information that it finds to be invalid. After an inode is marked bad, the kernel still permits access to the file name, but any attempt to access the data in the file or change the inode fails. |
| Disabling transactions | If the file system detects an error while writing the intent log, it disables transactions. After transactions are disabled, the files in the file system can still be read or written, but no block or inode frees or allocations, structural changes, directory entry changes, or other changes to metadata are allowed.   |

**Disabling a file system** If an error occurs that compromises the integrity of the file system, VxFS disables itself. If the intent log fails or an inode-list error occurs, the super-block is ordinarily updated (setting the `VX_FULLFSCK` flag) so that the next `fsck` does a full structural check. If this super-block update fails, any further changes to the file system can cause inconsistencies that are undetectable by the intent log replay. To avoid this situation, the file system disables itself.

## Recovering a disabled file system

When the file system is disabled, no data can be written to the disk. Although some minor file system operations still work, most simply return `EIO`. The only thing that can be done when the file system is disabled is to do a `umount` and run a full `fsck`.

Although a log replay may produce a clean file system, do a full structural check to be safe.

The file system usually becomes disabled because of disk errors. Disk failures that disable a file system should be fixed as quickly as possible.

See the `fsck_vxfs(1M)` manual page.

### To execute a full structural check

- ◆ Use the `fsck` command to execute a full structural check:

```
# fsck -F vxfs -o full -y /dev/vx/rdisk/diskgroup/volume
```

---

**Warning:** Be careful when running this command. By specifying the `-y` option, all `fsck` user prompts are answered with a "yes", which can make irreversible changes if it performs a full file system check.

---

## About kernel messages

Kernel messages are diagnostic or error messages generated by the Veritas File System (VxFS) kernel. Each message has a description and a suggestion on how to handle or correct the underlying problem.

## About global message IDs

When a VxFS kernel message displays on the system console, it is preceded by a numerical ID shown in the `msgcnt` field. This ID number increases with each instance

of the message to guarantee that the sequence of events is known when analyzing file system problems.

Each message is also written to an internal kernel buffer that you can view in the file `/var/adm/syslog/syslog.log`.

In some cases, additional data is written to the kernel buffer. For example, if an inode is marked bad, the contents of the bad inode are written. When an error message is displayed on the console, you can use the unique message ID to find the message in `/var/adm/syslog/syslog.log` and obtain the additional information.

## Kernel messages

Some commonly encountered kernel messages are described on the following table:

**Table B-1**      Kernel messages

Message Number	Message and Definition
001	<p>NOTICE: msgcnt x: mesg 001: V-2-1: vx_nospace - <i>mount_point</i> file system full (n block extent)</p> <ul style="list-style-type: none"><li>■ <b>Description</b> The file system is out of space. Often, there is plenty of space and one runaway process used up all the remaining free space. In other cases, the available free space becomes fragmented and unusable for some files.</li><li>■ <b>Action</b> Monitor the free space in the file system and prevent it from becoming full. If a runaway process has used up all the space, stop that process, find the files created by the process, and remove them. If the file system is out of space, remove files, defragment, or expand the file system. To remove files, use the <code>find</code> command to locate the files that are to be removed. To get the most space with the least amount of work, remove large files or file trees that are no longer needed. To defragment or expand the file system, use the <code>fsadm</code> command. See the <code>fsadm_vxfs(1M)</code> manual page.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
002	<p>WARNING: msgcnt x: msg 002: V-2-2: vx_snap_strategy - <i>mount_point</i> file system write attempt to read-only file system</p> <p>WARNING: msgcnt x: msg 002: V-2-2: vx_snap_copyblk - <i>mount_point</i> file system write attempt to read-only file system</p> <ul style="list-style-type: none"> <li>■ Description The kernel tried to write to a read-only file system. This is an unlikely problem, but if it occurs, the file system is disabled.</li> <li>■ Action The file system was not written, so no action is required. Report this as a bug to your customer support organization.</li> </ul>
003, 004, 005	<p>WARNING: msgcnt x: msg 003: V-2-3: vx_mapbad - <i>mount_point</i> file system free extent bitmap in au <i>aun</i> marked bad</p> <p>WARNING: msgcnt x: msg 004: V-2-4: vx_mapbad - <i>mount_point</i> file system free inode bitmap in au <i>aun</i> marked bad</p> <p>WARNING: msgcnt x: msg 005: V-2-5: vx_mapbad - <i>mount_point</i> file system inode extended operation bitmap in au <i>aun</i> marked bad</p> <ul style="list-style-type: none"> <li>■ Description If there is an I/O failure while writing a bitmap, the map is marked bad. The kernel considers the maps to be invalid, so does not do any more resource allocation from maps. This situation can cause the file system to report out of space or out of inode error messages even though <i>df</i> may report an adequate amount of free space. This error may also occur due to bitmap inconsistencies. If a bitmap fails a consistency check, or blocks are freed that are already free in the bitmap, the file system has been corrupted. This may have occurred because a user or process wrote directly to the device or used <i>fsdb</i> to change the file system. The <i>VX_FULLFSCK</i> flag is set. If the map that failed was a free extent bitmap, and the <i>VX_FULLFSCK</i> flag cannot be set, then the file system is disabled.</li> <li>■ Action Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process was writing to the device, report the problem to your customer support organization. Unmount the file system and use <i>fsck</i> to run a full structural check.</li> </ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
006, 007	<p>WARNING: msgcnt x: mesg 006: V-2-6: vx_sumupd - <i>mount_point</i> file system summary update in au <i>aun</i> failed</p> <p>WARNING: msgcnt x: mesg 007: V-2-7: vx_sumupd - <i>mount_point</i> file system summary update in inode au <i>iaun</i> failed</p> <ul style="list-style-type: none"><li>■ Description An I/O error occurred while writing the allocation unit or inode allocation unit bitmap summary to disk. This sets the <code>VX_FULLFSCK</code> flag on the file system. If the <code>VX_FULLFSCK</code> flag cannot be set, the file system is disabled.</li><li>■ Action Check the console log for I/O errors. If the problem was caused by a disk failure, replace the disk before the file system is mounted for write access, and use <code>fsck</code> to run a full structural check.</li></ul>
008, 009	<p>WARNING: msgcnt x: mesg 008: V-2-8: vx_direrr: function - <i>mount_point</i> file system dir inode <i>dir_inumber</i> dev/block device <i>ID/block</i> dirent inode <i>dirent_inumber</i> error <i>errno</i></p> <p>WARNING: msgcnt x: mesg 009: V-2-9: vx_direrr: function - <i>mount_point</i> file system dir inode <i>dir_inumber</i> dirent inode <i>dirent_inumber</i> immediate directory error <i>errno</i></p> <ul style="list-style-type: none"><li>■ Description A directory operation failed in an unexpected manner. The mount point, inode, and block number identify the failing directory. If the inode is an immediate directory, the directory entries are stored in the inode, so no block number is reported. If the error is <code>ENOENT</code> or <code>ENOTDIR</code>, an inconsistency was detected in the directory block. This inconsistency could be a bad free count, a corrupted hash chain, or any similar directory structure error. If the error is <code>EIO</code> or <code>ENXIO</code>, an I/O failure occurred while reading or writing the disk block. The <code>VX_FULLFSCK</code> flag is set in the super-block so that <code>fsck</code> will do a full structural check the next time it is run.</li><li>■ Action Check the console log for I/O errors. If the problem was caused by a disk failure, replace the disk before the file system is mounted for write access. Unmount the file system and use <code>fsck</code> to run a full structural check.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
010	<p>WARNING: msgcnt x: mesg 010: V-2-10: vx_ialloc - <i>mount_point</i> file system inode <i>inumber</i> not free</p> <ul style="list-style-type: none"><li>■ Description When the kernel allocates an inode from the free inode bitmap, it checks the mode and link count of the inode. If either is non-zero, the free inode bitmap or the inode list is corrupted. The <code>VX_FULLFCK</code> flag is set in the super-block so that <code>fsck</code> will do a full structural check the next time it is run.</li><li>■ Action Unmount the file system and use <code>fsck</code> to run a full structural check.</li></ul>
011	<p>NOTICE: msgcnt x: mesg 011: V-2-11: vx_noinode - <i>mount_point</i> file system out of inodes</p> <ul style="list-style-type: none"><li>■ Description The file system is out of inodes.</li><li>■ Action Monitor the free inodes in the file system. If the file system is getting full, create more inodes either by removing files or by expanding the file system. See the <code>fsadm_vxfs(1M)</code> online manual page.</li></ul>
012	<p>WARNING: msgcnt x: mesg 012: V-2-12: vx_iget - <i>mount_point</i> file system invalid inode number <i>inumber</i></p> <ul style="list-style-type: none"><li>■ Description When the kernel tries to read an inode, it checks the inode number against the valid range. If the inode number is out of range, the data structure that referenced the inode number is incorrect and must be fixed. The <code>VX_FULLFCK</code> flag is set in the super-block so that <code>fsck</code> will do a full structural check the next time it is run.</li><li>■ Action Unmount the file system and use <code>fsck</code> to run a full structural check.</li></ul>



Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
013	<p>WARNING: msgcnt x: mesg 013: V-2-13: vx_iposition - <i>mount_point</i> file system inode <i>inumber</i> invalid inode list extent</p> <ul style="list-style-type: none"><li>■ Description For a Version 2 and above disk layout, the inode list is dynamically allocated. When the kernel tries to read an inode, it must look up the location of the inode in the inode list file. If the kernel finds a bad extent, the inode cannot be accessed. All of the inode list extents are validated when the file system is mounted, so if the kernel finds a bad extent, the integrity of the inode list is questionable. This is a very serious error. The <code>VX_FULLFCK</code> flag is set in the super-block and the file system is disabled.</li><li>■ Action Unmount the file system and use <code>fsck</code> to run a full structural check.</li></ul>
014	<p>WARNING: msgcnt x: mesg 014: V-2-14: vx_iget - inode table overflow</p> <ul style="list-style-type: none"><li>■ Description All the system in-memory inodes are busy and an attempt was made to use a new inode.</li><li>■ Action Look at the processes that are running and determine which processes are using inodes. If it appears there are runaway processes, they might be tying up the inodes. If the system load appears normal, increase the <code>vx_ninode</code> parameter in the kernel. <b>Note:</b> The tunable parameter <code>vx_ninode</code> is used to set the value of <code>vxfs_ninode</code>. See <a href="#">“Tuning the VxFS file system”</a> on page 46.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
015	<p>WARNING: msgcnt x: mesg 015: V-2-15: vx_ibadinactive - <i>mount_point</i> file system cannot mark inode <i>inumber</i> bad</p> <p>WARNING: msgcnt x: mesg 015: V-2-15: vx_ilisterr - <i>mount_point</i> file system cannot mark inode <i>inumber</i> bad</p> <ul style="list-style-type: none"><li>■ Description An attempt to mark an inode bad on disk, and the super-block update to set the <code>VX_FULFSCCK</code> flag, failed. This indicates that a catastrophic disk error may have occurred since both an inode list block and the super-block had I/O failures. The file system is disabled to preserve file system integrity.</li><li>■ Action Unmount the file system and use <code>fsck</code> to run a full structural check. Check the console log for I/O errors. If the disk failed, replace it before remounting the file system.</li></ul>
016	<p>WARNING: msgcnt x: mesg 016: V-2-16: vx_ilisterr - <i>mount_point</i> file system error reading inode <i>inumber</i></p> <ul style="list-style-type: none"><li>■ Description An I/O error occurred while reading the inode list. The <code>VX_FULFSCCK</code> flag is set.</li><li>■ Action Check the console log for I/O errors. If the problem was caused by a disk failure, replace the disk before the file system is mounted for write access. Unmount the file system and use <code>fsck</code> to run a full structural check.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
017	<p>WARNING: msgcnt x: mesg 017: V-2-17: vx_attr_getblk - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: mesg 017: V-2-17: vx_attr_iget - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: mesg 017: V-2-17: vx_attr_indadd - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: mesg 017: V-2-17: vx_attr_indtrunc - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: mesg 017: V-2-17: vx_attr_iremove - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: mesg 017: V-2-17: vx_bmap - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: mesg 017: V-2-17: vx_bmap_indirect_ext4 - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: mesg 017: V-2-17: vx_delbuf_flush - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: mesg 017: V-2-17: vx_dio_iovec - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: mesg 017: V-2-17: vx_dirbread - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: mesg 017: V-2-17: vx_dircreate - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: mesg 017: V-2-17: vx_dirlook - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: mesg 017: V-2-17: vx_doextop_iau - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: mesg 017: V-2-17: vx_doextop_now - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: mesg 017: V-2-17: vx_do_getpage - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: mesg 017: V-2-17: vx_enter_ext4 - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
017 (continued)	<p>WARNING: msgcnt x: msg 017: V-2-17: vx_exttrunc - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: msg 017: V-2-17: vx_get_alloc - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: msg 017: V-2-17: vx_ilisterr - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: msg 017: V-2-17: vx_indtrunc - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: msg 017: V-2-17: vx_iread - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: msg 017: V-2-17: vx_iremove - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: msg 017: V-2-17: vx_iremove_attr - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: msg 017: V-2-17: vx_logwrite_flush - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: msg 017: V-2-17: vx_oltmount_iget - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: msg 017: V-2-17: vx_overlay_bmap - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: msg 017: V-2-17: vx_readnomap - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: msg 017: V-2-17: vx_reorg_trunc - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: msg 017: V-2-17: vx_stablestore - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: msg 017: V-2-17: vx_tranitimes - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: msg 017: V-2-17: vx_trunc - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: msg 017: V-2-17: vx_write_alloc2 - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
017 (continued)	<p>WARNING: msgcnt x: msg 017: V-2-17: vx_write_default - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <p>WARNING: msgcnt x: msg 017: V-2-17: vx_zero_alloc - <i>mount_point</i> file system inode <i>inumber</i> marked bad in core</p> <ul style="list-style-type: none"><li>■ Description<p>When inode information is no longer dependable, the kernel marks it bad in memory. This is followed by a message to mark it bad on disk as well unless the mount command <code>ioerror</code> option is set to <code>disable</code>, or there is subsequent I/O failure when updating the inode on disk. No further operations can be performed on the inode.</p><p>The most common reason for marking an inode bad is a disk I/O failure. If there is an I/O failure in the inode list, on a directory block, or an indirect address extent, the integrity of the data in the inode, or the data the kernel tried to write to the inode list, is questionable. In these cases, the disk driver prints an error message and one or more inodes are marked bad.</p><p>The kernel also marks an inode bad if it finds a bad extent address, invalid inode fields, or corruption in directory data blocks during a validation check. A validation check failure indicates the file system has been corrupted. This usually occurs because a user or process has written directly to the device or used <code>fsdb</code> to change the file system.</p><p>The <code>VX_FULLFSCK</code> flag is set in the super-block so <code>fsck</code> will do a full structural check the next time it is run.</p></li><li>■ Action<p>Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process is writing to the device, report the problem to your customer support organization. In either case, unmount the file system. The file system can be remounted without a full <code>fsck</code> unless the <code>VX_FULLFSCK</code> flag is set for the file system.</p></li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
019	<p>WARNING: msgcnt x: mesg 019: V-2-19: vx_log_add - <i>mount_point</i> file system log overflow</p> <ul style="list-style-type: none"><li>■ Description Log ID overflow. When the log ID reaches <code>VX_MAXLOGID</code> (approximately one billion by default), a flag is set so the file system resets the log ID at the next opportunity. If the log ID has not been reset, when the log ID reaches <code>VX_DISLOGID</code> (approximately <code>VX_MAXLOGID</code> plus 500 million by default), the file system is disabled. Since a log reset will occur at the next 60 second sync interval, this should never happen.</li><li>■ Action Unmount the file system and use <code>fsck</code> to run a full structural check.</li></ul>
020	<p>WARNING: msgcnt x: mesg 020: V-2-20: vx_logerr - <i>mount_point</i> file system log error <i>errno</i></p> <ul style="list-style-type: none"><li>■ Description Intent log failed. The kernel will try to set the <code>VX_FULLFSCK</code> and <code>VX_LOGBAD</code> flags in the super-block to prevent running a log replay. If the super-block cannot be updated, the file system is disabled.</li><li>■ Action Unmount the file system and use <code>fsck</code> to run a full structural check. Check the console log for I/O errors. If the disk failed, replace it before remounting the file system.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
021	<p>WARNING: msgcnt x: mesg 021: V-2-21: vx_fs_init - <i>mount_point</i> file system validation failure</p> <ul style="list-style-type: none"><li>■ Description<p>When a VxFS file system is mounted, the structure is read from disk. If the file system is marked clean, the structure is correct and the first block of the intent log is cleared.</p><p>If there is any I/O problem or the structure is inconsistent, the kernel sets the <code>VX_FULFSCCK</code> flag and the mount fails.</p><p>If the error is not related to an I/O failure, this may have occurred because a user or process has written directly to the device or used <i>fsdb</i> to change the file system.</p></li><li>■ Action<p>Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process is writing to the device, report the problem to your customer support organization. In either case, unmount the file system and use <i>fsck</i> to run a full structural check.</p></li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
022	<p>WARNING: msgcnt x: mesg 022: V-2-22: vx_mountroot - root file system remount failed</p> <ul style="list-style-type: none"><li>■ <b>Description</b><p>The remount of the root file system failed. The system will not be usable if the root file system cannot be remounted for read/write access.</p><p>When a root Veritas File System is first mounted, it is mounted for read-only access. After <code>fsck</code> is run, the file system is remounted for read/write access. The remount fails if <code>fsck</code> completed a resize operation or modified a file that was opened before the <code>fsck</code> was run. It also fails if an I/O error occurred during the remount. Usually, the system halts or reboots automatically.</p></li><li>■ <b>Action</b><p>Reboot the system. The system either remounts the root cleanly or runs a full structural <code>fsck</code> and remounts cleanly. If the remount succeeds, no further action is necessary.</p><p>Check the console log for I/O errors. If the disk has failed, replace it before the file system is mounted for write access.</p><p>If the system won't come up and a full structural <code>fsck</code> hasn't been run, reboot the system on a backup root and manually run a full structural <code>fsck</code>. If the problem persists after the full structural <code>fsck</code> and there are no I/O errors, contact your customer support organization.</p></li></ul>
023	<p>WARNING: msgcnt x: mesg 023: V-2-23: vx_unmountroot - root file system is busy and cannot be unmounted cleanly</p> <ul style="list-style-type: none"><li>■ <b>Description</b><p>There were active files in the file system and they caused the unmount to fail.</p><p>When the system is halted, the root file system is unmounted. This happens occasionally when a process is hung and it cannot be killed before unmounting the root.</p></li><li>■ <b>Action</b><p><code>fsck</code> will run when the system is rebooted. It should clean up the file system. No other action is necessary.</p><p>If the problem occurs every time the system is halted, determine the cause and contact your customer support organization.</p></li></ul>



Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
024	<p>WARNING: msgcnt x: msg 024: V-2-24: vx_cutwait - <i>mount_point</i> file system current usage table update error</p> <ul style="list-style-type: none"><li>■ Description Update to the current usage table (CUT) failed. For a Version 2 disk layout, the CUT contains a fileset version number and total number of blocks used by each fileset. The <code>VX_FULLFCK</code> flag is set in the super-block. If the super-block cannot be written, the file system is disabled.</li><li>■ Action Unmount the file system and use <code>fck</code> to run a full structural check.</li></ul>
025	<p>WARNING: msgcnt x: msg 025: V-2-25: vx_wsUPER - <i>mount_point</i> file system super-block update failed</p> <ul style="list-style-type: none"><li>■ Description An I/O error occurred while writing the super-block during a resize operation. The file system is disabled.</li><li>■ Action Unmount the file system and use <code>fck</code> to run a full structural check. Check the console log for I/O errors. If the problem is a disk failure, replace the disk before the file system is mounted for write access.</li></ul>
026	<p>WARNING: msgcnt x: msg 026: V-2-26: vx_snap_copyblk - <i>mount_point</i> primary file system read error</p> <ul style="list-style-type: none"><li>■ Description Snapshot file system error. When the primary file system is written, copies of the original data must be written to the snapshot file system. If a read error occurs on a primary file system during the copy, any snapshot file system that doesn't already have a copy of the data is out of date and must be disabled.</li><li>■ Action An error message for the primary file system prints. Resolve the error on the primary file system and rerun any backups or other applications that were using the snapshot that failed when the error occurred.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
027	<p>WARNING: msgcnt x: mesg 027: V-2-27: vx_snap_bpcopy - <i>mount_point</i> snapshot file system write error</p> <ul style="list-style-type: none"><li>■ Description A write to the snapshot file system failed. As the primary file system is updated, copies of the original data are read from the primary file system and written to the snapshot file system. If one of these writes fails, the snapshot file system is disabled.</li><li>■ Action Check the console log for I/O errors. If the disk has failed, replace it. Resolve the error on the disk and rerun any backups or other applications that were using the snapshot that failed when the error occurred.</li></ul>
028	<p>WARNING: msgcnt x: mesg 028: V-2-28: vx_snap_alloc - <i>mount_point</i> snapshot file system out of space</p> <ul style="list-style-type: none"><li>■ Description The snapshot file system ran out of space to store changes. During a snapshot backup, as the primary file system is modified, the original data is copied to the snapshot file system. This error can occur if the snapshot file system is left mounted by mistake, if the snapshot file system was given too little disk space, or the primary file system had an unexpected burst of activity. The snapshot file system is disabled.</li><li>■ Action Make sure the snapshot file system was given the correct amount of space. If it was, determine the activity level on the primary file system. If the primary file system was unusually busy, rerun the backup. If the primary file system is no busier than normal, move the backup to a time when the primary file system is relatively idle or increase the amount of disk space allocated to the snapshot file system. Rerun any backups that failed when the error occurred.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
029, 030	<p>WARNING: msgcnt x: mesg 029: V-2-29: vx_snap_getbp - <i>mount_point</i> snapshot file system block map write error</p> <p>WARNING: msgcnt x: mesg 030: V-2-30: vx_snap_getbp - <i>mount_point</i> snapshot file system block map read error</p> <ul style="list-style-type: none"><li>■ Description During a snapshot backup, each snapshot file system maintains a block map on disk. The block map tells the snapshot file system where data from the primary file system is stored in the snapshot file system. If an I/O operation to the block map fails, the snapshot file system is disabled.</li><li>■ Action Check the console log for I/O errors. If the disk has failed, replace it. Resolve the error on the disk and rerun any backups that failed when the error occurred.</li></ul>
031	<p>WARNING: msgcnt x: mesg 031: V-2-31: vx_disable - <i>mount_point</i> file system disabled</p> <ul style="list-style-type: none"><li>■ Description File system disabled, preceded by a message that specifies the reason. This usually indicates a serious disk problem.</li><li>■ Action Unmount the file system and use <code>fsck</code> to run a full structural check. If the problem is a disk failure, replace the disk before the file system is mounted for write access.</li></ul>
032	<p>WARNING: msgcnt x: mesg 032: V-2-32: vx_disable - <i>mount_point</i> snapshot file system disabled</p> <ul style="list-style-type: none"><li>■ Description Snapshot file system disabled, preceded by a message that specifies the reason.</li><li>■ Action Unmount the snapshot file system, correct the problem specified by the message, and rerun any backups that failed due to the error.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
033	<p>WARNING: msgcnt x: mesg 033: V-2-33: vx_check_badblock - <i>mount_point</i> file system had an I/O error, setting <code>VX_FULFSCK</code></p> <ul style="list-style-type: none"><li>■ Description When the disk driver encounters an I/O error, it sets a flag in the super-block structure. If the flag is set, the kernel will set the <code>VX_FULFSCK</code> flag as a precautionary measure. Since no other error has set the <code>VX_FULFSCK</code> flag, the failure probably occurred on a data block.</li><li>■ Action Unmount the file system and use <code>fsck</code> to run a full structural check. Check the console log for I/O errors. If the problem is a disk failure, replace the disk before the file system is mounted for write access.</li></ul>
034	<p>WARNING: msgcnt x: mesg 034: V-2-34: vx_resetlog - <i>mount_point</i> file system cannot reset log</p> <ul style="list-style-type: none"><li>■ Description The kernel encountered an error while resetting the log ID on the file system. This happens only if the super-block update or log write encountered a device failure. The file system is disabled to preserve its integrity.</li><li>■ Action Unmount the file system and use <code>fsck</code> to run a full structural check. Check the console log for I/O errors. If the problem is a disk failure, replace the disk before the file system is mounted for write access.</li></ul>
035	<p>WARNING: msgcnt x: mesg 035: V-2-35: vx_inactive - <i>mount_point</i> file system inactive of locked inode <i>inumber</i></p> <ul style="list-style-type: none"><li>■ Description <code>VOP_INACTIVE</code> was called for an inode while the inode was being used. This should never happen, but if it does, the file system is disabled.</li><li>■ Action Unmount the file system and use <code>fsck</code> to run a full structural check. Report as a bug to your customer support organization.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
036	<p>WARNING: msgcnt x: mesg 036: V-2-36: vx_lctbad - <i>mount_point</i> file system link count table <i>lctnumber</i> bad</p> <ul style="list-style-type: none"><li>■ Description Update to the link count table (LCT) failed. For a Version 2 and above disk layout, the LCT contains the link count for all the structural inodes. The <code>VX_FULLFSCK</code> flag is set in the super-block. If the super-block cannot be written, the file system is disabled.</li><li>■ Action Unmount the file system and use <code>fsck</code> to run a full structural check.</li></ul>
037	<p>WARNING: msgcnt x: mesg 037: V-2-37: vx_metaioerr - function - <i>volume_name</i> file system meta data [read write] error in dev/block <i>device_ID/block</i></p> <ul style="list-style-type: none"><li>■ Description A read or a write error occurred while accessing file system metadata. The full <code>fsck</code> flag on the file system was set. The message specifies whether the disk I/O that failed was a read or a write. File system metadata includes inodes, directory blocks, and the file system log. If the error was a write error, it is likely that some data was lost. This message should be accompanied by another file system message describing the particular file system metadata affected, as well as a message from the disk driver containing information about the disk I/O error.</li><li>■ Action Resolve the condition causing the disk error. If the error was the result of a temporary condition (such as accidentally turning off a disk or a loose cable), correct the condition. Check for loose cables, etc. Unmount the file system and use <code>fsck</code> to run a full structural check (possibly with loss of data). In case of an actual disk error, if it was a read error and the disk driver remaps bad sectors on write, it may be fixed when <code>fsck</code> is run since <code>fsck</code> is likely to rewrite the sector with the read error. In other cases, you replace or reformat the disk drive and restore the file system from backups. Consult the documentation specific to your system for information on how to recover from disk errors. The disk driver should have printed a message that may provide more information.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
038	<p>WARNING: msgcnt x: mesg 038: V-2-38: vx_dataioerr - <i>volume_name</i> file system file data [read write] error in dev/block <i>device_ID/block</i></p> <ul style="list-style-type: none"><li>■ Description A read or a write error occurred while accessing file data. The message specifies whether the disk I/O that failed was a read or a write. File data includes data currently in files and free blocks. If the message is printed because of a read or write error to a file, another message that includes the inode number of the file will print. The message may be printed as the result of a read or write error to a free block, since some operations allocate an extent and immediately perform I/O to it. If the I/O fails, the extent is freed and the operation fails. The message is accompanied by a message from the disk driver regarding the disk I/O error.</li><li>■ Action Resolve the condition causing the disk error. If the error was the result of a temporary condition (such as accidentally turning off a disk or a loose cable), correct the condition. Check for loose cables, etc. If any file data was lost, restore the files from backups. Determine the file names from the inode number. See the ncheck(1M) manual page. If an actual disk error occurred, make a backup of the file system, replace or reformat the disk drive, and restore the file system from the backup. Consult the documentation specific to your system for information on how to recover from disk errors. The disk driver should have printed a message that may provide more information.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
039	<p>WARNING: msgcnt x: mesg 039: V-2-39: vx_writesuper - file system super-block write error</p> <ul style="list-style-type: none"><li>■ Description An attempt to write the file system super block failed due to a disk I/O error. If the file system was being mounted at the time, the mount will fail. If the file system was mounted at the time and the full <code>fsck</code> flag was being set, the file system will probably be disabled and Message 031 will also be printed. If the super-block was being written as a result of a sync operation, no other action is taken.</li><li>■ Action Resolve the condition causing the disk error. If the error was the result of a temporary condition (such as accidentally turning off a disk or a loose cable), correct the condition. Check for loose cables, etc. Unmount the file system and use <code>fsck</code> to run a full structural check.  If an actual disk error occurred, make a backup of the file system, replace or reformat the disk drive, and restore the file system from backups. Consult the documentation specific to your system for information on how to recover from disk errors. The disk driver should have printed a message that may provide more information.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
056	<p>WARNING: msgcnt x: mesg 056: V-2-56: vx_mapbad - <i>mount_point</i> file system extent allocation unit state bitmap number <i>number</i> marked bad</p> <ul style="list-style-type: none"><li>■ Description<p>If there is an I/O failure while writing a bitmap, the map is marked bad. The kernel considers the maps to be invalid, so does not do any more resource allocation from maps. This situation can cause the file system to report "out of space" or "out of inode" error messages even though <i>df</i> may report an adequate amount of free space.</p><p>This error may also occur due to bitmap inconsistencies. If a bitmap fails a consistency check, or blocks are freed that are already free in the bitmap, the file system has been corrupted. This may have occurred because a user or process wrote directly to the device or used <i>fsdb</i> to change the file system.</p><p>The <code>VX_FULLFSCK</code> flag is set. If the <code>VX_FULLFSCK</code> flag cannot be set, the file system is disabled.</p></li><li>■ Action<p>Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process was writing to the device, report the problem to your customer support organization. Unmount the file system and use <i>fsck</i> to run a full structural check.</p></li></ul>
057	<p>WARNING: msgcnt x: mesg 057: V-2-57: vx_esum_bad - <i>mount_point</i> file system extent allocation unit summary number <i>number</i> marked bad</p> <ul style="list-style-type: none"><li>■ Description<p>An I/O error occurred reading or writing an extent allocation unit summary.</p><p>The <code>VX_FULLFSCK</code> flag is set. If the <code>VX_FULLFSCK</code> flag cannot be set, the file system is disabled.</p></li><li>■ Action<p>Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process was writing to the device, report the problem to your customer support organization. Unmount the file system and use <i>fsck</i> to run a full structural check.</p></li></ul>



Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
058	<p>WARNING: msgcnt x: mesg 058: V-2-58: vx_isum_bad - <i>mount_point</i> file system inode allocation unit summary number <i>number</i> marked bad</p> <ul style="list-style-type: none"><li>■ Description An I/O error occurred reading or writing an inode allocation unit summary. The <code>VX_FULLFSCK</code> flag is set. If the <code>VX_FULLFSCK</code> flag cannot be set, the file system is disabled.</li><li>■ Action Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process was writing to the device, report the problem to your customer support organization. Unmount the file system and use <code>fsck</code> to run a full structural check.</li></ul>
059	<p>WARNING: msgcnt x: mesg 059: V-2-59: vx_snap_getbitbp - <i>mount_point</i> snapshot file system bitmap write error</p> <ul style="list-style-type: none"><li>■ Description An I/O error occurred while writing to the snapshot file system bitmap. There is no problem with the snapped file system, but the snapshot file system is disabled.</li><li>■ Action Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process was writing to the device, report the problem to your customer support organization. Restart the snapshot on an error free disk partition. Rerun any backups that failed when the error occurred.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
060	<p>WARNING: msgcnt x: mesg 060: V-2-60: vx_snap_getbitbp - <i>mount_point</i> snapshot file system bitmap read error</p> <ul style="list-style-type: none"><li>■ Description An I/O error occurred while reading the snapshot file system bitmap. There is no problem with snapped file system, but the snapshot file system is disabled.</li><li>■ Action Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process was writing to the device, report the problem to your customer support organization. Restart the snapshot on an error free disk partition. Rerun any backups that failed when the error occurred.</li></ul>
061	<p>WARNING: msgcnt x: mesg 061: V-2-61: vx_resize - <i>mount_point</i> file system remount failed</p> <ul style="list-style-type: none"><li>■ Description During a file system resize, the remount to the new size failed. The <code>VX_FULLEFSCK</code> flag is set and the file system is disabled.</li><li>■ Action Unmount the file system and use <code>fsck</code> to run a full structural check. After the check, the file system shows the new size.</li></ul>
062	<p>NOTICE: msgcnt x: mesg 062: V-2-62: vx_attr_creatop - invalid disposition returned by attribute driver</p> <ul style="list-style-type: none"><li>■ Description A registered extended attribute intervention routine returned an invalid return code to the VxFS driver during extended attribute inheritance.</li><li>■ Action Determine which vendor supplied the registered extended attribute intervention routine and contact their customer support organization.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
063	<p>WARNING: msgcnt x: mesg 063: V-2-63: vx_fset_markbad - <i>mount_point</i> file system <i>mount_point</i> fileset (index number) marked bad</p> <ul style="list-style-type: none"><li>■ Description An error occurred while reading or writing a fileset structure. <code>VX_FULFSCCK</code> flag is set. If the <code>VX_FULFSCCK</code> flag cannot be set, the file system is disabled.</li><li>■ Action Unmount the file system and use <code>fsck</code> to run a full structural check.</li></ul>
064	<p>WARNING: msgcnt x: mesg 064: V-2-64: vx_ivalidate - <i>mount_point</i> file system inode number version number exceeds fileset's</p> <ul style="list-style-type: none"><li>■ Description During inode validation, a discrepancy was found between the inode version number and the fileset version number. The inode may be marked bad, or the fileset version number may be changed, depending on the ratio of the mismatched version numbers. <code>VX_FULFSCCK</code> flag is set. If the <code>VX_FULFSCCK</code> flag cannot be set, the file system is disabled.</li><li>■ Action Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process is writing to the device, report the problem to your customer support organization. In either case, unmount the file system and use <code>fsck</code> to run a full structural check.</li></ul>
066	<p>NOTICE: msgcnt x: mesg 066: V-2-66: DMAPi mount event - buffer</p> <ul style="list-style-type: none"><li>■ Description An HSM (Hierarchical Storage Management) agent responded to a DMAPi mount event and returned a message in buffer.</li><li>■ Action Consult the HSM product documentation for the appropriate response to the message.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
067	<p>WARNING: msgcnt x: mesg 067: V-2-67: mount of <i>device_path</i> requires HSM agent</p> <ul style="list-style-type: none"> <li>■ Description The file system mount failed because the file system was marked as being under the management of an HSM agent, and no HSM agent was found during the mount.</li> <li>■ Action Restart the HSM agent and try to mount the file system again.</li> </ul>
069	<p>WARNING: msgcnt x: mesg 069: V-2-69: memory usage specified by the vxfs:vxfs_ninode and vxfs:vx_bc_bufhwm parameters exceeds available memory; the system may hang under heavy load</p> <ul style="list-style-type: none"> <li>■ Description The value of the system tunable parameters—<i>vx_ninode</i> and <i>vx_bc_bufhwm</i>—add up to a value that is more than 66% of the kernel virtual address space or more than 50% of the physical system memory. VxFS inodes require approximately one kilobyte each, so both values can be treated as if they are in units of one kilobyte.</li> <li>■ Action To avoid a system hang, reduce the value of one or both parameters to less than 50% of physical memory or to 66% of kernel virtual memory. See <a href="#">“Tuning the VxFS file system”</a> on page 46. <b>Note:</b> The tunable parameter <i>vx_ninode</i> is used to set the value of <i>vxfs_ninode</i>.</li> </ul>
070	<p>WARNING: msgcnt x: mesg 070: V-2-70: checkpoint <i>checkpoint_name</i> removed from file system <i>mount_point</i></p> <ul style="list-style-type: none"> <li>■ Description The file system ran out of space while updating a Storage Checkpoint. The Storage Checkpoint was removed to allow the operation to complete.</li> <li>■ Action Increase the size of the file system. If the file system size cannot be increased, remove files to create sufficient space for new Storage Checkpoints. Monitor capacity of the file system closely to ensure it does not run out of space. See the <i>fsadm_vxfs(1M)</i> manual page.</li> </ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
071	<p>NOTICE: msgcnt x: mesg 071: V-2-71: cleared data I/O error flag in <i>mount_point</i> file system</p> <ul style="list-style-type: none"><li>■ Description The user data I/O error flag was reset when the file system was mounted. This message indicates that a read or write error occurred while the file system was previously mounted. See Message Number 038.</li><li>■ Action Informational only, no action required.</li></ul>
072	<p>WARNING: msgcnt x: vxfs: mesg 072: could not failover for <i>volume_name</i> file system</p> <ul style="list-style-type: none"><li>■ Description This message is specific to the cluster file system. The message indicates a problem in a scenario where a node failure has occurred in the cluster and the newly selected primary node encounters a failure.</li><li>■ Action Save the system logs and core dump of the node along with the disk image (metasave) and contact your customer support organization. The node can be rebooted to join the cluster.</li></ul>
075	<p>WARNING: msgcnt x: mesg 075: V-2-75: replay fsck failed for <i>mount_point</i> file system</p> <ul style="list-style-type: none"><li>■ Description The log replay failed during a failover or while migrating the CFS primary-ship to one of the secondary cluster nodes. The file system was disabled.</li><li>■ Action Unmount the file system from the cluster. Use <code>fsck</code> to run a full structural check and mount the file system again.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
076	<p>NOTICE: msgcnt x: mesg 076: V-2-76: checkpoint asynchronous operation on <i>mount_point</i> file system still in progress</p> <ul style="list-style-type: none"><li>■ Description</li></ul> <p>An EBUSY message was received while trying to unmount a file system. The unmount failure was caused by a pending asynchronous fileset operation, such as a fileset removal or fileset conversion to a nodata Storage Checkpoint.</p> <ul style="list-style-type: none"><li>■ Action</li></ul> <p>The operation may take a considerable length of time. You can do a forced unmount, or simply wait for the operation to complete so file system can be unmounted cleanly.</p> <p>See the <code>umount_vxfs(1M)</code> manual page.</p>
077	<p>WARNING: msgcnt x: mesg 077: V-2-77: vx_fshdchange - <i>mount_point</i> file system number fileset, fileset header: checksum failed</p> <ul style="list-style-type: none"><li>■ Description</li></ul> <p>Disk corruption was detected while changing fileset headers. This can occur when writing a new inode allocation unit, preventing the allocation of new inodes in the fileset.</p> <ul style="list-style-type: none"><li>■ Action</li></ul> <p>Unmount the file system and use <code>fsck</code> to run a full structural check.</p>
078	<p>WARNING: msgcnt x: mesg 078: V-2-78: vx_ilealloc - <i>mount_point</i> file system <i>mount_point</i> fileset (index number) ilist corrupt</p> <ul style="list-style-type: none"><li>■ Description</li></ul> <p>The inode list for the fileset was corrupted and the corruption was detected while allocating new inodes. The failed system call returns an ENOSPC error. Any subsequent inode allocations will fail unless a sufficient number of files are removed.</p> <ul style="list-style-type: none"><li>■ Action</li></ul> <p>Unmount the file system and use <code>fsck</code> to run a full structural check.</p>

Table B-1      Kernel messages (*continued*)

Message Number	Message and Definition
079	

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
	WARNING: msgcnt x: mesg 017: V-2-79: vx_attr_getblk - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk
	WARNING: msgcnt x: mesg 017: V-2-79: vx_attr_iget - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk
	WARNING: msgcnt x: mesg 017: V-2-79: vx_attr_indadd - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk
	WARNING: msgcnt x: mesg 017: V-2-79: vx_attr_indtrunc - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk
	WARNING: msgcnt x: mesg 017: V-2-79: vx_attr_iremove - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk
	WARNING: msgcnt x: mesg 017: V-2-79: vx_bmap - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk
	WARNING: msgcnt x: mesg 017: V-2-79: vx_bmap_indirect_ext4 - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk
	WARNING: msgcnt x: mesg 017: V-2-79: vx_delbuf_flush - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk
	WARNING: msgcnt x: mesg 017: V-2-79: vx_dio_iovec - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk
	WARNING: msgcnt x: mesg 017: V-2-79: vx_dirbread - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk
	WARNING: msgcnt x: mesg 017: V-2-79: vx_dircreate - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk
	WARNING: msgcnt x: mesg 017: V-2-79: vx_dirlook - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk
	WARNING: msgcnt x: mesg 017: V-2-79: vx_doextop_iau - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk
	WARNING: msgcnt x: mesg 017: V-2-79: vx_doextop_now - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk
	WARNING: msgcnt x: mesg 017: V-2-79: vx_do_getpage - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk
	WARNING: msgcnt x: mesg 017: V-2-79: vx_enter_ext4 - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk
	WARNING: msgcnt x: mesg 017: V-2-79: vx_exttrunc - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk
	WARNING: msgcnt x: mesg 017: V-2-79: vx_get_alloc - <i>mount_point</i>



Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
	file system inode <i>inumber</i> marked bad on disk
079 (continued)	<p>WARNING: msgcnt x: mesg 017: V-2-79: vx_ilsterr - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk</p> <p>WARNING: msgcnt x: mesg 017: V-2-79: vx_indtrunc - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk</p> <p>WARNING: msgcnt x: mesg 017: V-2-79: vx_iread - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk</p> <p>WARNING: msgcnt x: mesg 017: V-2-79: vx_iremove - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk</p> <p>WARNING: msgcnt x: mesg 017: V-2-79: vx_iremove_attr - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk</p> <p>WARNING: msgcnt x: mesg 017: V-2-79: vx_logwrite_flush - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk</p> <p>WARNING: msgcnt x: mesg 017: V-2-79: vx_olmount_iget - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk</p> <p>WARNING: msgcnt x: mesg 017: V-2-79: vx_overlay_bmap - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk</p> <p>WARNING: msgcnt x: mesg 017: V-2-79: vx_readnomap - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk</p> <p>WARNING: msgcnt x: mesg 017: V-2-79: vx_reorg_trunc - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk</p> <p>WARNING: msgcnt x: mesg 017: V-2-79: vx_stablestore - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk</p> <p>WARNING: msgcnt x: mesg 017: V-2-79: vx_tranitimes - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk</p> <p>WARNING: msgcnt x: mesg 017: V-2-79: vx_trunc - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk</p> <p>WARNING: msgcnt x: mesg 017: V-2-79: vx_write_alloc2 - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk</p> <p>WARNING: msgcnt x: mesg 017: V-2-79: vx_write_default - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk</p> <p>WARNING: msgcnt x: mesg 017: V-2-79: vx_zero_alloc - <i>mount_point</i> file system inode <i>inumber</i> marked bad on disk</p>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
079 (continued)	<ul style="list-style-type: none"><li>■ <b>Description</b><p>When inode information is no longer dependable, the kernel marks it bad on disk. The most common reason for marking an inode bad is a disk I/O failure. If there is an I/O failure in the inode list, on a directory block, or an indirect address extent, the integrity of the data in the inode, or the data the kernel tried to write to the inode list, is questionable. In these cases, the disk driver prints an error message and one or more inodes are marked bad.</p><p>The kernel also marks an inode bad if it finds a bad extent address, invalid inode fields, or corruption in directory data blocks during a validation check. A validation check failure indicates the file system has been corrupted. This usually occurs because a user or process has written directly to the device or used <i>fsdb</i> to change the file system.</p><p>The <code>VX_FULLFCK</code> flag is set in the super-block so <i>fsck</i> will do a full structural check the next time it is run.</p></li><li>■ <b>Action</b><p>Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process is writing to the device, report the problem to your customer support organization. In either case, unmount the file system and use <i>fsck</i> to run a full structural check.</p></li></ul>
080	<p>WARNING: msgcnt x: vxfs: msg 080: Disk layout versions older than Version 4 will not be supported in the next release. It is advisable to upgrade to the latest disk layout version now.</p> <p>See the <i>vxupgrade(1M)</i> manual page.</p> <p>See the <i>Veritas Storage Foundation Release Notes</i>.</p> <ul style="list-style-type: none"><li>■ <b>Action</b><p>Use the <i>vxupgrade</i> command to begin upgrading file systems using older disk layouts to Version 5, then 6, then 7. Consider the following when planning disk layout upgrades:</p></li><li>■ Version 2 disk layout file systems have an 8 million inode limit. Images of Version 2 disk layout file systems created by copy utilities, such as <i>dd</i> or <i>volcopy</i>, will become unusable after a disk layout upgrade.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
081	<p>WARNING: msgcnt x: mesg 081: V-2-81: possible network partition detected</p> <ul style="list-style-type: none"><li>■ Description This message displays when CFS detects a possible network partition and disables the file system locally, that is, on the node where the message appears.</li><li>■ Action There are one or more private network links for communication between the nodes in a cluster. At least one link must be active to maintain the integrity of the cluster. If all the links go down, after the last network link is broken, the node can no longer communicate with other nodes in the cluster.  Check the network connections. After verifying that the network connections is operating correctly, unmount the disabled file system and mount it again.</li></ul>
082	<p>WARNING: msgcnt x: mesg 082: V-2-82: <i>volume_name</i> file system is on shared volume. It may get damaged if cluster is in partitioned state.</p> <ul style="list-style-type: none"><li>■ Description If a cluster node is in a partitioned state, and if the file system is on a shared VxVM volume, this volume may become corrupted by accidental access from another node in the cluster.</li><li>■ Action These shared disks can also be seen by nodes in a different partition, so they can inadvertently be corrupted. So the second message 082 tells that the device mentioned is on shared volume and damage can happen only if it is a real partition problem. Do not use it on any other node until the file system is unmounted from the mounted nodes.</li></ul>
083	<p>WARNING: msgcnt x: mesg 083: V-2-83: <i>mount_point</i> file system log is not compatible with the specified intent log I/O size</p> <ul style="list-style-type: none"><li>■ Description Either the specified <code>mount</code> logiosize size is not compatible with the file system layout, or the file system is corrupted.</li><li>■ Action Mount the file system again without specifying the logiosize option, or use a logiosize value compatible with the intent log specified when the file system was created. If the error persists, unmount the file system and use <code>fsck</code> to run a full structural check.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
084	<p>WARNING: msgcnt x: msg 084: V-2-84: in <i>volume_name</i> quota on failed during assumption. (stage <i>stage_number</i>)</p> <ul style="list-style-type: none"> <li>■ Description In a cluster file system, when the primary of the file system fails, a secondary file system is chosen to assume the role of the primary. The assuming node will be able to enforce quotas after becoming the primary. If the new primary is unable to enforce quotas this message will be displayed.</li> <li>■ Action Issue the <code>quotaon</code> command from any of the nodes that have the file system mounted.</li> </ul>
085	<p>WARNING: msgcnt x: msg 085: V-2-85: Checkpoint quota - warning: <i>file_system</i> file system fileset quota hard limit exceeded</p> <ul style="list-style-type: none"> <li>■ Description The system administrator sets the quotas for Storage Checkpoints in the form of a soft limit and hard limit. This message displays when the hard limit is exceeded.</li> <li>■ Action Delete Storage Checkpoints or increase the hard limit.</li> </ul>
086	<p>WARNING: msgcnt x: msg 086: V-2-86: Checkpoint quota - warning: <i>file_system</i> file system fileset quota soft limit exceeded</p> <ul style="list-style-type: none"> <li>■ Description The system administrator sets the quotas for Storage Checkpoints in the form of a soft limit and hard limit. This message displays when the soft limit is exceeded.</li> <li>■ Action Delete Storage Checkpoints or increase the soft limit. This is not a mandatory action, but is recommended.</li> </ul>
087	<p>WARNING: msgcnt x: msg 087: V-2-87: vx_dotdot_manipulate: <i>file_system</i> file system <i>inumber</i> inode <i>ddnumber</i> dotdot inode error</p> <ul style="list-style-type: none"> <li>■ Description When performing an operation that changes an inode entry, if the inode is incorrect, this message will display.</li> <li>■ Action Run a full file system check using <code>fsck</code> to correct the errors.</li> </ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
088	<p>WARNING: msgcnt x: mesg 088: V-2-88: quotaon on <i>file_system</i> failed; limits exceed limit</p> <ul style="list-style-type: none"><li>■ Description The external quota file, <i>quotas</i>, contains the quota values, which range from 0 up to 2147483647. When quotas are turned on by the <i>quotaon</i> command, this message displays when a user exceeds the quota limit.</li><li>■ Action Correct the quota values in the <i>quotas</i> file.</li></ul>
089	<p>WARNING: msgcnt x: mesg 089: V-2-89: quotaon on <i>file_system</i> invalid; disk usage for group/user id <i>uid</i> exceeds sectors sectors</p> <ul style="list-style-type: none"><li>■ Description The supported quota limit is up to 2147483647 sectors. When quotas are turned on by the <i>quotaon</i> command, this message displays when a user exceeds the supported quota limit.</li><li>■ Action Ask the user to delete files to lower the quota below the limit.</li></ul>
090	<p>WARNING: msgcnt x: mesg 090: V-2-90: quota on <i>file_system</i> failed; soft limits greater than hard limits</p> <ul style="list-style-type: none"><li>■ Description One or more users or groups has a soft limit set greater than the hard limit, preventing the BSD quota from being turned on.</li><li>■ Action Check the soft limit and hard limit for every user and group and confirm that the soft limit is not set greater than the hard limit.</li></ul>
091	<p>WARNING: msgcnt x: mesg 091: V-2-91: vx_fcl_truncate - failure to punch hole at offset <i>offset</i> for <i>bytes</i> bytes in File Change Log file; error <i>error_number</i></p> <ul style="list-style-type: none"><li>■ Description The vxfs kernel has experienced an error while trying to manage the space consumed by the File Change Log file. Because the space cannot be actively managed at this time, the FCL has been deactivated and has been truncated to 1 file system block, which contains the FCL superblock.</li><li>■ Action Re-activate the FCL.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
092	<p>WARNING: msgcnt x: mesg 092: V-2-92: vx_mkfcltran - failure to map offset <i>offset</i> in File Change Log file</p> <ul style="list-style-type: none"><li>■ Description The vxfs kernel was unable to map actual storage to the next offset in the File Change Log file. This is mostly likely caused by a problem with allocating to the FCL file. Because no new FCL records can be written to the FCL file, the FCL has been deactivated.</li><li>■ Action Re-activate the FCL.</li></ul>
095	<p>WARNING: msgcnt x: mesg 095: V-2-95: Failed to set <code>vxfs_ifree_timelag</code> since the specified value is less than the recommended minimum value of <i>time</i>.</p> <ul style="list-style-type: none"><li>■ Description The value for <code>vxfs_ifree_timelag</code> specified by the system administrator is less than the recommended minimum value, <i>time</i>. No new change is made to this tunable value.</li><li>■ Action Informational only; no action required.</li></ul>
096	<p>WARNING: msgcnt x: mesg 096: V-2-96: <i>file_system</i> file system fullfsck flag set - <i>function_name</i>.</p> <ul style="list-style-type: none"><li>■ Description The next time the file system is mounted, a full <code>fsck</code> must be performed.</li><li>■ Action No immediate action required. When the file system is unmounted, run a full file system check using <code>fsck</code> before mounting it again.</li></ul>
097	<p>WARNING: msgcnt x: mesg 097: V-2-97: VxFS failed to create new thread (<i>error_number</i>, <i>function_address:argument_address</i>)</p> <ul style="list-style-type: none"><li>■ Description VxFS failed to create a kernel thread due to resource constraints, which is often a memory shortage.</li><li>■ Action VxFS will retry the thread creation until it succeeds; no immediate action is required. Kernel resources, such as kernel memory, might be overcommitted. If so, reconfigure the system accordingly.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
098	<p>WARNING: msgcnt x: mesg 098: V-2-98: VxFS failed to initialize File Change Log for fileset fileset (index number) of <i>mount_point</i> file system</p> <ul style="list-style-type: none"><li>■ Description VxFS mount failed to initialize FCL structures for the current fileset mount. As a result, FCL could not be turned on. The FCL file will have no logging records.</li><li>■ Action Reactivate the FCL.</li></ul>
099	<p>WARNING: msgcnt x: mesg 099: V-2-99: The specified value for <i>vx_ninode</i> is less than the recommended minimum value of <i>min_value</i></p> <ul style="list-style-type: none"><li>■ Description Auto-tuning or the value specified by the system administrator resulted in a value lower than the recommended minimum for the total number of inodes that can be present in the inode cache. VxFS will ignore the newly tuned value and will keep the value specified in the message (<i>VX_MINNINODE</i>).</li><li>■ Action Informational only; no action required.</li></ul>
100	<p>WARNING: msgcnt x: mesg 100: V-2-100: Inode <i>inumber</i> can not be accessed: file size exceeds OS limitations.</p> <ul style="list-style-type: none"><li>■ Description The specified inode's size is larger than the file size limit of the current operating system. The file cannot be opened on the current platform. This can happen when a file is created on one OS and the filesystem is then moved to a machine running an OS with a smaller file size limit.</li><li>■ Action If the file system is moved to the platform on which the file was created, the file can be accessed from there. It can then be converted to multiple smaller files in a manner appropriate to the application and the file's format, or simply be deleted if it is no longer required.</li></ul>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
101	<p>WARNING: msgcnt x: mesg 101: V-2-101: File Change Log on <i>mount_point</i> for file set <i>index</i> approaching max file size supported. File Change Log will be reactivated when its size hits max file size supported.</p> <ul style="list-style-type: none"><li>■ Description</li></ul> <p>The size of the FCL file is approaching the maximum file size supported. This size is platform specific. When the FCL file reaches the maximum file size, the FCL will be deactivated and reactivated. All logging information gathered so far will be lost.</p> <ul style="list-style-type: none"><li>■ Action</li></ul> <p>Take any corrective action possible to restrict the loss due to the FCL being deactivated and reactivated.</p>
102	<p>WARNING: msgcnt x: mesg 102: V-2-102: File Change Log of <i>mount_point</i> for file set <i>index</i> has been reactivated.</p> <ul style="list-style-type: none"><li>■ Description</li></ul> <p>The size of FCL file reached the maximum supported file size and the FCL has been reactivated. All records stored in the FCL file, starting from the current <i>fc_loff</i> up to the maximum file size, have been purged. New records will be recorded in the FCL file starting from offset <i>fs_bsize</i>. The activation time in the FCL is reset to the time of reactivation. The impact is equivalent to File Change Log being deactivated and activated.</p> <ul style="list-style-type: none"><li>■ Action</li></ul> <p>Informational only; no action required.</p>
103	<p>WARNING: msgcnt x: mesg 103: V-2-103: File Change Log merge on <i>mount_point</i> for file set <i>index</i> failed.</p> <ul style="list-style-type: none"><li>■ Description</li></ul> <p>The VxFS kernel has experienced an error while merging internal per-node File Change Log files into the external File Change Log file. Since the File Change Log cannot be maintained correctly without this, the File Change Log has been deactivated.</p> <ul style="list-style-type: none"><li>■ Action</li></ul> <p>Re-activate the File Change Log.</p>



Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
104	<p>WARNING: msgcnt x: msg 104: V-2-104: File System <i>mount_point</i> device <i>volume_name</i> disabled</p> <ul style="list-style-type: none"><li>■ Description</li></ul> <p>The volume manager detected that the specified volume has failed, and the volume manager has disabled the volume. No further I/O requests are sent to the disabled volume.</p> <ul style="list-style-type: none"><li>■ Action</li></ul> <p>The volume must be repaired.</p>
105	<p>WARNING: msgcnt x: msg 105: V-2-105: File System <i>mount_point</i> device <i>volume_name</i> re-enabled</p> <ul style="list-style-type: none"><li>■ Description</li></ul> <p>The volume manager detected that a previously disabled volume is now operational, and the volume manager has re-enabled the volume.</p> <ul style="list-style-type: none"><li>■ Action</li></ul> <p>Informational only; no action required.</p>
106	<p>WARNING: msgcnt x: msg 106: V-2-106: File System <i>mount_point</i> device <i>volume_name</i> has BAD label</p> <ul style="list-style-type: none"><li>■ Description</li></ul> <p>A file system's label does not match the label that the multi-volume support feature expects the file system to have. The file system's volume is effectively disabled.</p> <ul style="list-style-type: none"><li>■ Action</li></ul> <p>If the label is bad because the volume does not match the assigned label, use the <code>vxvset</code> command to fix the label. Otherwise, the label might have been overwritten and the volume's contents may be lost. Call technical support so that the issue can be investigated.</p>
107	<p>WARNING: msgcnt x: msg 107: V-2-107: File System <i>mount_point</i> device <i>volume_name</i> valid label found</p> <ul style="list-style-type: none"><li>■ Description</li></ul> <p>The label of a file system that had a bad label was somehow restored. The underlying volume is functional.</p> <ul style="list-style-type: none"><li>■ Action</li></ul> <p>Informational only; no action required.</p>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
108	<p>WARNING: msgcnt x: mesg 108: V-2-108: vx_dexh_error - error: fileset <i>fileset</i>, directory inode number <i>dir_inumber</i>, bad hash inode <i>hash_inode</i>, seg <i>segment</i> bno <i>block_number</i></p> <ul style="list-style-type: none"><li>■ Description</li></ul> <p>The supplemental hash for a directory is corrupt.</p> <ul style="list-style-type: none"><li>■ Action</li></ul> <p>If the file system is mounted read/write, the hash for the directory will be automatically removed and recreated. If the removal or recreation fails, subsequent messages indicate the type of problem. If there are no further messages, the removal and recreation of the hash succeeded.</p>
109	<p>WARNING: msgcnt x: mesg 109: V-2-109: failed to tune down <i>tunable_name</i> to <i>tunable_value</i> possibly due to <i>tunable_object</i> in use, could free up only up to <i>suggested_tunable_value</i></p> <ul style="list-style-type: none"><li>■ Description</li></ul> <p>When the value of a tunable, such as <i>ninode</i> or <i>bufhwm</i>, is modified using the <code>kctune</code> command, sometimes the tunable cannot be tuned down to the specified value because of the current system usage. The minimum value to which the tunable can be tuned is also provided as part of the warning message.</p> <ul style="list-style-type: none"><li>■ Action</li></ul> <p>Tune down the tunable to the minimum possible value indicated by the warning message.</p> <p>See <a href="#">“Tuning the VxFS file system”</a> on page 46.</p>
110	<p>WARNING: msgcnt x: mesg 110: V-2-110: The specified value for <i>vx_bc_bufhwm</i> is less than the recommended minimum value of <i>recommended_minimum_value</i>.</p> <ul style="list-style-type: none"><li>■ Description</li></ul> <p>Setting the <i>vx_bc_bufhwm</i> tunable to restrict the memory used by the VxFS buffer cache to a value that is too low has a degrading effect on the system performance on a wide range of applications. Symantec does not recommend setting <i>vx_bc_bufhwm</i> to a value less than the recommended minimum value, which is provided as part of the warning message.</p> <ul style="list-style-type: none"><li>■ Action</li></ul> <p>Tune the <i>vx_bc_bufhwm</i> tunable to a value greater than the recommended minimum indicated by the warning message.</p>

Table B-1 Kernel messages (*continued*)

Message Number	Message and Definition
111	<p>WARNING: msgcnt x: msg 111: V-2-111: You have exceeded the authorized usage (maximum <i>maxfs</i> unique mounted user-data file systems) for this product and are out of compliance with your License Agreement. Please email <a href="mailto:sales_mail@symantec.com">sales_mail@symantec.com</a> or contact your Symantec sales representative for information on how to obtain additional licenses for this product.</p> <ul style="list-style-type: none"><li>■ Description</li></ul> <p>As per your Storage Foundation Basic license agreement, you are allowed to have only a limited number of VxFS file systems, and you have exceeded this number.</p> <ul style="list-style-type: none"><li>■ Action</li></ul> <p>Email <a href="mailto:sales_mail@symantec.com">sales_mail@symantec.com</a> or contact your Symantec sales representative for information on how to obtain additional licenses for this product.</p>
112	<p>WARNING: msgcnt x: msg 112: V-2-112: The new value requires changes to the inode table, which can be made only after a reboot.</p> <ul style="list-style-type: none"><li>■ Description</li></ul> <p>When the value of <code>vx_ninode</code> is modified to tune down the number of inodes, the tunable cannot be tuned down in cases that require changes to the VxFS inode tables. The change to the tunable is marked to take effect after the next boot, during which time the change can be committed after editing the inode tables. Tuning down <code>vx_ninode</code> without changes to the VxFS inode table may cause applications to fail with the <b>ENFILE</b> error.</p> <ul style="list-style-type: none"><li>■ Action</li></ul> <p>Reboot the system so that the new tunable value can be committed after you make changes to the VxFS inode tables.</p>

## About unique message identifiers

VxFS generates diagnostic or error messages for issues not related to the kernel, which are displayed along with a unique message identifier (UMI). Each message has a description and a suggestion on how to handle or correct the underlying problem. The UMI is used to identify the issue should you need to call Technical Support for assistance.

# Unique message identifiers

Some commonly encountered UMIs and the associated messages are described on the following table:

**Table B-2** Unique message identifiers and messages

Message Number	Message and Definition
20002	<p>UX:vxfs <i>command</i>: ERROR: V-3-20002: <i>message</i></p> <ul style="list-style-type: none"><li>■ Description The command attempted to call <code>stat()</code> on a device path to ensure that the path refers to a character device before opening the device, but the <code>stat()</code> call failed. The error message will include the platform-specific message for the particular error that was encountered, such as "Access denied" or "No such file or directory".</li><li>■ Action The corrective action depends on the particular error.</li></ul>
20003	<p>UX:vxfs <i>command</i>: ERROR: V-3-20003: <i>message</i></p> <ul style="list-style-type: none"><li>■ Description The command attempted to open a disk device, but the <code>open()</code> call failed. The error message includes the platform-specific message for the particular error that was encountered, such as "Access denied" or "No such file or directory".</li><li>■ Action The corrective action depends on the particular error.</li></ul>
20005	<p>UX:vxfs <i>command</i>: ERROR: V-3-20005: <i>message</i></p> <ul style="list-style-type: none"><li>■ Description The command attempted to read the superblock from a device, but the <code>read()</code> call failed. The error message will include the platform-specific message for the particular error that was encountered, such as "Access denied" or "No such file or directory".</li><li>■ Action The corrective action depends on the particular error.</li></ul>
20012	<p>UX:vxfs <i>command</i>: ERROR: V-3-20012: <i>message</i></p> <ul style="list-style-type: none"><li>■ Description The command was invoked on a device that did not contain a valid VxFS file system.</li><li>■ Action Check that the path specified is what was intended.</li></ul>

**Table B-2** Unique message identifiers and messages (*continued*)

Message Number	Message and Definition
20076	<p>UX:vxfs <i>command</i>: ERROR: V-3-20076: <i>message</i></p> <ul style="list-style-type: none"><li>■ <b>Description</b> The command called <code>stat()</code> on a file, which is usually a file system mount point, but the call failed.</li><li>■ <b>Action</b> Check that the path specified is what was intended and that the user has permission to access that path.</li></ul>
21256	<p>UX:vxfs <i>command</i>: ERROR: V-3-21256: <i>message</i></p> <ul style="list-style-type: none"><li>■ <b>Description</b> The attempt to mount the file system failed because either the request was to mount a particular Storage Checkpoint that does not exist, or the file system is managed by an HSM and the HSM is not running.</li><li>■ <b>Action</b> In the first case, use the <code>fsckptadm list</code> command to see which Storage Checkpoints exist and mount the appropriate Storage Checkpoint. In the second case, make sure the HSM is running. If the HSM is not running, start and mount the file system again.</li></ul>
21264	<p>UX:vxfs <i>command</i>: ERROR: V-3-21264: <i>message</i></p> <ul style="list-style-type: none"><li>■ <b>Description</b> The attempt to mount a VxFS file system has failed because either the volume being mounted or the directory which is to be the mount point is busy. The reason that a VxVM volume could be busy is if the volume is in a shared disk group and the volume is currently being accessed by a VxFS command, such as <code>fsck</code>, on a node in the cluster. One reason that the mount point could be busy is if a process has the directory open or has the directory as its current directory. Another reason that the mount point could be busy is if the directory is NFS-exported.</li><li>■ <b>Action</b> For a busy mount point, if a process has the directory open or has the directory as its current directory, use the <code>fuser</code> command to locate the processes and either get them to release their references to the directory or kill the processes. Afterward, attempt to mount the file system again.</li></ul>

**Table B-2** Unique message identifiers and messages (*continued*)

Message Number	Message and Definition
21268	<p>UX:vxfs <i>command</i>: ERROR: V-3-21268: <i>message</i></p> <ul style="list-style-type: none"> <li>■ <b>Description</b> This message is printed by two different commands: <code>fsckpt_restore</code> and <code>mount</code>. In both cases, the kernel's attempt to mount the file system failed because of I/O errors or corruption of the VxFS metadata.</li> <li>■ <b>Action</b> Check the console log for I/O errors and fix any problems reported there. Run a full <code>fsck</code>.</li> </ul>
21272	<p>UX:vxfs <i>command</i>: ERROR: V-3-21272: <i>message</i></p> <ul style="list-style-type: none"> <li>■ <b>Description</b> The mount options specified contain mutually-exclusive options, or in the case of a remount, the new mount options differed from the existing mount options in a way that is not allowed to change in a remount.</li> <li>■ <b>Action</b> Change the requested mount options so that they are all mutually compatible and retry the mount.</li> </ul>
23729	<p>UX:vxfs <i>command</i>: ERROR: V-3-23729: <i>message</i></p> <ul style="list-style-type: none"> <li>■ <b>Description</b> Cluster mounts require the <code>vxfsckd</code> daemon to be running, which is controlled by Veritas Cluster Server (VCS).</li> <li>■ <b>Action</b> Check the VCS status to see why this service is not running. After starting the daemon via VCS, try the mount again.</li> </ul>
24996	<p>UX:vxfs <i>command</i>: ERROR: V-3-24996: <i>message</i></p> <ul style="list-style-type: none"> <li>■ <b>Description</b> In some releases of VxFS, before the VxFS <code>mount</code> command attempts to mount a file system, <code>mount</code> tries to read the VxFS superblock to determine the disk layout version of the file system being mounted so that <code>mount</code> can check if that disk layout version is supported by the installed release of VxFS. If the attempt to read the superblock fails for any reason, this message is displayed. This message will usually be preceded by another error message that gives more information as to why the superblock could not be read.</li> <li>■ <b>Action</b> The corrective action depends on the preceding error, if any.</li> </ul>

# Dewey kernel messages

This section contains all the Kernel error code sources in Dewey format.

## V-2-1

NOTICE: msgcnt x: mesg 001: V-2-1: vx\_nospace - *mount\_point* file system full (n block extent)

### Description:

The file system is out of space.

Often, there is plenty of space and one runaway process used up all the remaining free space. In other cases, the available free space becomes fragmented and unusable for some files.

### Recommended action:

Monitor the free space in the file system and prevent it from becoming full. If a runaway process has used up all the space, stop that process, find the files created by the process, and remove them. If the file system is out of space, remove files, defragment, or expand the file system.

To remove files, use the `find` command to locate the files that are to be removed. To get the most space with the least amount of work, remove large files or file trees that are no longer needed. To defragment or expand the file system, use the `fsadm` command.

See the `fsadm_vxfs(1M)` manual page.

## V-2-2

WARNING: msgcnt x: mesg 002: V-2-2: vx\_snap\_strategy - *mount\_point* file system write attempt to read-only file system

WARNING: msgcnt x: mesg 002: V-2-2: vx\_snap\_copyblk - *mount\_point* file system write attempt to read-only file system

### Description:

The kernel tried to write to a read-only file system. This is an unlikely problem, but if it occurs, the file system is disabled.

### Recommended action:

The file system was not written, so no action is required. Report this as a bug to your customer support organization.

## V-2-3

WARNING: msgcnt x: mesg 003: V-2-3: vx\_mapbad - *mount\_point* file system free extent bitmap in au *aun* marked bad

### Description:

If there is an I/O failure while writing a bitmap, the map is marked bad. The kernel considers the maps to be invalid, so does not do any more resource allocation from maps. This situation can cause the file system to report out of space or out of inode error messages even though *df* may report an adequate amount of free space.

This error may also occur due to bitmap inconsistencies. If a bitmap fails a consistency check, or blocks are freed that are already free in the bitmap, the file system has been corrupted. This may have occurred because a user or process wrote directly to the device or used *fsdb* to change the file system.

The *VX\_FULLFCK* flag is set. If the map that failed was a free extent bitmap, and the *VX\_FULLFCK* flag cannot be set, then the file system is disabled.

### Recommended action:

Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process was writing to the device, report the problem to your customer support organization. Unmount the file system and use *fsck* to run a full structural check.

## V-2-4

WARNING: msgcnt x: mesg 004: V-2-4: vx\_mapbad - *mount\_point* file system free inode bitmap in au *aun* marked bad

### Description:

If there is an I/O failure while writing a bitmap, the map is marked bad. The kernel considers the maps to be invalid, so does not do any more resource allocation from maps. This situation can cause the file system to report out of space or out of inode error messages even though *df* may report an adequate amount of free space.

This error may also occur due to bitmap inconsistencies. If a bitmap fails a consistency check, or blocks are freed that are already free in the bitmap, the file system has been corrupted. This may have occurred because a user or process wrote directly to the device or used *fsdb* to change the file system.

The *VX\_FULLFCK* flag is set. If the map that failed was a free extent bitmap, and the *VX\_FULLFCK* flag cannot be set, then the file system is disabled.

### Recommended action:



Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process was writing to the device, report the problem to your customer support organization. Unmount the file system and use `fsck` to run a full structural check.

## V-2-5

WARNING: msgcnt x: mesg 005: V-2-5: vx\_mapbad - *mount\_point* file system inode extended operation bitmap in au *aun* marked bad

### Description:

If there is an I/O failure while writing a bitmap, the map is marked bad. The kernel considers the maps to be invalid, so does not do any more resource allocation from maps. This situation can cause the file system to report out of space or out of inode error messages even though `df` may report an adequate amount of free space.

This error may also occur due to bitmap inconsistencies. If a bitmap fails a consistency check, or blocks are freed that are already free in the bitmap, the file system has been corrupted. This may have occurred because a user or process wrote directly to the device or used `fsdb` to change the file system.

The `VX_FULFSCCK` flag is set. If the map that failed was a free extent bitmap, and the `VX_FULFSCCK` flag cannot be set, then the file system is disabled.

### Recommended action:

Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process was writing to the device, report the problem to your customer support organization. Unmount the file system and use `fsck` to run a full structural check.

## V-2-6

WARNING: msgcnt x: mesg 006: V-2-6: vx\_sumupd - *mount\_point* file system summary update in au *aun* failed

### Description:

An I/O error occurred while writing the allocation unit or inode allocation unit bitmap summary to disk. This sets the `VX_FULFSCCK` flag on the file system. If the `VX_FULFSCCK` flag cannot be set, the file system is disabled.

### Recommended action:

Check the console log for I/O errors. If the problem was caused by a disk failure, replace the disk before the file system is mounted for write access, and use `fsck` to run a full structural check.

## V-2-7

WARNING: msgcnt x: mesg 007: V-2-7: vx\_sumupd - *mount\_point* file system summary update in inode au *iaun* failed

### Description:

An I/O error occurred while writing the allocation unit or inode allocation unit bitmap summary to disk. This sets the `VX_FULLFSCK` flag on the file system. If the `VX_FULLFSCK` flag cannot be set, the file system is disabled.

### Recommended action:

Check the console log for I/O errors. If the problem was caused by a disk failure, replace the disk before the file system is mounted for write access, and use `fsck` to run a full structural check.

## V-2-8

WARNING: msgcnt x: mesg 008: V-2-8: vx\_direrr: function - *mount\_point* file system dir inode *dir\_inumber* dev/block *device\_ID/block* dirent inode *dirent\_inumber* error *errno*

### Description:

A directory operation failed in an unexpected manner. The mount point, inode, and block number identify the failing directory. If the inode is an immediate directory, the directory entries are stored in the inode, so no block number is reported. If the error is `ENOENT` or `ENOTDIR`, an inconsistency was detected in the directory block. This inconsistency could be a bad free count, a corrupted hash chain, or any similar directory structure error. If the error is `EIO` or `ENXIO`, an I/O failure occurred while reading or writing the disk block.

The `VX_FULLFSCK` flag is set in the super-block so that `fsck` will do a full structural check the next time it is run.

### Recommended action:

Check the console log for I/O errors. If the problem was caused by a disk failure, replace the disk before the file system is mounted for write access. Unmount the file system and use `fsck` to run a full structural check.

## V-2-9

WARNING: msgcnt x: mesg 009: V-2-9: vx\_direrr: function - *mount\_point* file system dir inode *dir\_inumber* dirent inode *dirent\_inumber* immediate directory error *errno*

### Description:

A directory operation failed in an unexpected manner. The mount point, inode, and block number identify the failing directory. If the inode is an immediate directory, the directory entries are stored in the inode, so no block number is reported. If the error is `ENOENT` or `ENOTDIR`, an inconsistency was detected in the directory block. This inconsistency could be a bad free count, a corrupted hash chain, or any similar directory structure error. If the error is `EIO` or `ENXIO`, an I/O failure occurred while reading or writing the disk block.

The `VX_FULLFSCK` flag is set in the super-block so that `fsck` will do a full structural check the next time it is run.

### Recommended action:

Check the console log for I/O errors. If the problem was caused by a disk failure, replace the disk before the file system is mounted for write access. Unmount the file system and use `fsck` to run a full structural check.

## V-2-10

WARNING: msgcnt x: mesg 010: V-2-10: vx\_ialloc - *mount\_point* file system inode *inumber* not free

### Description:

When the kernel allocates an inode from the free inode bitmap, it checks the mode and link count of the inode. If either is non-zero, the free inode bitmap or the inode list is corrupted.

The `VX_FULLFSCK` flag is set in the super-block so that `fsck` will do a full structural check the next time it is run.

### Recommended action:

Unmount the file system and use `fsck` to run a full structural check.

## V-2-11

NOTICE: msgcnt x: mesg 011: V-2-11: vx\_noinode - *mount\_point* file system out of inodes

### Description:

The file system is out of inodes.

**Recommended action:**

Monitor the free inodes in the file system. If the file system is getting full, create more inodes either by removing files or by expanding the file system.

See the `fsadm_vxfs(1M)` online manual page.

## V-2-12

WARNING: msgcnt x: mesg 012: V-2-12: vx\_iget - *mount\_point* file system invalid inode number *inumber*

**Description:**

When the kernel tries to read an inode, it checks the inode number against the valid range. If the inode number is out of range, the data structure that referenced the inode number is incorrect and must be fixed.

The `VX_FULLFSCK` flag is set in the super-block so that `fsck` will do a full structural check the next time it is run.

**Recommended action:**

Unmount the file system and use `fsck` to run a full structural check.

## V-2-13

WARNING: msgcnt x: mesg 013: V-2-13: vx\_igroup - *mount\_point* file system inode *inumber* invalid inode list extent

**Description:**

For a Version 2 and above disk layout, the inode list is dynamically allocated. When the kernel tries to read an inode, it must look up the location of the inode in the inode list file. If the kernel finds a bad extent, the inode cannot be accessed. All of the inode list extents are validated when the file system is mounted, so if the kernel finds a bad extent, the integrity of the inode list is questionable. This is a very serious error.

The `VX_FULLFSCK` flag is set in the super-block and the file system is disabled.

Recommended Recommended action:

Unmount the file system and use `fsck` to run a full structural check.

## V-2-14

WARNING: msgcnt x: mesg 014: V-2-14: vx\_igroup - inode table overflow

**Description:**

All the system in-memory inodes are busy and an attempt was made to use a new inode.

**Recommended action:**

Look at the processes that are running and determine which processes are using inodes. If it appears there are runaway processes, they might be tying up the inodes. If the system load appears normal, increase the `vx_ninode` parameter in the kernel.

See [“Tuning the VxFS file system”](#) on page 46.

## V-2-15

WARNING: msgcnt x: mesg 015: V-2-15: vx\_ibadinactive - *mount\_point* file system cannot mark inode *inumber* bad

WARNING: msgcnt x: mesg 015: V-2-15: vx\_ilisterr - *mount\_point* file system cannot mark inode *inumber* bad

**Description:**

An attempt to mark an inode bad on disk, and the super-block update to set the `VX_FULLFSCK` flag, failed. This indicates that a catastrophic disk error may have occurred since both an inode list block and the super-block had I/O failures. The file system is disabled to preserve file system integrity.

**Recommended action:**

Unmount the file system and use `fsck` to run a full structural check. Check the console log for I/O errors. If the disk failed, replace it before remounting the file system.

## V-2-16

WARNING: msgcnt x: mesg 016: V-2-16: vx\_ilisterr - *mount\_point* file system error reading inode *inumber*

**Description:**

An I/O error occurred while reading the inode list. The `VX_FULLFSCK` flag is set.

**Recommended action:**

Check the console log for I/O errors. If the problem was caused by a disk failure, replace the disk before the file system is mounted for write access. Unmount the file system and use `fsck` to run a full structural check.

## V-2-17

WARNING: msgcnt x: msg 017: V-2-17: vx\_attr\_getblk - *mount\_point* file system  
inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_attr\_iget - *mount\_point* file system  
inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_attr\_indadd - *mount\_point* file system  
inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_attr\_indtrunc - *mount\_point* file system  
inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_attr\_iremove - *mount\_point* file system  
inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_bmap - *mount\_point* file system inode  
*inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_bmap\_indirect\_ext4 - *mount\_point*  
file system inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_delbuf\_flush - *mount\_point* file system  
inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_dio\_iovec - *mount\_point* file system  
inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_dirbread - *mount\_point* file system  
inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_dircreate - *mount\_point* file system  
inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_dirlook - *mount\_point* file system inode  
*inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_doextop\_iau - *mount\_point* file system  
inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_doextop\_now - *mount\_point* file system  
inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_do\_getpage - *mount\_point* file system  
inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_enter\_ext4 - *mount\_point* file system  
inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_exttrunc - *mount\_point* file system  
inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_get\_alloc - *mount\_point* file system inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_ilsterr - *mount\_point* file system inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_indtrunc - *mount\_point* file system inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_iread - *mount\_point* file system inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_remove - *mount\_point* file system inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_remove\_attr - *mount\_point* file system inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_logwrite\_flush - *mount\_point* file system inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_olmount\_iget - *mount\_point* file system inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_overlay\_bmap - *mount\_point* file system inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_readnomap - *mount\_point* file system inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_reorg\_trunc - *mount\_point* file system inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_stablestore - *mount\_point* file system inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_tranitimes - *mount\_point* file system inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_trunc - *mount\_point* file system inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_write\_alloc2 - *mount\_point* file system inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_write\_default - *mount\_point* file system inode *inumber* marked bad in core

WARNING: msgcnt x: msg 017: V-2-17: vx\_zero\_alloc - *mount\_point* file system inode *inumber* marked bad in core

**Description:**

When inode information is no longer dependable, the kernel marks it bad in memory. This is followed by a message to mark it bad on disk as well unless the mount command `ioerror` option is set to `disable`, or there is subsequent I/O failure when updating the inode on disk. No further operations can be performed on the inode.

The most common reason for marking an inode bad is a disk I/O failure. If there is an I/O failure in the inode list, on a directory block, or an indirect address extent, the integrity of the data in the inode, or the data the kernel tried to write to the inode list, is questionable. In these cases, the disk driver prints an error message and one or more inodes are marked bad.

The kernel also marks an inode bad if it finds a bad extent address, invalid inode fields, or corruption in directory data blocks during a validation check. A validation check failure indicates the file system has been corrupted. This usually occurs because a user or process has written directly to the device or used `fsdb` to change the file system.

The `VX_FULLFSCK` flag is set in the super-block so `fsck` will do a full structural check the next time it is run.

**Recommended action:**

Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process is writing to the device, report the problem to your customer support organization. In either case, unmount the file system. The file system can be remounted without a full `fsck` unless the `VX_FULLFSCK` flag is set for the file system.

## V-2-19

WARNING: msgcnt x: mesg 019: V-2-19: vx\_log\_add - *mount\_point* file system log overflow

**Description:**

Log ID overflow. When the log ID reaches `VX_MAXLOGID` (approximately one billion by default), a flag is set so the file system resets the log ID at the next opportunity. If the log ID has not been reset, when the log ID reaches `VX_DISLOGID` (approximately `VX_MAXLOGID` plus 500 million by default), the file system is disabled. Since a log reset will occur at the next 60 second sync interval, this should never happen.

**Recommended action:**

Unmount the file system and use `fsck` to run a full structural check.



## V-2-20

WARNING: msgcnt x: mesg 020: V-2-20: vx\_logerr - *mount\_point* file system log error *errno*

**Description:**

Intent log failed. The kernel will try to set the `VX_FULLFCK` and `VX_LOGBAD` flags in the super-block to prevent running a log replay. If the super-block cannot be updated, the file system is disabled.

**Recommended action:**

Unmount the file system and use `fck` to run a full structural check. Check the console log for I/O errors. If the disk failed, replace it before remounting the file system.

## V-2-21

WARNING: msgcnt x: mesg 021: V-2-21: vx\_fs\_init - *mount\_point* file system validation failure

**Description:**

When a VxFS file system is mounted, the structure is read from disk. If the file system is marked clean, the structure is correct and the first block of the intent log is cleared.

If there is any I/O problem or the structure is inconsistent, the kernel sets the `VX_FULLFCK` flag and the mount fails.

If the error is not related to an I/O failure, this may have occurred because a user or process has written directly to the device or used `fsdb` to change the file system.

**Recommended action:**

Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process is writing to the device, report the problem to your customer support organization. In either case, unmount the file system and use `fck` to run a full structural check.

## V-2-22

WARNING: msgcnt x: mesg 022: V-2-22: vx\_mountroot - root file system remount failed

**Description:**

The remount of the root file system failed. The system will not be usable if the root file system cannot be remounted for read/write access.

When a root Veritas File System is first mounted, it is mounted for read-only access. After `fsck` is run, the file system is remounted for read/write access. The remount fails if `fsck` completed a resize operation or modified a file that was opened before the `fsck` was run. It also fails if an I/O error occurred during the remount.

Usually, the system halts or reboots automatically.

**Recommended action:**

Reboot the system. The system either remounts the root cleanly or runs a full structural `fsck` and remounts cleanly. If the remount succeeds, no further action is necessary.

Check the console log for I/O errors. If the disk has failed, replace it before the file system is mounted for write access.

If the system won't come up and a full structural `fsck` hasn't been run, reboot the system on a backup root and manually run a full structural `fsck`. If the problem persists after the full structural `fsck` and there are no I/O errors, contact your customer support organization.

## V-2-23

WARNING: msgcnt x: mesg 023: V-2-23: vx\_unmountroot - root file system is busy and cannot be unmounted cleanly

**Description:**

There were active files in the file system and they caused the unmount to fail.

When the system is halted, the root file system is unmounted. This happens occasionally when a process is hung and it cannot be killed before unmounting the root.

**Recommended action:**

`fsck` will run when the system is rebooted. It should clean up the file system. No other action is necessary.

If the problem occurs every time the system is halted, determine the cause and contact your customer support organization.

## V-2-24

WARNING: msgcnt x: mesg 024: V-2-24: vx\_cutwait - *mount\_point* file system current usage table update error

**Description:**

Update to the current usage table (CUT) failed.

For a Version 2 disk layout, the CUT contains a fileset version number and total number of blocks used by each fileset.

The `VX_FULLFSCK` flag is set in the super-block. If the super-block cannot be written, the file system is disabled.

**Recommended action:**

Unmount the file system and use `fsck` to run a full structural check.

## V-2-25

WARNING: msgcnt x: mesg 025: V-2-25: vx\_wsuper - *mount\_point* file system super-block update failed

**Description:**

An I/O error occurred while writing the super-block during a resize operation. The file system is disabled.

**Recommended action:**

Unmount the file system and use `fsck` to run a full structural check. Check the console log for I/O errors. If the problem is a disk failure, replace the disk before the file system is mounted for write access.

## V-2-26

WARNING: msgcnt x: mesg 026: V-2-26: vx\_snap\_copyblk - *mount\_point* primary file system read error

**Description:**

Snapshot file system error.

When the primary file system is written, copies of the original data must be written to the snapshot file system. If a read error occurs on a primary file system during the copy, any snapshot file system that doesn't already have a copy of the data is out of date and must be disabled.

**Recommended action:**

An error message for the primary file system prints. Resolve the error on the primary file system and rerun any backups or other applications that were using the snapshot that failed when the error occurred.

## V-2-27

WARNING: msgcnt x: mesg 027: V-2-27: vx\_snap\_bpcopy - *mount\_point* snapshot file system write error

**Description:**

A write to the snapshot file system failed.

As the primary file system is updated, copies of the original data are read from the primary file system and written to the snapshot file system. If one of these writes fails, the snapshot file system is disabled.

**Recommended action:**

Check the console log for I/O errors. If the disk has failed, replace it. Resolve the error on the disk and rerun any backups or other applications that were using the snapshot that failed when the error occurred.

## V-2-28

WARNING: msgcnt x: mesg 028: V-2-28: vx\_snap\_alloc - *mount\_point* snapshot file system out of space

**Description:**

The snapshot file system ran out of space to store changes.

During a snapshot backup, as the primary file system is modified, the original data is copied to the snapshot file system. This error can occur if the snapshot file system is left mounted by mistake, if the snapshot file system was given too little disk space, or the primary file system had an unexpected burst of activity. The snapshot file system is disabled.

**Recommended action:**

Make sure the snapshot file system was given the correct amount of space. If it was, determine the activity level on the primary file system. If the primary file system was unusually busy, rerun the backup. If the primary file system is no busier than normal, move the backup to a time when the primary file system is relatively idle or increase the amount of disk space allocated to the snapshot file system.

Rerun any backups that failed when the error occurred.

## V-2-29

WARNING: msgcnt x: mesg 029: V-2-29: vx\_snap\_getbp - *mount\_point* snapshot file system block map write error

**Description:**

During a snapshot backup, each snapshot file system maintains a block map on disk. The block map tells the snapshot file system where data from the primary file system is stored in the snapshot file system. If an I/O operation to the block map fails, the snapshot file system is disabled.

**Recommended action:**

Check the console log for I/O errors. If the disk has failed, replace it. Resolve the error on the disk and rerun any backups that failed when the error occurred.

## V-2-30

WARNING: msgcnt x: msg 030: V-2-30: vx\_snap\_getbp - *mount\_point* snapshot file system block map read error

**Description:**

During a snapshot backup, each snapshot file system maintains a block map on disk. The block map tells the snapshot file system where data from the primary file system is stored in the snapshot file system. If an I/O operation to the block map fails, the snapshot file system is disabled.

**Recommended action:**

Check the console log for I/O errors. If the disk has failed, replace it. Resolve the error on the disk and rerun any backups that failed when the error occurred.

## V-2-31

WARNING: msgcnt x: msg 031: V-2-31: vx\_disable - *mount\_point* file system disabled

**Description:**

File system disabled, preceded by a message that specifies the reason. This usually indicates a serious disk problem.

**Recommended action:**

Unmount the file system and use `fsck` to run a full structural check. If the problem is a disk failure, replace the disk before the file system is mounted for write access.

## V-2-32

WARNING: msgcnt x: msg 032: V-2-32: vx\_disable - *mount\_point* snapshot file system disabled

**Description:**

Snapshot file system disabled, preceded by a message that specifies the reason.

**Recommended action:**

Unmount the snapshot file system, correct the problem specified by the message, and rerun any backups that failed due to the error.

## V-2-33

WARNING: msgcnt x: mesg 033: V-2-33: vx\_check\_badblock - *mount\_point* file system had an I/O error, setting `VX_FULFSCK`

**Description:**

When the disk driver encounters an I/O error, it sets a flag in the super-block structure. If the flag is set, the kernel will set the `VX_FULFSCK` flag as a precautionary measure. Since no other error has set the `VX_FULFSCK` flag, the failure probably occurred on a data block.

**Recommended action:**

Unmount the file system and use `fsck` to run a full structural check. Check the console log for I/O errors. If the problem is a disk failure, replace the disk before the file system is mounted for write access.

## V-2-34

WARNING: msgcnt x: mesg 034: V-2-34: vx\_resetlog - *mount\_point* file system cannot reset log

**Description:**

The kernel encountered an error while resetting the log ID on the file system. This happens only if the super-block update or log write encountered a device failure. The file system is disabled to preserve its integrity.

**Recommended action:**

Unmount the file system and use `fsck` to run a full structural check. Check the console log for I/O errors. If the problem is a disk failure, replace the disk before the file system is mounted for write access.

## V-2-35

WARNING: msgcnt x: mesg 035: V-2-35: vx\_inactive - *mount\_point* file system inactive of locked inode *inumber*

**Description:**

VOP\_INACTIVE was called for an inode while the inode was being used. This should never happen, but if it does, the file system is disabled.

**Recommended action:**

Unmount the file system and use `fsck` to run a full structural check. Report as a bug to your customer support organization.

## V-2-36

WARNING: msgcnt x: msg 036: V-2-36: vx\_lctbad - *mount\_point* file system link count table *lctnumber* bad

**Description:**

Update to the link count table (LCT) failed.

For a Version 2 and above disk layout, the LCT contains the link count for all the structural inodes. The `VX_FULLFSCK` flag is set in the super-block. If the super-block cannot be written, the file system is disabled.

**Recommended action:**

Unmount the file system and use `fsck` to run a full structural check.

## V-2-37

WARNING: msgcnt x: msg 037: V-2-37: vx\_metaioerr - function - *volume\_name* file system meta data [read|write] error in dev/block *device\_ID/block*

**Description:**

A read or a write error occurred while accessing file system metadata. The full `fsck` flag on the file system was set. The message specifies whether the disk I/O that failed was a read or a write.

File system metadata includes inodes, directory blocks, and the file system log. If the error was a write error, it is likely that some data was lost. This message should be accompanied by another file system message describing the particular file system metadata affected, as well as a message from the disk driver containing information about the disk I/O error.

**Recommended action:**

Resolve the condition causing the disk error. If the error was the result of a temporary condition (such as accidentally turning off a disk or a loose cable), correct the condition. Check for loose cables, etc. Unmount the file system and use `fsck` to run a full structural check (possibly with loss of data).

In case of an actual disk error, if it was a read error and the disk driver remaps bad sectors on write, it may be fixed when `fsck` is run since `fsck` is likely to rewrite the sector with the read error. In other cases, you replace or reformat the disk drive and restore the file system from backups. Consult the documentation specific to

your system for information on how to recover from disk errors. The disk driver should have printed a message that may provide more information.

## V-2-38

WARNING: msgcnt x: mesg 038: V-2-38: vx\_dataioerr - *volume\_name* file system file data [read|write] error in dev/block *device\_ID/block*

### Description:

A read or a write error occurred while accessing file data. The message specifies whether the disk I/O that failed was a read or a write. File data includes data currently in files and free blocks. If the message is printed because of a read or write error to a file, another message that includes the inode number of the file will print. The message may be printed as the result of a read or write error to a free block, since some operations allocate an extent and immediately perform I/O to it. If the I/O fails, the extent is freed and the operation fails. The message is accompanied by a message from the disk driver regarding the disk I/O error.

### Recommended action:

Resolve the condition causing the disk error. If the error was the result of a temporary condition (such as accidentally turning off a disk or a loose cable), correct the condition. Check for loose cables, etc. If any file data was lost, restore the files from backups. Determine the file names from the inode number.

See the ncheck(1M) manual page.

If an actual disk error occurred, make a backup of the file system, replace or reformat the disk drive, and restore the file system from the backup. Consult the documentation specific to your system for information on how to recover from disk errors. The disk driver should have printed a message that may provide more information.

## V-2-39

WARNING: msgcnt x: mesg 039: V-2-39: vx\_writesuper - file system super-block write error

### Description:

An attempt to write the file system super block failed due to a disk I/O error. If the file system was being mounted at the time, the mount will fail. If the file system was mounted at the time and the full `fsck` flag was being set, the file system will probably be disabled and Message 031 will also be printed. If the super-block was being written as a result of a sync operation, no other action is taken.

### Recommended action:



Resolve the condition causing the disk error. If the error was the result of a temporary condition (such as accidentally turning off a disk or a loose cable), correct the condition. Check for loose cables, etc. Unmount the file system and use `fsck` to run a full structural check.

If an actual disk error occurred, make a backup of the file system, replace or reformat the disk drive, and restore the file system from backups. Consult the documentation specific to your system for information on how to recover from disk errors. The disk driver should have printed a message that may provide more information.

## V-2-56

WARNING: msgcnt x: mesg 056: V-2-56: vx\_mapbad - *mount\_point* file system extent allocation unit state bitmap number *number* marked bad

### Description:

If there is an I/O failure while writing a bitmap, the map is marked bad. The kernel considers the maps to be invalid, so does not do any more resource allocation from maps. This situation can cause the file system to report "out of space" or "out of inode" error messages even though `df` may report an adequate amount of free space.

This error may also occur due to bitmap inconsistencies. If a bitmap fails a consistency check, or blocks are freed that are already free in the bitmap, the file system has been corrupted. This may have occurred because a user or process wrote directly to the device or used `fsdb` to change the file system.

The `VX_FULLFSCK` flag is set. If the `VX_FULLFSCK` flag cannot be set, the file system is disabled.

### Recommended action:

Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process was writing to the device, report the problem to your customer support organization. Unmount the file system and use `fsck` to run a full structural check.

## V-2-57

WARNING: msgcnt x: mesg 057: V-2-57: vx\_esum\_bad - *mount\_point* file system extent allocation unit summary number *number* marked bad

### Description:

An I/O error occurred reading or writing an extent allocation unit summary.

The `VX_FULLFSCK` flag is set. If the `VX_FULLFSCK` flag cannot be set, the file system is disabled.

**Recommended action:**

Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process was writing to the device, report the problem to your customer support organization. Unmount the file system and use `fsck` to run a full structural check.

## V-2-58

WARNING: msgcnt x: msg 058: V-2-58: vx\_isum\_bad - *mount\_point* file system inode allocation unit summary number *number* marked bad

**Description:**

An I/O error occurred reading or writing an inode allocation unit summary.

The `VX_FULLFSCK` flag is set. If the `VX_FULLFSCK` flag cannot be set, the file system is disabled.

**Recommended action:**

Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process was writing to the device, report the problem to your customer support organization. Unmount the file system and use `fsck` to run a full structural check.

## V-2-59

WARNING: msgcnt x: msg 059: V-2-59: vx\_snap\_getbitbp - *mount\_point* snapshot file system bitmap write error

**Description:**

An I/O error occurred while writing to the snapshot file system bitmap. There is no problem with the snapped file system, but the snapshot file system is disabled.

**Recommended action:**

Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process was writing to the device, report the problem to your customer support organization. Restart the snapshot on an error free disk partition. Rerun any backups that failed when the error occurred.

## V-2-60

WARNING: msgcnt x: mesg 060: V-2-60: vx\_snap\_getbitbp - *mount\_point* snapshot file system bitmap read error

**Description:**

An I/O error occurred while reading the snapshot file system bitmap. There is no problem with snapped file system, but the snapshot file system is disabled.

**Recommended action:**

Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process was writing to the device, report the problem to your customer support organization. Restart the snapshot on an error free disk partition. Rerun any backups that failed when the error occurred.

## V-2-61

WARNING: msgcnt x: mesg 061: V-2-61: vx\_resize - *mount\_point* file system remount failed

**Description:**

During a file system resize, the remount to the new size failed. The `VX_FULFSCCK` flag is set and the file system is disabled.

**Recommended action:**

Unmount the file system and use `fsck` to run a full structural check. After the check, the file system shows the new size.

## V-2-62

NOTICE: msgcnt x: mesg 062: V-2-62: vx\_attr\_creatop - invalid disposition returned by attribute driver

**Description:**

A registered extended attribute intervention routine returned an invalid return code to the VxFS driver during extended attribute inheritance.

**Recommended action:**

Determine which vendor supplied the registered extended attribute intervention routine and contact their customer support organization.

## V-2-63

WARNING: msgcnt x: mesg 063: V-2-63: vx\_fset\_markbad - *mount\_point* file system *mount\_point* fileset (index *number*) marked bad

**Description:**

An error occurred while reading or writing a fileset structure. `VX_FULLFSCK` flag is set. If the `VX_FULLFSCK` flag cannot be set, the file system is disabled.

**Recommended action:**

Unmount the file system and use `fsck` to run a full structural check.

## V-2-64

WARNING: msgcnt x: mesg 064: V-2-64: vx\_invalidate - *mount\_point* file system inode number version number exceeds fileset's

**Description:**

During inode validation, a discrepancy was found between the inode version number and the fileset version number. The inode may be marked bad, or the fileset version number may be changed, depending on the ratio of the mismatched version numbers.

`VX_FULLFSCK` flag is set. If the `VX_FULLFSCK` flag cannot be set, the file system is disabled.

**Recommended action:**

Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process is writing to the device, report the problem to your customer support organization. In either case, unmount the file system and use `fsck` to run a full structural check.

## V-2-66

NOTICE: msgcnt x: mesg 066: V-2-66: DMAPI mount event - buffer

**Description:**

An HSM (Hierarchical Storage Management) agent responded to a DMAPI mount event and returned a message in buffer.

**Recommended action:**

Consult the HSM product documentation for the appropriate response to the message.

## V-2-67

WARNING: msgcnt x: mesg 067: V-2-67: mount of *device\_path* requires HSM agent

**Description:**

The file system mount failed because the file system was marked as being under the management of an HSM agent, and no HSM agent was found during the mount.

**Recommended action:**

Restart the HSM agent and try to mount the file system again.

## V-2-69

WARNING: msgcnt x: mesg 069: V-2-69: memory usage specified by the vxfs:vxfs\_ninode and vxfs:vx\_bc\_bufhwm parameters exceeds available memory; the system may hang under heavy load

**Description:**

The value of the system tunable parameters `vx_ninode` and `vx_bc_bufhwm`—add up to a value that is more than 66% of the kernel virtual address space or more than 50% of the physical system memory. VxFS inodes require approximately one kilobyte each, so both values can be treated as if they are in units of one kilobyte.

**Recommended action:**

To avoid a system hang, reduce the value of one or both parameters to less than 50% of physical memory or to 66% of kernel virtual memory.

See [“Tuning the VxFS file system”](#) on page 46.

## V-2-70

WARNING: msgcnt x: mesg 070: V-2-70: checkpoint *checkpoint\_name* removed from file system *mount\_point*

**Description:**

The file system ran out of space while updating a Storage Checkpoint. The Storage Checkpoint was removed to allow the operation to complete.

**Recommended action:**

Increase the size of the file system. If the file system size cannot be increased, remove files to create sufficient space for new Storage Checkpoints. Monitor capacity of the file system closely to ensure it does not run out of space.

See the `fsadm_vxfs(1M)` manual page.

## V-2-71

NOTICE: msgcnt x: mesg 071: V-2-71: cleared data I/O error flag in *mount\_point* file system

**Description:**

The user data I/O error flag was reset when the file system was mounted. This message indicates that a read or write error occurred while the file system was previously mounted.

See Message Number 038.

**Recommended action:**

Informational only, no action required.

## V-2-72

WARNING: msgcnt x: vxfs: mesg 072: could not failover for *volume\_name* file system

**Description:**

This message is specific to the cluster file system. The message indicates a problem in a scenario where a node failure has occurred in the cluster and the newly selected primary node encounters a failure.

**Recommended action:**

Save the system logs and core dump of the node along with the disk image (metasave) and contact your customer support organization. The node can be rebooted to join the cluster.

## V-2-75

WARNING: msgcnt x: mesg 075: V-2-75: replay fsck failed for *mount\_point* file system

**Description:**

The log replay failed during a failover or while migrating the CFS primary-ship to one of the secondary cluster nodes. The file system was disabled.

**Recommended action:**

Unmount the file system from the cluster. Use `fsck` to run a full structural check and mount the file system again.

## V-2-76

NOTICE: msgcnt x: msg 076: V-2-76: checkpoint asynchronous operation on *mount\_point* file system still in progress

An EBUSY message was received while trying to unmount a file system. The unmount failure was caused by a pending asynchronous fileset operation, such as a fileset removal or fileset conversion to a nodata Storage Checkpoint.

**Description:**

Action

The operation may take a considerable length of time. You can do a forced unmount, or simply wait for the operation to complete so file system can be unmounted cleanly.

See the `umount_vxfs(1M)` manual page.

## V-2-77

WARNING: msgcnt x: msg 077: V-2-77: vx\_fshdchange - *mount\_point* file system number fileset, fileset header: checksum failed

**Description:**

Disk corruption was detected while changing fileset headers. This can occur when writing a new inode allocation unit, preventing the allocation of new inodes in the fileset.

**Recommended action:**

Unmount the file system and use `fsck` to run a full structural check.

## V-2-78

WARNING: msgcnt x: msg 078: V-2-78: vx\_ilealloc - *mount\_point* file system *mount\_point* fileset (index number) ilist corrupt

**Description:**

The inode list for the fileset was corrupted and the corruption was detected while allocating new inodes. The failed system call returns an ENOSPC error. Any subsequent inode allocations will fail unless a sufficient number of files are removed.

**Recommended action:**

Unmount the file system and use `fsck` to run a full structural check.

## V-2-79

WARNING: msgcnt x: msg 017: V-2-79: vx\_attr\_getblk - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_attr\_iget - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_attr\_indadd - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_attr\_indtrunc - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_attr\_iremove - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_bmap - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_bmap\_indirect\_ext4 - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_delbuf\_flush - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_dio\_iovec - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_dirbread - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_dircreate - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_dirlook - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_doextop\_iau - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_doextop\_now - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_do\_getpage - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_enter\_ext4 - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_exttrunc - *mount\_point* file system inode *inumber* marked bad on disk



WARNING: msgcnt x: msg 017: V-2-79: vx\_get\_alloc - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_ilsterr - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_indtrunc - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_iread - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_iremove - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_iremove\_attr - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_logwrite\_flush - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_olmount\_iget - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_overlay\_bmap - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_readnomap - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_reorg\_trunc - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_stablestore - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_tranitimes - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_trunc - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_write\_alloc2 - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_write\_default - *mount\_point* file system inode *inumber* marked bad on disk

WARNING: msgcnt x: msg 017: V-2-79: vx\_zero\_alloc - *mount\_point* file system inode *inumber* marked bad on disk

**Description:**

When inode information is no longer dependable, the kernel marks it bad on disk. The most common reason for marking an inode bad is a disk I/O failure. If there is an I/O failure in the inode list, on a directory block, or an indirect address extent, the integrity of the data in the inode, or the data the kernel tried to write to the inode list, is questionable. In these cases, the disk driver prints an error message and one or more inodes are marked bad.

The kernel also marks an inode bad if it finds a bad extent address, invalid inode fields, or corruption in directory data blocks during a validation check. A validation check failure indicates the file system has been corrupted. This usually occurs because a user or process has written directly to the device or used *fsdb* to change the file system.

The `VX_FULLFSCK` flag is set in the super-block so `fsck` will do a full structural check the next time it is run.

**Recommended action:**

Check the console log for I/O errors. If the problem is a disk failure, replace the disk. If the problem is not related to an I/O failure, find out how the disk became corrupted. If no user or process is writing to the device, report the problem to your customer support organization. In either case, unmount the file system and use `fsck` to run a full structural check.

## V-2-80

WARNING: msgcnt x: vxfs: msg 080: Disk layout versions older than Version 4 will not be supported in the next release. It is advisable to upgrade to the latest disk layout version now.

See the `vxupgrade(1M)` manual page.

See the *Veritas Storage Foundation Release Notes*.

**Recommended action:**

Use the `vxupgrade` command to begin upgrading file systems using older disk layouts to Version 5, then 6, then 7. Consider the following when planning disk layout upgrades:

Version 2 disk layout file systems have an 8 million inode limit.

Images of Version 2 disk layout file systems created by copy utilities, such as `dd` or `volcopy`, will become unusable after a disk layout upgrade.

## V-2-81

WARNING: msgcnt x: msg 081: V-2-81: possible network partition detected

**Description:**

This message displays when CFS detects a possible network partition and disables the file system locally, that is, on the node where the message appears.

**Recommended action:**

There are one or more private network links for communication between the nodes in a cluster. At least one link must be active to maintain the integrity of the cluster. If all the links go down, after the last network link is broken, the node can no longer communicate with other nodes in the cluster.

Check the network connections. After verifying that the network connections is operating correctly, unmount the disabled file system and mount it again.

## V-2-82

WARNING: msgcnt x: mesg 082: V-2-82: *volume\_name* file system is on shared volume. It may get damaged if cluster is in partitioned state.

**Description:**

If a cluster node is in a partitioned state, and if the file system is on a shared VxVM volume, this volume may become corrupted by accidental access from another node in the cluster.

**Recommended action:**

These shared disks can also be seen by nodes in a different partition, so they can inadvertently be corrupted. So the second message 082 tells that the device mentioned is on shared volume and damage can happen only if it is a real partition problem. Do not use it on any other node until the file system is unmounted from the mounted nodes.

## V-2-83

WARNING: msgcnt x: mesg 083: V-2-83: *mount\_point* file system log is not compatible with the specified intent log I/O size

**Description:**

Either the specified `mount logiosize` size is not compatible with the file system layout, or the file system is corrupted.

**Recommended action:**

Mount the file system again without specifying the `logiosize` option, or use a `logiosize` value compatible with the intent log specified when the file system was created. If the error persists, unmount the file system and use `fsck` to run a full structural check.

## V-2-84

WARNING: msgcnt x: mesg 084: V-2-84: in *volume\_name* quota on failed during assumption. (stage *stage\_number*)

**Description:**

In a cluster file system, when the primary of the file system fails, a secondary file system is chosen to assume the role of the primary. The assuming node will be able to enforce quotas after becoming the primary.

If the new primary is unable to enforce quotas this message will be displayed.

**Recommended action:**

Issue the quotaon command from any of the nodes that have the file system mounted.

## V-2-85

WARNING: msgcnt x: mesg 085: V-2-85: Checkpoint quota - warning: *file\_system* file system fileset quota hard limit exceeded

**Description:**

The system administrator sets the quotas for Storage Checkpoints in the form of a soft limit and hard limit. This message displays when the hard limit is exceeded.

**Recommended action:**

Delete Storage Checkpoints or increase the hard limit.

## V-2-86

WARNING: msgcnt x: mesg 086: V-2-86: Checkpoint quota - warning: *file\_system* file system fileset quota soft limit exceeded

**Description:**

The system administrator sets the quotas for Storage Checkpoints in the form of a soft limit and hard limit. This message displays when the soft limit is exceeded.

**Recommended action:**

Delete Storage Checkpoints or increase the soft limit. This is not a mandatory action, but is recommended.

## V-2-87

WARNING: msgcnt x: mesg 087: V-2-87: vx\_dotdot\_manipulate: *file\_system* file system *inumber* inode *ddnumber* dotdot inode error

**Description:**

When performing an operation that changes an inode entry, if the inode is incorrect, this message will display.

**Recommended action:**

Run a full file system check using `fsck` to correct the errors.

## V-2-88

WARNING: msgcnt x: msg 088: V-2-88: quotaon on *file\_system* failed; limits exceed limit

**Description:**

The external quota file, `quotas`, contains the quota values, which range from 0 up to 2147483647. When quotas are turned on by the `quotaon` command, this message displays when a user exceeds the quota limit.

**Recommended action:**

Correct the quota values in the `quotas` file.

## V-2-89

WARNING: msgcnt x: msg 089: V-2-89: quotaon on *file\_system* invalid; disk usage for group/user id *uid* exceeds sectors sectors

**Description:**

The supported quota limit is up to 2147483647 sectors. When quotas are turned on by the `quotaon` command, this message displays when a user exceeds the supported quota limit.

**Recommended action:**

Ask the user to delete files to lower the quota below the limit.

## V-2-90

WARNING: msgcnt x: msg 090: V-2-90: quota on *file\_system* failed; soft limits greater than hard limits

**Description:**

One or more users or groups has a soft limit set greater than the hard limit, preventing the BSD quota from being turned on.

**Recommended action:**

Check the soft limit and hard limit for every user and group and confirm that the soft limit is not set greater than the hard limit.

## V-2-91

WARNING: msgcnt x: mesg 091: V-2-91: vx\_fcl\_truncate - failure to punch hole at offset *offset* for bytes bytes in File Change Log file; error *error\_number*

### Description:

The vxfs kernel has experienced an error while trying to manage the space consumed by the File Change Log file. Because the space cannot be actively managed at this time, the FCL has been deactivated and has been truncated to 1 file system block, which contains the FCL superblock.

### Recommended action:

Re-activate the FCL.

## V-2-92

WARNING: msgcnt x: mesg 092: V-2-92: vx\_mkfcltran - failure to map offset *offset* in File Change Log file

### Description:

The vxfs kernel was unable to map actual storage to the next offset in the File Change Log file. This is mostly likely caused by a problem with allocating to the FCL file. Because no new FCL records can be written to the FCL file, the FCL has been deactivated.

### Recommended action:

Re-activate the FCL.

## V-2-95

WARNING: msgcnt x: mesg 095: V-2-95: Failed to set `vxfs_ifree_timelag` since the specified value is less than the recommended minimum value of *time*.

### Description:

The value for `vxfs_ifree_timelag` specified by the system administrator is less than the recommended minimum value, *time*. No new change is made to this tunable value.

### Recommended action:

Informational only; no action required.

## V-2-96

WARNING: msgcnt x: mesg 096: V-2-96: *file\_system* file system fullfsck flag set - *function\_name*.

**Description:**

The next time the file system is mounted, a full `fsck` must be performed.

**Recommended action:**

No immediate action required. When the file system is unmounted, run a full file system check using `fsck` before mounting it again.

## V-2-97

WARNING: msgcnt x: mesg 097: V-2-97: VxFS failed to create new thread (*error\_number*, *function\_address:argument\_address*)

**Description:**

VxFS failed to create a kernel thread due to resource constraints, which is often a memory shortage.

**Recommended action:**

VxFS will retry the thread creation until it succeeds; no immediate action is required. Kernel resources, such as kernel memory, might be overcommitted. If so, reconfigure the system accordingly.

## V-2-98

WARNING: msgcnt x: mesg 098: V-2-98: VxFS failed to initialize File Change Log for fileset *filesset* (index number) of *mount\_point* file system

**Description:**

VxFS mount failed to initialize FCL structures for the current fileset mount. As a result, FCL could not be turned on. The FCL file will have no logging records.

**Recommended action:**

Reactivate the FCL.

## V-2-99

WARNING: msgcnt x: mesg 099: V-2-99: The specified value for *vx\_ninode* is less than the recommended minimum value of *min\_value*

**Description:**

Auto-tuning or the value specified by the system administrator resulted in a value lower than the recommended minimum for the total number of inodes that can be present in the inode cache. VxFS will ignore the newly tuned value and will keep the value specified in the message (`VX_MINNINODE`).

**Recommended action:**

Informational only; no action required.

## V-2-100

WARNING: msgcnt x: msg 100: V-2-100: Inode *inumber* can not be accessed: file size exceeds OS limitations.

**Description:**

The specified inode's size is larger than the file size limit of the current operating system. The file cannot be opened on the current platform. This can happen when a file is created on one OS and the filesystem is then moved to a machine running an OS with a smaller file size limit.

**Recommended action:**

If the file system is moved to the platform on which the file was created, the file can be accessed from there. It can then be converted to multiple smaller files in a manner appropriate to the application and the file's format, or simply be deleted if it is no longer required.

## V-2-101

WARNING: msgcnt x: msg 101: V-2-101: File Change Log on *mount\_point* for file set *index* approaching max file size supported. File Change Log will be reactivated when its size hits max file size supported.

**Description:**

The size of the FCL file is approaching the maximum file size supported. This size is platform specific. When the FCL file is reaches the maximum file size, the FCL will be deactivated and reactivated. All logging information gathered so far will be lost.

**Recommended action:**

Take any corrective action possible to restrict the loss due to the FCL being deactivated and reactivated.



## V-2-102

WARNING: msgcnt x: mesg 102: V-2-102: File Change Log of *mount\_point* for file set *index* has been reactivated.

**Description:**

The size of FCL file reached the maximum supported file size and the FCL has been reactivated. All records stored in the FCL file, starting from the current *fc\_loff* up to the maximum file size, have been purged. New records will be recorded in the FCL file starting from offset *fs\_bsize*. The activation time in the FCL is reset to the time of reactivation. The impact is equivalent to File Change Log being deactivated and activated.

**Recommended action:**

Informational only; no action required.

## V-2-103

WARNING: msgcnt x: mesg 103: V-2-103: File Change Log merge on *mount\_point* for file set *index* failed.

**Description:**

The VxFS kernel has experienced an error while merging internal per-node File Change Log files into the external File Change Log file. Since the File Change Log cannot be maintained correctly without this, the File Change Log has been deactivated.

**Recommended action:**

Re-activate the File Change Log.

## V-2-104

WARNING: msgcnt x: mesg 104: V-2-104: File System *mount\_point* device *volume\_name* disabled

**Description:**

The volume manager detected that the specified volume has failed, and the volume manager has disabled the volume. No further I/O requests are sent to the disabled volume.

**Recommended action:**

The volume must be repaired.

## V-2-105

WARNING: msgcnt x: mesg 105: V-2-105: File System *mount\_point* device *volume\_name* re-enabled

**Description:**

The volume manager detected that a previously disabled volume is now operational, and the volume manager has re-enabled the volume.

**Recommended action:**

Informational only; no action required.

## V-2-106

WARNING: msgcnt x: mesg 106: V-2-106: File System *mount\_point* device *volume\_name* has BAD label

**Description:**

A file system's label does not match the label that the multi-volume support feature expects the file system to have. The file system's volume is effectively disabled.

**Recommended action:**

If the label is bad because the volume does not match the assigned label, use the `vxvset` command to fix the label. Otherwise, the label might have been overwritten and the volume's contents may be lost. Call technical support so that the issue can be investigated.

## V-2-107

WARNING: msgcnt x: mesg 107: V-2-107: File System *mount\_point* device *volume\_name* valid label found

**Description:**

The label of a file system that had a bad label was somehow restored. The underlying volume is functional.

**Recommended action:**

Informational only; no action required.

## V-2-108

WARNING: msgcnt x: mesg 108: V-2-108: vx\_dexh\_error - error: fileset *filesset*, directory inode number *dir\_inumber*, bad hash inode *hash\_inode*, seg *segment* bno *block\_number*

**Description:**

The supplemental hash for a directory is corrupt.

**Recommended action:**

If the file system is mounted read/write, the hash for the directory will be automatically removed and recreated. If the removal or recreation fails, subsequent messages indicate the type of problem. If there are no further messages, the removal and recreation of the hash succeeded.

## V-2-109

WARNING: msgcnt x: mesg 109: V-2-109: failed to tune down *tunable\_name* to *tunable\_value* possibly due to *tunable\_object* in use, could free up only up to *suggested\_tunable\_value*

**Description:**

When the value of a tunable, such as *ninode* or *bufhwm*, is modified using the *ktune* command, sometimes the tunable cannot be tuned down to the specified value because of the current system usage. The minimum value to which the tunable can be tuned is also provided as part of the warning message.

**Recommended action:**

Tune down the tunable to the minimum possible value indicated by the warning message.

See [“Tuning the VxFS file system”](#) on page 46.

## V-2-110

WARNING: msgcnt x: mesg 110: V-2-110: The specified value for *vx\_bc\_bufhwm* is less than the recommended minimum value of *recommended\_minimum\_value*.

**Description:**

Setting the *vx\_bc\_bufhwm* tunable to restrict the memory used by the VxFS buffer cache to a value that is too low has a degrading effect on the system performance on a wide range of applications. Symantec does not recommend setting *vx\_bc\_bufhwm* to a value less than the recommended minimum value, which is provided as part of the warning message.

**Recommended action:**

Tune the *vx\_bc\_bufhwm* tunable to a value greater than the recommended minimum indicated by the warning message.

## V-2-111

WARNING: msgcnt x: mesg 111: V-2-111: You have exceeded the authorized usage (maximum *maxfs* unique mounted user-data file systems) for this product and are out of compliance with your License Agreement. Please email **sales\_mail@symantec.com** or contact your Symantec sales representative for information on how to obtain additional licenses for this product.

**Description:**

As per your Storage Foundation Basic license agreement, you are allowed to have only a limited number of VxFS file systems, and you have exceeded this number.

**Recommended action:**

Email **sales\_mail@symantec.com** or contact your Symantec sales representative for information on how to obtain additional licenses for this product.

## V-2-112

WARNING: msgcnt x: mesg 112: V-2-112: The new value requires changes to the inode table, which can be made only after a reboot.

**Description:**

When the value of `vx_ninode` is modified to tune down the number of inodes, the tunable cannot be tuned down in cases that require changes to the VxFS inode tables. The change to the tunable is marked to take effect after the next boot, during which time the change can be committed after editing the inode tables. Tuning down `vx_ninode` without changes to the VxFS inode table may cause applications to fail with the **ENFILE** error.

**Recommended action:**

Reboot the system so that the new tunable value can be committed after you make changes to the VxFS inode tables.

## Dewey UMI messages

This section contains all the UMI error code sources in Dewey format.

## V-3-20002

UX:vxfs *command*: ERROR: V-3-20002: *message*

**Description:**

The command attempted to call `stat()` on a device path to ensure that the path refers to a character device before opening the device, but the `stat()` call failed. The error message will include the platform-specific message for the particular error that was encountered, such as "Access denied" or "No such file or directory".

**Recommended action:**

The corrective action depends on the particular error.

## V-3-20003

UX:vxfs *command*: ERROR: V-3-20003: *message*

**Description:**

The command attempted to open a disk device, but the `open()` call failed. The error message includes the platform-specific message for the particular error that was encountered, such as "Access denied" or "No such file or directory".

**Recommended action:**

The corrective action depends on the particular error.

## V-3-20005

UX:vxfs *command*: ERROR: V-3-20005: *message*

**Description:**

The command attempted to read the superblock from a device, but the `read()` call failed. The error message will include the platform-specific message for the particular error that was encountered, such as "Access denied" or "No such file or directory".

**Recommended action:**

The corrective action depends on the particular error.

## V-3-20012

UX:vxfs *command*: ERROR: V-3-20012: *message*

**Description:**

The command was invoked on a device that did not contain a valid VxFS file system.

**Recommended action:**

Check that the path specified is what was intended.

## V-3-20076

UX:vxfs *command*: ERROR: V-3-20076: *message*

**Description:**

The command called `stat()` on a file, which is usually a file system mount point, but the call failed.

**Recommended action:**

Check that the path specified is what was intended and that the user has permission to access that path.

## V-3-21256

UX:vxfs *command*: ERROR: V-3-21256: *message*

**Description:**

The attempt to mount the file system failed because either the request was to mount a particular Storage Checkpoint that does not exist, or the file system is managed by an HSM and the HSM is not running.

**Recommended action:**

In the first case, use the `fsckptadm list` command to see which Storage Checkpoints exist and mount the appropriate Storage Checkpoint. In the second case, make sure the HSM is running. If the HSM is not running, start and mount the file system again.

## V-3-21264

UX:vxfs *command*: ERROR: V-3-21264: *message*

**Description:**

The attempt to mount a VxFS file system has failed because either the volume being mounted or the directory which is to be the mount point is busy.

The reason that a VxVM volume could be busy is if the volume is in a shared disk group and the volume is currently being accessed by a VxFS command, such as `fsck`, on a node in the cluster.

One reason that the mount point could be busy is if a process has the directory open or has the directory as its current directory.

Another reason that the mount point could be busy is if the directory is NFS-exported.

**Recommended action:**

For a busy mount point, if a process has the directory open or has the directory as its current directory, use the `fuser` command to locate the processes and either get them to release their references to the directory or kill the processes. Afterward, attempt to mount the file system again.

## V-3-21268

UX:vxfs *command*: ERROR: V-3-21268: *message*

### Description:

This message is printed by two different commands: `fsckpt_restore` and `mount`. In both cases, the kernel's attempt to mount the file system failed because of I/O errors or corruption of the VxFS metadata.

### Recommended action:

Check the console log for I/O errors and fix any problems reported there. Run a full `fsck`.

## V-3-21272

UX:vxfs *command*: ERROR: V-3-21272: *message*

### Description:

The mount options specified contain mutually-exclusive options, or in the case of a remount, the new mount options differed from the existing mount options in a way that is not allowed to change in a remount.

### Recommended action:

Change the requested mount options so that they are all mutually compatible and retry the mount.

## V-3-23729

UX:vxfs *command*: ERROR: V-3-23729: *message*

### Description:

Cluster mounts require the `vxfsckd` daemon to be running, which is controlled by Veritas Cluster Server (VCS).

### Recommended action:

Check the VCS status to see why this service is not running. After starting the daemon via VCS, try the mount again.

## V-3-24996

UX:vxfs *command*: ERROR: V-3-24996: *message*

**Description:**

In some releases of VxFS, before the VxFS `mount` command attempts to mount a file system, `mount` tries to read the VxFS superblock to determine the disk layout version of the file system being mounted so that `mount` can check if that disk layout version is supported by the installed release of VxFS. If the attempt to read the superblock fails for any reason, this message is displayed. This message will usually be preceded by another error message that gives more information as to why the superblock could not be read.

**Recommended action:**

The corrective action depends on the preceding error, if any.



# Disk layout

This appendix includes the following topics:

- [About disk layouts](#)
- [Supported disk layouts and operating systems](#)
- [VxFS Version 4 disk layout](#)
- [VxFS Version 5 disk layout](#)
- [VxFS Version 6 disk layout](#)
- [VxFS Version 7 disk layout](#)
- [VxFS Version 8 disk layout](#)

## About disk layouts

The disk layout is the way file system information is stored on disk. On VxFS, several different disk layout versions were created to take advantage of evolving technological developments.

The disk layout versions used on VxFS are:

Version 1	Version 1 disk layout is the original VxFS disk layout provided with pre-2.0 versions of VxFS.	Not Supported
Version 2	Version 2 disk layout supports features such as filesets, dynamic inode allocation, and enhanced security. The Version 2 layout is available with and without quotas support.	Not Supported

Version 3	Version 3 disk layout encompasses all file system structural information in files, rather than at fixed locations on disk, allowing for greater scalability. Version 3 supports files and file systems up to one terabyte in size.	Not Supported
Version 4	<p>Version 4 disk layout encompasses all file system structural information in files, rather than at fixed locations on disk, allowing for greater scalability. Version 4 supports files and file systems up to two terabytes in size.</p> <p>A disk layout Version 4 file system can still be mounted, but this will be disallowed in future releases. Symantec recommends that you upgrade from Version 4 to the latest default disk layout version. You cannot create new file systems with disk layout Version 4. The only operation that you can perform on a file system with disk layout Version 4 is to upgrade the disk layout to a supported version. If you upgrade a file system from disk layout Version 4 to a later version, once the upgrade operation finishes, you must unmount the file system cleanly, then re-mount the file system.</p>	Deprecated
Version 5	<p>Version 5 enables the creation of file system sizes up to 32 terabytes. File sizes can be a maximum of 4 billion file system blocks. File systems larger than 2 TB must be created on a Veritas Volume Manager volume. Version 5 also enables setting up to 1024 access control list (ACL) entries.</p> <p>A disk layout Version 5 file system can still be mounted, but this will be disallowed in future releases. Symantec recommends that you upgrade from Version 5 to the latest default disk layout version. You cannot create new file systems with disk layout Version 5. The only operation that you can perform on a file system with disk layout Version 5 is to upgrade the disk layout to a supported version. If you upgrade a file system from disk layout Version 5 to a later version, once the upgrade operation finishes, you must unmount the file system cleanly, then re-mount the file system.</p>	Deprecated
Version 6	Version 6 disk layout enables features such as multi-volume support, cross-platform data sharing, named data streams, and File Change Log.	Supported
Version 7	Version 7 disk layout enables support for variable and large size history log records, more than 2048 volumes, large directory hash, and SmartTier.	Supported

Version 8      Version 8 disk layout enables support for file-level snapshots.      Supported

Some of the disk layout versions were not supported on all UNIX operating systems. Currently, the Version 4 and later disk layouts can be created, and the Version 5 and later disk layouts can be mounted. Version 7 is the default disk layout version.

The `vxupgrade` command is provided to upgrade an existing VxFS file system to the Version 5 and later disk layout while the file system remains online. You must upgrade in steps from older to newer layouts.

See the `vxupgrade(1M)` manual page.

The `vxfsconvert` command is provided to upgrade Version 2 and 3 disk layouts to the Version 7 disk layout while the file system is not mounted.

See the `vxfsconvert(1M)` manual page.

## Supported disk layouts and operating systems

Table C-1 shows which disk layouts supported on the which operating systems.

**Table C-1** File system type and operating system versions

Disk Layout		JFS 3.3, HP-UX 11i v1	VxFS 3.5, HP-UX 11i v1	VxFS 3.5.2, HP-UX 11i v2 PI	VxFS 4.1, HP-UX 11i v2 PI	VxFS 5.0, HP-UX 11i v2 PI	VxFS 5.0, HP-UX 11i v3	VxFS 5.0.1 and 5.1 SP1, HP-UX 11i v3
Version 1	mkfs	No	No	No	No	No	No	No
	Local Mount	No	No	No	No	No	No	No
	Shared Mount	No	No	No	No	No	No	No
Version 2	mkfs	Yes	No	No	No	No	No	No
	Local Mount	Yes	Yes	Yes	Yes	No	No	No
	Shared Mount	No	No	No	No	No	No	No

**Table C-1** File system type and operating system versions (*continued*)

Disk Layout		JFS 3.3, HP-UX 11i v1	VxFS 3.5, HP-UX 11i v1	VxFS 3.5.2, HP-UX 11i v2 PI	VxFS 4.1, HP-UX 11i v2 PI	VxFS 5.0, HP-UX 11i v2 PI	VxFS 5.0, HP-UX 11i v3	VxFS 5.0.1 and 5.1 SP1, HP-UX 11i v3
Version 3	mkfs	Yes	No	No	No	No	No	No
	Local Mount	Yes	Yes	Yes	Yes	No	No	No
	Shared Mount	No	No	No	No	No	No	No
Version 4	mkfs	No	No	No	No	No	No	No
	Local Mount	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Shared Mount	No	Yes	No	Yes	No	No	No
Version 5	mkfs	No	No	Yes	Yes	Yes	Yes	Yes
	Local Mount	No	No	Yes	Yes	Yes	Yes	Yes
	Shared Mount	No	No	No	Yes	No	No	No
Version 6	mkfs	No	No	No	Yes	Yes	Yes	Yes
	Local Mount	No	No	No	Yes	Yes	Yes	Yes
	Shared Mount	No	No	No	Yes	Yes	Yes	Yes
Version 7	mkfs	No	No	No	Yes	Yes	Yes	Yes
	Local Mount	No	No	No	Yes	Yes	Yes	Yes
	Shared Mount	No	No	No	Yes	Yes	Yes	Yes

**Table C-1** File system type and operating system versions (*continued*)

Disk Layout		JFS 3.3, HP-UX 11i v1	VxFS 3.5, HP-UX 11i v1	VxFS 3.5.2, HP-UX 11i v2 PI	VxFS 4.1, HP-UX 11i v2 PI	VxFS 5.0, HP-UX 11i v2 PI	VxFS 5.0, HP-UX 11i v3	VxFS 5.0.1 and 5.1 SP1, HP-UX 11i v3
Version 8	mkfs	No	No	No	Yes	Yes	Yes	Yes
	Local Mount	No	No	No	Yes	Yes	Yes	Yes
	Shared Mount	No	No	No	Yes	Yes	Yes	Yes

## VxFS Version 4 disk layout

The Version 4 disk layout allows the file system to scale easily to accommodate large files and large file systems.

The original disk layouts divided up the file system space into allocation units (AUs). The first AU started part way into the file system which caused potential alignment problems depending on where the first AU started. Each allocation unit also had its own summary, bitmaps, and data blocks. Because this AU structural information was stored at the start of each AU, this also limited the maximum size of an extent that could be allocated. By replacing the allocation unit model of previous versions, the need for alignment of allocation units and the restriction on extent sizes was removed.

The VxFS Version 4 disk layout divides the entire file system space into fixed size allocation units. The first allocation unit starts at block zero and all allocation units are a fixed length of 32K blocks. An exception may be the last AU, which occupies whatever space remains at the end of the file system. Because the first AU starts at block zero instead of part way through the file system as in previous versions, there is no longer a need for explicit AU alignment or padding to be added when creating a file system.

The Version 4 file system also moves away from the model of storing AU structural data at the start of an AU and puts all structural information in files. So expanding the file system structures simply requires extending the appropriate structural files. This removes the extent size restriction imposed by the previous layouts.

All Version 4 structural files reside in the structural fileset.

The structural files in the Version 4 disk layout are:

File	Description
object location table file	Contains the object location table (OLT). The OLT, which is referenced from the super-block, is used to locate the other structural files.
label file	Encapsulates the super-block and super-block replicas. Although the location of the primary super-block is known, the label file can be used to locate super-block copies if there is structural damage to the file system.
device file	Records device information such as volume length and volume label, and contains pointers to other structural files.
fileset header file	Holds information on a per-fileset basis. This may include the inode of the fileset's inode list file, the maximum number of inodes allowed, an indication of whether the file system supports large files, and the inode number of the quotas file if the fileset supports quotas. When a file system is created, there are two filesets—the structural fileset defines the file system structure, the primary fileset contains user data.
inode list file	Both the primary fileset and the structural fileset have their own set of inodes stored in an inode list file. Only the inodes in the primary fileset are visible to users. When the number of inodes is increased, the kernel increases the size of the inode list file.
inode allocation unit file	Holds the free inode map, extended operations map, and a summary of inode resources.
log file	Maps the block used by the file system intent log.
extent allocation unit state file	Indicates the allocation state of each AU by defining whether each AU is free, allocated as a whole (no bitmaps allocated), or expanded, in which case the bitmaps associated with each AU determine which extents are allocated.
extent allocation unit summary file	Contains the AU summary for each allocation unit, which contains the number of free extents of each size. The summary for an extent is created only when an allocation unit is expanded for use.
free extent map file	Contains the free extent maps for each of the allocation units.
quotas files	Contains quota information in records. Each record contains resources allocated either per user.

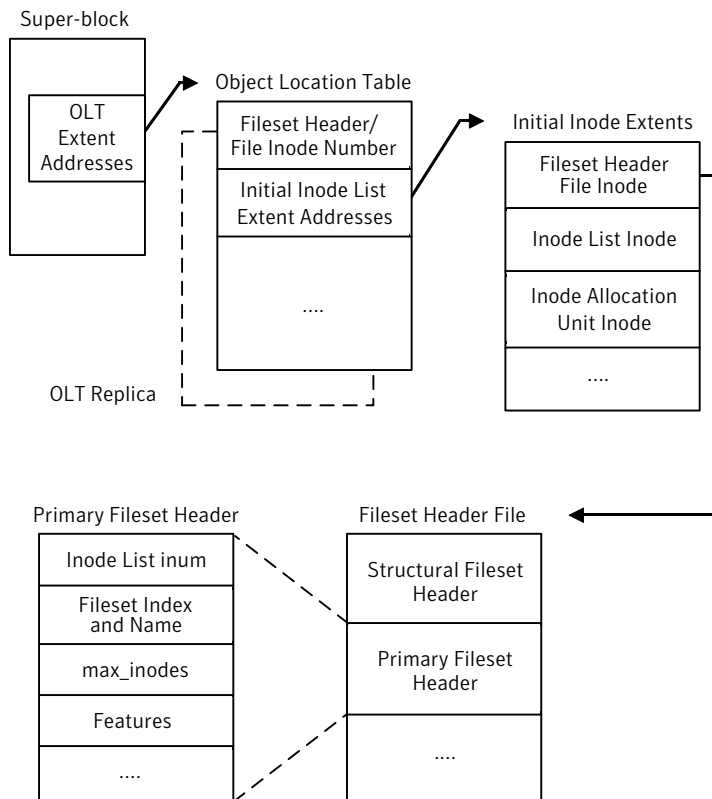
The Version 4 disk layout supports Access Control Lists and Block-Level Incremental (BLI) Backup. BLI Backup is a backup method that stores and retrieves only the data blocks changed since the previous backup, not entire files. This saves times, storage space, and computing resources required to backup large databases.

Figure C-1 shows how the kernel and utilities build information about the structure of the file system.

The super-block location is in a known location from which the OLT can be located. From the OLT, the initial extents of the structural inode list can be located along with the inode number of the fileset header file. The initial inode list extents contain the inode for the fileset header file from which the extents associated with the fileset header file are obtained.

As an example, when mounting the file system, the kernel needs to access the primary fileset in order to access its inode list, inode allocation unit, quotas file and so on. The required information is obtained by accessing the fileset header file from which the kernel can locate the appropriate entry in the file and access the required information.

**Figure C-1** VxFS Version 4 disk layout



## VxFS Version 5 disk layout

VxFS disk layout Version 5 is similar to Version 4. Structural files in Version 5 are the same in Version 4. However, the Version 5 disk layout supports file systems up to 32 terabytes. For a file system to take advantage of VxFS 32-terabyte support, it must be created on a Veritas Volume Manager volume, and only on a 64-bit kernel operating system. File sizes can be a maximum of 4 billion file system blocks. For 64-bit kernels, the maximum size of the file system you can create depends on the block size:

Block Size	Maximum File System Size
1024 bytes	4,294,967,039 sectors (≈4 TB)
2048 bytes	8,589,934,078 sectors (≈8 TB)
4096 bytes	17,179,868,156 sectors (≈16 TB)
8192 bytes	34,359,736,312 sectors (≈32 TB)

If you specify the file system size when creating a file system, the block size defaults to the appropriate value as shown above.

See the `mkfs(1M)` manual page.

See [“About quota files on Veritas File System”](#) on page 79.

The Version 5 disk layout also supports up to 1024 access control list entries.

## VxFS Version 6 disk layout

VxFS disk layout Version 6 is similar to Version 5, except that Version 6 enables features such as multi-volume support, cross-platform data sharing, named data streams, and File Change Log. Structural files in Version 6 are the same in Version 5. The Version 6 disk layout can theoretically support files and file systems up to 8 exabytes ( $2^{63}$ ). For a file system to take advantage of VxFS 8-exabyte support, it must be created on a Veritas Volume Manager volume. For 64-bit kernels, the maximum size of the file system you can create depends on the block size:

Block Size	Currently-Supported Theoretical Maximum File System Size
1024 bytes	68,719,472,624 sectors (≈32 TB)
2048 bytes	137,438,945,248 sectors (≈64 TB)
4096 bytes	274,877,890,496 sectors (≈128 TB)



Block Size	Currently-Supported Theoretical Maximum File System Size
8192 bytes	549,755,780,992 sectors (≈256 TB)

---

**Note:** Sector size in bytes specified by the `DEV_BSIZE` system parameter.

---

If you specify the file system size when creating a file system, the block size defaults to the appropriate value as shown above.

See the `mkfs(1M)` manual page.

See [“About quota files on Veritas File System”](#) on page 79.

## VxFS Version 7 disk layout

VxFS disk layout Version 7 is similar to Version 6, except that Version 7 enables support for variable and large size history log records, more than 2048 volumes, large directory hash, and SmartTier. The Version 7 disk layout can theoretically support files and file systems up to 8 exabytes ( $2^{63}$ ). For a file system to take advantage of VxFS 8-exabyte support, it must be created on a Veritas Volume Manager volume. For 64-bit kernels, the maximum size of the file system you can create depends on the block size:

Block Size	Currently-Supported Theoretical Maximum File System Size
1024 bytes	68,719,472,624 sectors (≈32 TB)
2048 bytes	137,438,945,248 sectors (≈64 TB)
4096 bytes	274,877,890,496 sectors (≈128 TB)
8192 bytes	549,755,780,992 sectors (≈256 TB)

---

**Note:** Sector size in bytes specified by the `DEV_BSIZE` system parameter.

---

If you specify the file system size when creating a file system, the block size defaults to the appropriate value as shown above.

See the `mkfs(1M)` manual page.

See [“About quota files on Veritas File System”](#) on page 79.

# VxFS Version 8 disk layout

VxFS disk layout Version 8 is similar to Version 7, except that Version 8 enables support for file-level snapshots. The Version 8 disk layout can theoretically support files and file systems up to 8 exabytes ( $2^{63}$ ). For a file system to take advantage of VxFS 8-exabyte support, it must be created on a Veritas Volume Manager volume. For 64-bit kernels, the maximum size of the file system you can create depends on the block size:

Block Size	Currently-Supported Theoretical Maximum File System Size
1024 bytes	68,719,472,624 sectors ( $\approx$ 32 TB)
2048 bytes	137,438,945,248 sectors ( $\approx$ 64 TB)
4096 bytes	274,877,890,496 sectors ( $\approx$ 128 TB)
8192 bytes	549,755,780,992 sectors ( $\approx$ 256 TB)

---

**Note:** Sector size in bytes specified by the `DEV_BSIZE` system parameter.

---

If you specify the file system size when creating a file system, the block size defaults to the appropriate value as shown above.

See the `mkfs(1M)` manual page.

See [“About quota files on Veritas File System”](#) on page 79.

# Glossary

<b>access control list (ACL)</b>	The information that identifies specific users or groups and their access privileges for a particular file or directory.
<b>agent</b>	A process that manages predefined Veritas Cluster Server (VCS) resource types. Agents bring resources online, take resources offline, and monitor resources to report any state changes to VCS. When an agent is started, it obtains configuration information from VCS and periodically monitors the resources and updates VCS with the resource status.
<b>allocation unit</b>	A group of consecutive blocks on a file system that contain resource summaries, free resource maps, and data blocks. Allocation units also contain copies of the super-block.
<b>API</b>	Application Programming Interface.
<b>asynchronous writes</b>	A delayed write in which the data is written to a page in the system's page cache, but is not written to disk before the write returns to the caller. This improves performance, but carries the risk of data loss if the system crashes before the data is flushed to disk.
<b>atomic operation</b>	An operation that either succeeds completely or fails and leaves everything as it was before the operation was started. If the operation succeeds, all aspects of the operation take effect at once and the intermediate states of change are invisible. If any aspect of the operation fails, then the operation aborts without leaving partial changes.
<b>Block-Level Incremental Backup (BLI Backup)</b>	A Symantec backup capability that does not store and retrieve entire files. Instead, only the data blocks that have changed since the previous backup are backed up.
<b>buffered I/O</b>	During a read or write operation, data usually goes through an intermediate kernel buffer before being copied between the user buffer and disk. If the same data is repeatedly read or written, this kernel buffer acts as a cache, which can improve performance. See unbuffered I/O and direct I/O.
<b>contiguous file</b>	A file in which data blocks are physically adjacent on the underlying media.
<b>data block</b>	A block that contains the actual data belonging to files and directories.
<b>data synchronous writes</b>	A form of synchronous I/O that writes the file data to disk before the write returns, but only marks the inode for later update. If the file size changes, the inode will be written before the write returns. In this mode, the file data is guaranteed to be on

	the disk before the write returns, but the inode modification times may be lost if the system crashes.
<b>defragmentation</b>	The process of reorganizing data on disk by making file data blocks physically adjacent to reduce access times.
<b>direct extent</b>	An extent that is referenced directly by an inode.
<b>direct I/O</b>	An unbuffered form of I/O that bypasses the kernel's buffering of data. With direct I/O, the file system transfers data directly between the disk and the user-supplied buffer. See buffered I/O and unbuffered I/O.
<b>discovered direct I/O</b>	Discovered Direct I/O behavior is similar to direct I/O and has the same alignment constraints, except writes that allocate storage or extend the file size do not require writing the inode changes before returning to the application.
<b>encapsulation</b>	A process that converts existing partitions on a specified disk to volumes. If any partitions contain file systems, <code>/etc/filesystems</code> entries are modified so that the file systems are mounted on volumes instead. Encapsulation is not applicable on some systems.
<b>extent</b>	A group of contiguous file system data blocks treated as a single unit. An extent is defined by the address of the starting block and a length.
<b>extent attribute</b>	A policy that determines how a file allocates extents.
<b>external quotas file</b>	A quotas file (named <code>quotas</code> ) must exist in the root directory of a file system for quota-related commands to work. See <code>quotas</code> file and <code>internal quotas</code> file.
<b>file system block</b>	The fundamental minimum size of allocation in a file system. This is equivalent to the fragment size on some UNIX file systems.
<b>fileset</b>	A collection of files within a file system.
<b>fixed extent size</b>	An extent attribute used to override the default allocation policy of the file system and set all allocations for a file to a specific fixed size.
<b>fragmentation</b>	The on-going process on an active file system in which the file system is spread further and further along the disk, leaving unused gaps or fragments between areas that are in use. This leads to degraded performance because the file system has fewer options when assigning a file to an extent.
<b>GB</b>	Gigabyte ( $2^{30}$ bytes or 1024 megabytes).
<b>hard limit</b>	The hard limit is an absolute limit on system resources for individual users for file and data block usage on a file system. See <code>quota</code> .
<b>indirect address extent</b>	An extent that contains references to other extents, as opposed to file data itself. A single indirect address extent references indirect data extents. A double indirect address extent references single indirect address extents.
<b>indirect data extent</b>	An extent that contains file data and is referenced via an indirect address extent.

<b>inode</b>	A unique identifier for each file within a file system that contains the data and metadata associated with that file.
<b>inode allocation unit</b>	A group of consecutive blocks containing inode allocation information for a given fileset. This information is in the form of a resource summary and a free inode map.
<b>intent logging</b>	A method of recording pending changes to the file system structure. These changes are recorded in a circular intent log file.
<b>internal quotas file</b>	VxFS maintains an internal quotas file for its internal usage. The internal quotas file maintains counts of blocks and indices used by each user. See quotas and external quotas file.
<b>K</b>	Kilobyte ( $2^{10}$ bytes or 1024 bytes).
<b>large file</b>	A file larger than two terabytes. VxFS supports files up to 8 exabytes in size.
<b>large file system</b>	A file system larger than one terabytes. VxFS supports file systems up to 8 exabytes in size.
<b>latency</b>	For file systems, this typically refers to the amount of time it takes a given file system operation to return to the user.
<b>metadata</b>	Structural data describing the attributes of files on a disk.
<b>MB</b>	Megabyte ( $2^{20}$ bytes or 1024 kilobytes).
<b>mirror</b>	A duplicate copy of a volume and the data therein (in the form of an ordered collection of subdisks). Each mirror is one copy of the volume with which the mirror is associated.
<b>multi-volume file system</b>	A single file system that has been created over multiple volumes, with each volume having its own properties.
<b>MVS</b>	Multi-volume support.
<b>object location table (OLT)</b>	The information needed to locate important file system structural elements. The OLT is written to a fixed location on the underlying media (or disk).
<b>object location table replica</b>	A copy of the OLT in case of data corruption. The OLT replica is written to a fixed location on the underlying media (or disk).
<b>page file</b>	A fixed-size block of virtual address space that can be mapped onto any of the physical addresses available on a system.
<b>preallocation</b>	A method of allowing an application to guarantee that a specified amount of space is available for a file, even if the file system is otherwise out of space.
<b>primary fileset</b>	The files that are visible and accessible to the user.
<b>quotas</b>	Quota limits on system resources for individual users for file and data block usage on a file system. See hard limit and soft limit.

<b>quotas file</b>	The quotas commands read and write the external quotas file to get or change usage limits. When quotas are turned on, the quota limits are copied from the external quotas file to the internal quotas file. See quotas, internal quotas file, and external quotas file.
<b>reservation</b>	An extent attribute used to preallocate space for a file.
<b>root disk group</b>	A special private disk group that always exists on the system. The root disk group is named rootdg.
<b>shared disk group</b>	A disk group in which the disks are shared by multiple hosts (also referred to as a cluster-shareable disk group).
<b>shared volume</b>	A volume that belongs to a shared disk group and is open on more than one node at the same time.
<b>snapshot file system</b>	An exact copy of a mounted file system at a specific point in time. Used to do online backups.
<b>snapped file system</b>	A file system whose exact image has been used to create a snapshot file system.
<b>soft limit</b>	The soft limit is lower than a hard limit. The soft limit can be exceeded for a limited time. There are separate time limits for files and blocks. See hard limit and quotas.
<b>Storage Checkpoint</b>	A facility that provides a consistent and stable view of a file system or database image and keeps track of modified data blocks since the last Storage Checkpoint.
<b>structural files</b>	The files that define the structure of the file system. These files are not visible or accessible to the user.
<b>super-block</b>	A block containing critical information about the file system such as the file system type, layout, and size. The VxFS super-block is always located 8192 bytes from the beginning of the file system and is 8192 bytes long.
<b>synchronous writes</b>	A form of synchronous I/O that writes the file data to disk, updates the inode times, and writes the updated inode to disk. When the write returns to the caller, both the data and the inode have been written to disk.
<b>TB</b>	Terabyte ( $2^{40}$ bytes or 1024 gigabytes).
<b>transaction</b>	Updates to the file system structure that are grouped together to ensure they are all completed.
<b>throughput</b>	For file systems, this typically refers to the number of I/O operations in a given unit of time.
<b>unbuffered I/O</b>	I/O that bypasses the kernel cache to increase I/O performance. This is similar to direct I/O, except when a file is extended; for direct I/O, the inode is written to disk synchronously, for unbuffered I/O, the inode update is delayed. See buffered I/O and direct I/O.

<b>volume</b>	A virtual disk which represents an addressable range of disk blocks used by applications such as file systems or databases.
<b>volume set</b>	A container for multiple different volumes. Each volume can have its own geometry.
<b>vxfs</b>	The Veritas File System type. Used as a parameter in some commands.
<b>VxFS</b>	Veritas File System.
<b>VxVM</b>	Veritas Volume Manager.

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