



# Sun StorEdge™ QFS and Sun StorEdge™ SAM-FS File System Administration Guide

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Adobe PostScript

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# Preface

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This manual, the *Sun StorEdge™ QFS and Sun StorEdge SAM-FS File System Administration Guide*, describes the file system software included in the Sun StorEdge QFS and Sun StorEdge SAM-FS 4.2 releases. The software products and the file systems they include are as follows:

- Sun StorEdge SAM-FS file system. The Sun StorEdge SAM-FS environment includes a general-purpose file system along with the storage and archive manager, SAM. The Sun StorEdge SAM-FS environment's file system enables data to be archived to automated libraries at device-rated speeds. Data can also be archived to files in another file system through a process known as *disk archiving*. The file system in the Sun StorEdge SAM-FS environment is a complete file system. The user is presented with a standard file system interface and can read and write files as though they were all on primary disk storage.
- Sun StorEdge QFS file system. The Sun StorEdge QFS file system can be used as a standalone file system, or it can be used in conjunction with the storage and archive manager, SAM. When used in conjunction with SAM, it is known as *Sun SAM-QFS*. Sun StorEdge QFS shares most of the Sun StorEdge SAM-FS file system's features. The Sun StorEdge QFS file system, however, is designed for high performance and contains more features than are supported within the Sun StorEdge SAM-FS environment.

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**Note** – You can purchase licenses for both Sun StorEdge QFS and Sun StorEdge SAM-FS software with the intent to run the Sun StorEdge QFS file system with the storage and archive manager found in the Sun StorEdge SAM-FS software. Such a system is referred to as *Sun SAM-QFS*.

This manual does not call out the Sun SAM-QFS configuration unless it is necessary for clarity. In this manual, you can assume that references to Sun StorEdge SAM-FS also apply to Sun SAM-QFS configurations when talking about storage and archive management. Likewise, you can assume that references to Sun StorEdge QFS also apply to Sun SAM-QFS configurations when talking about file system design and capabilities.

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The Sun StorEdge QFS and Sun StorEdge SAM-FS file systems are technologically similar, but within this manual, differences are noted when necessary.

The Sun StorEdge QFS and Sun StorEdge SAM-FS 4.2 releases are supported on the following minimum Sun Solaris™ Operating System (OS) platform levels.

**TABLE P-1** Minimum Sun Solaris OS Platform Levels

Product	Minimum Platform Levels
Sun StorEdge QFS	Solaris 8 07/01
	Solaris 9 04/03
	Solaris 10
Sun StorEdge SAM-FS	Solaris 8 07/01
	Solaris 9 04/03
	Solaris 10
Sun StorEdge QFS in a Sun Cluster environment	Solaris 8 02/02
	Solaris 9 04/03

This manual is written for system administrators responsible for installing, configuring, and maintaining Sun StorEdge QFS and Sun StorEdge SAM-FS file systems. You, the system administrator, are assumed to be knowledgeable about Solaris OS procedures, including installation, configuration, creating accounts, performing system backups, and other basic Solaris OS system administration tasks.

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## How This Book Is Organized

This manual contains the following chapters:

- Chapter 1 provides overview information.
- Chapter 2 provides file system design information.
- Chapter 3 provides volume management information.
- Chapter 4 explains how to perform various tasks for the Sun StorEdge QFS and Sun StorEdge SAM-FS file systems. Tasks covered include initializing a file system, adding a server, adding disk cache, and other system administration activities.
- Chapter 5 explains how to use the shared Sun StorEdge QFS file system.
- Chapter 6 explains how to use the `samu(1M)` operator utility.
- Chapter 7 explains how to use file system quotas.
- Chapter 8 describes how Sun StorEdge QFS software works in a Sun Cluster environment.

- Chapter 9 explains miscellaneous advanced topics such as using multireader file system and performance features.

The glossary defines terms used in this and other Sun StorEdge QFS and Sun StorEdge SAM-FS documentation.

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## Using UNIX Commands

This document does not contain information on basic UNIX<sup>®</sup> commands and procedures such as shutting down the system, booting the system, and configuring devices. Refer to one or more of the following for this information:

- Software documentation that you received with your system
- Solaris OS documentation, which is at the following URL:

<http://docs.sun.com>

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## Shell Prompts

TABLE P-2 shows the shell prompts that this manual uses.

**TABLE P-2** Shell Prompts

Shell	Prompt
C shell	<i>machine-name%</i>
C shell superuser	<i>machine-name#</i>
Bourne shell and Korn shell	\$
Bourne shell and Korn shell superuser	#

# Typographic Conventions

TABLE P-3 lists the typographic conventions used in this manual.

**TABLE P-3** Typographic Conventions

Typeface or Symbol	Meaning	Examples
AaBbCc123	The names of commands, files, and directories; on-screen computer output.	Edit your <code>.login</code> file. Use <code>ls -a</code> to list all files. % You have mail.
<b>AaBbCc123</b>	What you type, when contrasted with on-screen computer output.	% <b>su</b> Password:
<i>AaBbCc123</i>	Book titles; new words or terms; words to be emphasized; and command line variables to be replaced with a real name or value.	Read Chapter 6 in the <i>User's Guide</i> . These are called <i>class</i> options. You <i>must</i> be root to do this. To delete a file, type <code>rm filename</code> .
[ ]	In syntax, brackets indicate that an argument is optional.	<code>scmadm [-d sec] [-r n[:n][,n]...] [-z]</code>
{ arg   arg }	In syntax, braces and pipes indicate that one of the arguments must be specified.	<code>sndradm -b { phost   shost }</code>
\	At the end of a command line, the backslash (\) indicates that the command continues on the next line.	<code>atm90 /dev/md/rdisk/d5 \ /dev/md/rdisk/d1 atm89</code>



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## Related Documentation

This manual is part of a set of documents that describes the operations of the Sun StorEdge QFS and Sun StorEdge SAM-FS software products. TABLE P-4 shows the complete release 4.3 documentation set for these products.

**TABLE P-4** Related Documentation

<b>Title</b>	<b>Part Number</b>
<i>Sun SAM-Remote Administration Guide</i>	816-2094-11
<i>Sun StorEdge QFS, Sun StorEdge SAM-FS, and Sun StorEdge SAM-QFS Disaster Recovery Guide</i>	817-4090-10
<i>Sun StorEdge QFS and Sun StorEdge SAM-FS File System Administration Guide</i>	819-1550-10
<i>Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide</i>	817-7722-10
<i>Sun StorEdge SAM-FS Storage and Archive Management Guide</i>	817-4093-10
<i>Sun StorEdge QFS Linux Client Guide</i>	819-1139-10
<i>Sun StorEdge QFS and Sun StorEdge SAM-FS 4.3 Release Notes</i>	817-7724-12

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## Accessing Sun Documentation Online

The Sun StorEdge QFS and Sun StorEdge SAM-FS software distribution includes PDF files for the documents for these products. These PDF files can be accessed at either of two locations by using one of the two methods below.

- Method 1: Access the documents at `docs.sun.com`.
  1. Go to the following URL:  
`docs.sun.com`  
The `docs.sun.com` page displays.
  2. Enter the appropriate product name from the following list in the search box:  
Sun StorEdge QFS  
Sun StorEdge SAM-FS  
Sun StorEdge SAM-QFS
- Method2: Access the documents at Sun's Network Storage documentation website.

1. Go to the following URL:

[www.sun.com/products-n-solutions/hardware/docs/Software/Storage\\_Software](http://www.sun.com/products-n-solutions/hardware/docs/Software/Storage_Software)

The Storage Software page displays.

2. Click on the appropriate product link.

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**Note** – Viewing PDF files requires the Acrobat Reader software, which is available for free from the following website:

[www.adobe.com/products/acrobat/readstep.html](http://www.adobe.com/products/acrobat/readstep.html)

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## Third-Party Web Sites

Sun is not responsible for the availability of third-party web sites mentioned in this document. Sun does not endorse and is not responsible or liable for any content, advertising, products, or other materials that are available on or through such sites or resources. Sun will not be responsible or liable for any actual or alleged damage or loss caused by or in connection with the use of or reliance on any such content, goods, or services that are available on or through such sites or resources.

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## Contacting Sun Technical Support

If you have technical questions about this product that are not answered in this document, go to the following web site:

<http://www.sun.com/service/contacting>

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## Licensing

For information on obtaining licenses for Sun StorEdge QFS and Sun StorEdge SAM-FS software, contact your Sun sales representative or your authorized service provider (ASP).

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## Diagnostics

The Sun StorEdge QFS and Sun StorEdge SAM-FS software includes the `samexplorer(1M)` script. This diagnostic script can be very useful to you and to the Sun customer support staff. This script produces a diagnostic report of the server configuration and collects log information. After the software is installed, you can access the `samexplorer(1M)` man page for more information about this script.

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## Installation Assistance

For installation and configuration services please contact Sun's Enterprise Services at 1-800-USA4SUN or contact your local Enterprise Services sales representative.

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## Sun Welcomes Your Comments

Sun is interested in improving its documentation and welcomes your comments and suggestions. You can submit your comments by going to the following web site:

<http://www.sun.com/hwdocs/feedback>

Please include the title and part number of your document with your feedback (*Sun StorEdge QFS and Sun StorEdge SAM-FS File System Administration Guide*, part number 819-1550-10).



# Overview

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The Sun StorEdge QFS and Sun StorEdge SAM-FS file systems are configurable file systems that present a standard UNIX file system interface to users. TABLE 1-1 shows how these file systems can be used or combined with the storage and archive management (SAM) software.

**TABLE 1-1**    Product Overview

Product	Components
Sun StorEdge QFS file system	Sun StorEdge QFS standalone file system
Sun StorEdge SAM-FS file system	Standard file system plus the storage and archive management utility, SAM
Sun SAM-QFS file system	The Sun StorEdge QFS file system combined with the storage and archive management utilities found in the Sun StorEdge SAM-FS software.

Technologically, the two file systems are similar, but there are also differences between them. This chapter presents an overview of the features common to these file systems, highlights the features that differentiate the file systems, and explains the commands available with each file system. Specifically, this chapter is divided into the following sections:

- “Common Features” on page 2
- “File System Differences” on page 4

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## Common Features

The Sun StorEdge QFS and Sun StorEdge SAM-FS file systems do not require changes to user programs, nor are changes required to the UNIX kernel. These file systems share the features described in the following sections.

### vnode Interface

The Sun StorEdge QFS and Sun StorEdge SAM-FS file systems are implemented using the standard Solaris operating system (OS) virtual file system (`vfs/vnode`) interface.

By using the `vfs/vnode` interface, these file systems work with the standard Solaris OS kernel and require no modifications to the kernel for file management support. Thus, the file system is protected from operating system changes and typically does not require extensive regression testing when the operating system is updated.

The kernel intercepts all requests for files, including those that reside in Sun StorEdge QFS and Sun StorEdge SAM-FS file systems. If the file is identified as a Sun StorEdge QFS or Sun StorEdge SAM-FS file, the kernel passes the request to the appropriate file system for handling. Sun StorEdge QFS and Sun StorEdge SAM-FS file systems are identified as type `samfs` in the `/etc/vfstab` file and on the `mount(1M)` command.

## Enhanced Volume Management

Sun StorEdge QFS and Sun StorEdge SAM-FS file systems support both striped and round-robin disk access. The master configuration file (`mcf`) and the `mount` parameters specify the volume management features and let the file system know the relationships between the devices it controls. This is in contrast to most UNIX file systems that can address only one device or one portion of a device. Sun StorEdge QFS and Sun StorEdge SAM-FS file systems do not require any additional volume management applications. If you want to use mirroring for any devices in a Sun StorEdge QFS or Sun StorEdge SAM-FS environment, obtain an additional package, such as a logical volume manager.

The Sun StorEdge QFS and Sun StorEdge SAM-FS integrated volume management features use the standard Solaris OS device driver interface to pass I/O requests to and from the underlying devices. The Sun StorEdge QFS and Sun StorEdge SAM-FS software groups storage devices into family sets upon which each file system resides.

## Support for Paged and Direct I/O

Sun StorEdge QFS and Sun StorEdge SAM-FS file systems support two different types of I/O: paged (also called *cached* or *buffered* I/O) and direct. These I/O types are as follows:

- When paged I/O is used, user data is cached in virtual memory pages and the kernel writes the data to disk. The standard Solaris OS interfaces manage paged I/O. This is the default type of I/O.
- When direct I/O is used, user data is written directly from user memory to disk. You can specify direct I/O by using the Solaris OS `directio(3C)` function call or the `setfa(1)` command with its `-D` option. Large block, sequential, aligned I/O can realize substantial performance improvements by using direct I/O.

## Preallocation of File Space

You can use the `setfa(1)` command to preallocate contiguous disk space for fast sequential reads and writes.

## Application Programming Interface Routines

The application programming interface (API) routines enable a program to perform various specialized functions, such as preallocating contiguous disk space or accessing a specific striped group. For more information about these routines, see the `intro_libsam(3)` man page.

## High Capacity

The Sun StorEdge QFS and Sun StorEdge SAM-FS file systems support files of up to  $2^{63}$  bytes in length. Such very large files can be striped across many disks or RAID devices, even within a single file system. This is true because Sun StorEdge QFS and Sun StorEdge SAM-FS file systems use true 64-bit addressing. This is in contrast to a standard UNIX file system (UFS), which is not a true 64-bit file system.

The number of file systems you can configure is virtually unlimited. The volume manager enables each file system to include up to 252 device partitions (typically disk). Each partition can include up to 4 terabytes of data. This configuration offers virtually unlimited storage capacity.

There is no predefined limit on the number of files on a Sun StorEdge SAM-FS file system. Because the inode space (which holds information about the files) is dynamically allocated, the maximum number of files is limited only by the amount of disk storage available. The inodes are cataloged in the `.inodes` file under the mount point. The `.inodes` file requires 512 bytes of storage per file.

For a Sun StorEdge QFS file system, the inodes are located on the metadata device(s) and are separated from the file data devices. In practice, the size of your metadata (`mm`) devices sets the limit on the number of files in a Sun StorEdge QFS file system. You can increase the maximum number of files by adding more metadata devices. The hard limit on the number of files is  $2^{32}-1$  files, and the recommended limit is  $10^7$  files.

## Fast File System Recovery

A key function of a file system is the ability to recover quickly after an unscheduled outage. Standard UNIX file systems require a lengthy file system check (`fsck(1M)`) to repair inconsistencies after a system failure.

Sun StorEdge QFS and Sun StorEdge SAM-FS file systems often do not require file system checks after a disruption that prevents the file system from being written to disk (using `sync(1M)`). In addition, they recover from system failures without using journaling. They accomplish this dynamically by using identification records, serial writes, and error checking for all critical I/O operations. After a system failure, Sun StorEdge QFS and Sun StorEdge SAM-FS file systems can be remounted immediately, even for multiterabyte-sized file systems.

## Adjustable Disk Allocation Unit

The disk allocation unit (DAU) is the basic unit of online storage. The Sun StorEdge QFS file systems include an adjustable DAU, which is useful for tuning the file system with the physical disk storage device and for eliminating the system overhead caused by read-modify-write operations. You can adjust the DAU size in multiples of 4 kilobytes.

---

## File System Differences

The Sun StorEdge QFS and Sun StorEdge SAM-FS file systems share many features, and these are described in “Common Features” on page 2. This section, however, describes the areas in which they differ. One area of difference is performance. The



Sun StorEdge QFS file system provides the ability to attain raw, device-rated disk speeds with the administrative convenience of a file system. The following sections note other ways in which the file systems differ.

## Metadata Storage

File systems use metadata to reference file and directory information. Typically, metadata resides on the same device as the file data. This is true for the Sun StorEdge SAM-FS file system.

The Sun StorEdge QFS file system separates the file system metadata from the file data by storing them on separate devices. The Sun StorEdge QFS file system enables you to define one or more separate metadata devices in order to reduce device head movement and rotational latency, improve RAID cache utilization, or mirror metadata without mirroring file data.

Both the Sun StorEdge QFS and Sun StorEdge SAM-FS file systems store inode metadata information in a separate file. This enables the number of files, and the file system as a whole, to be enlarged dynamically.

## Support for Multiple Striped Groups

To support multiple RAID devices in a single file system, striped groups can be defined in Sun StorEdge QFS file systems. You can optimize disk block allocation for a striped group. This reduces the overhead for updating the on-disk allocation map. Users can assign a file to a striped group either through an API routine or by using the `setfa(1)` command.

## SAM Interoperability

The Sun StorEdge SAM-FS file system combines file system features with the storage and archive management utility, SAM. Users can read and write files directly from magnetic disk, or they can access archive copies of files as though they were all on primary disk storage.

The Sun StorEdge QFS file system can be used as a standalone file system, or it can be used in conjunction with the storage and archive manager, SAM. If you are licensed for both Sun StorEdge QFS and Sun StorEdge SAM-FS, it is called *Sun SAM-QFS*.

When possible, Sun StorEdge SAM-FS software uses the standard Solaris OS disk and tape device drivers. For devices not directly supported under the Solaris OS, such as certain automated library and optical disk devices, Sun Microsystems provides special device drivers in the Sun StorEdge SAM-FS software package.

## Sun Cluster Interoperability

The Sun StorEdge QFS file system is supported as a local file system and as a highly available file system in a Sun Cluster environment. The Sun StorEdge SAM-FS file system is not supported in a Sun Cluster environment.

## Sun StorEdge QFS Shared File System Support

The shared file system can be implemented as either a Sun StorEdge QFS shared file system or as a Sun SAM-QFS shared file system. A shared file system enables you to implement a distributed file system that can be mounted on multiple Sun Solaris host systems.

Sun StorEdge QFS shared file systems do not support the following file types:

- `b` — block special files
- `c` — character special files
- `p` — FIFO (named pipe) special files

The shared file system does not support segmented files. You cannot implement a Sun SAM-QFS shared file system in a Sun Cluster environment.

For more information about this file system, see the “Sun StorEdge QFS Shared File System” on page 91.

# File System Design

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Well-designed file systems are critical to ensuring quick and uninterrupted access to information. Good design is also essential to file system recovery. This chapter contains the following sections:

- “Design Basics” on page 7
- “Inode Files and File Characteristics” on page 8
- “Specifying Disk Allocation Units and Stripe Widths” on page 15
- “File Allocation Methods” on page 23

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## Design Basics

Sun StorEdge QFS and Sun StorEdge SAM-FS file systems are multithreaded, advanced storage management systems. To take maximum advantage of these capabilities, create multiple file systems whenever possible.

The Sun StorEdge QFS and Sun StorEdge SAM-FS file systems use a linear search method when performing directory lookups. They search from the beginning of the directory to the end. As the number of files in a directory increases, the search time through the directory also increases. Users who have directories with thousands of files can experience excessive search times. These long search times are also evident when you restore a file system. To increase performance and speed up file system dumps and restores, you should keep the number of files in a directory under 10,000.

The directory name lookup cache (DNLC) feature improves file system performance. This cache stores the directory lookup information for files whose paths are sufficiently short (30 characters or less), removing the need to perform directory lookups on the fly. The DNLC feature is available in all Solaris operating system (OS) 9 and later releases, and in the later Solaris OS release 8 updates.

# Inode Files and File Characteristics

The types of files to be stored in a file system affect file system design. An *inode* is a 512-byte block of information that describes the characteristics of a file or directory. This information is allocated dynamically within the file system.

The inodes are stored in the `.inodes` file located under the file system mount point. A Sun StorEdge SAM-FS `.inodes` file resides on the same physical device as the file data and is interleaved with the file data. In contrast, a Sun StorEdge QFS `.inodes` file resides on a metadata device that is separate from the file data device.

Like a standard Solaris operating system (OS) inode, a Sun StorEdge QFS or Sun StorEdge SAM-FS file system inode contains the file's POSIX standard inode times: file access, file modification, and inode changed times. The Sun StorEdge QFS and Sun StorEdge SAM-FS file systems add a creation time, an attribute change time, and a residence time. TABLE 2-1 summarizes the times that are recorded in the inode.

**TABLE 2-1** Content of `.inode` Files

Time	Incident
access	Time the file was last accessed. POSIX standard.
modification	Time the file was last modified. POSIX standard.
changed	Time the inode information was last changed. POSIX standard.
attributes	Time the attributes specific to the Sun StorEdge QFS or Sun StorEdge SAM-FS files systems were last changed. Sun Microsystems extension.
creation	Time the file was created. Sun Microsystems extension.
residence	Time the file changed from offline to online or vice versa. Sun Microsystems extension.

The attributes specific to the Sun StorEdge QFS and Sun StorEdge SAM-FS file systems include both user settings and general file states. The following two sections describe these characteristics.

## File Attributes and File States

A user-specified attributes of a file and its system-specified states are stored in the file's inode. You can use the `sls(1) -D` command to display these inode attributes. For more information about `sls(1)` options, see the `sls(1)` man page.

A user can specify the following commands to set attributes:

- `archive(1)`
- `ssum(1)`
- `release(1)`
- `segment(1)`
- `setfa(1)`
- `stage(1)`

Users can set attributes from within applications by specifying the following application programming interface (API) routines:

- `sam_archive(3)`
- `sam_release(3)`
- `sam_segment(3)`
- `sam_setfa(3)`
- `sam_ssum(3)`
- `sam_stage(3)`

## User-Specified File Attributes

TABLE 2-2 shows the user-specified attributes that are listed in the inode.

**TABLE 2-2** User-Specified File Attributes

Command	Definition	Used By
<code>archive -C</code>	The file is marked for concurrent archiving. This means that the file can be archived even if it is open for a write operation. You can use the <code>archive(1)</code> command to set this attribute.	Sun StorEdge SAM-FS
<code>archive -n</code>	The file is marked to never be archived. The superuser can use the <code>archive(1)</code> command to set this attribute.	Sun StorEdge SAM-FS
<code>release -a</code>	This file is marked to be released as soon as one archive copy is made. You can set this attribute from within the <code>archiver.cmd</code> file or by using the <code>release(1)</code> command.	Sun StorEdge SAM-FS
<code>release -n</code>	This file is marked to never be released. You can set this attribute from within the <code>archiver.cmd</code> file, or the superuser can use the <code>release(1)</code> command to set it.	Sun StorEdge SAM-FS

**TABLE 2-2** User-Specified File Attributes (*Continued*)

Command	Definition	Used By
<code>release -p</code>	The file is marked for partial release. You can set this attribute from within the <code>archiver.cmd</code> file or by using the <code>release(1)</code> command.	Sun StorEdge SAM-FS
<code>stage -a</code>	The file is marked for associative staging. You can set this attribute from within the <code>archiver.cmd</code> file or by using the <code>stage(1)</code> command.	Sun StorEdge SAM-FS
<code>stage -n</code>	The file is marked to never be staged. This signifies direct access to removable media cartridges. You can set this attribute from within the <code>archiver.cmd</code> file, or the superuser can use the <code>stage(1)</code> command to set it.  Not supported on Sun StorEdge QFS shared file system clients.	Sun StorEdge SAM-FS
<code>setfa -D</code>	The file is marked for direct I/O.	Sun StorEdge QFS Sun StorEdge SAM-FS
<code>setfa -gn</code>	The file is marked for allocation on striped group <i>n</i> .	Sun StorEdge QFS
<code>setfa -sm</code>	The file is marked for allocation with a stripe width of <i>m</i> .	Sun StorEdge QFS Sun StorEdge SAM-FS
<code>segment nm stage_ahead x</code>	The file is marked for segmentation. The <i>nm</i> notation indicates that the segment is <i>n</i> megabytes in size. The <code>stage_ahead x</code> attribute indicates the number of segments ( <i>x</i> ) to be staged ahead. You can use the <code>segment(1)</code> command to set this attribute.	Sun StorEdge SAM-FS

You can set the attributes shown in TABLE 2-2 on both files and directories. After directory attributes are set, files that are created in the directory inherit all the directory attributes at the time of creation. Files created before an attribute is applied to the parent directory do not inherit directory attributes.

If you have purchased the optional WORM package, you can also apply WORM (write once read many) attributes to a file using the `ssum` command, and set the file's retention period. See "WORM File Systems" on page 310 for details.

Users can gather information about file attributes by using the `s1s(1)` command, which is described in "Displaying File Information" on page 11.

# System-Specified File States

TABLE 2-3 shows the various states that the file systems set for a file. These states are stored in the inode.

TABLE 2-3 System-Specified File States

Attribute	Definition	Used By
archdone	Indicates that the file’s archive requirements have been met. There is no more work the archiver must do on the file. The archiver sets this attribute. It cannot be set by a user. Note that archdone does not necessarily indicate that the file has been archived.	Sun StorEdge SAM-FS
damaged	The file is damaged. The stager or the samfsrestore(1M) command sets this attribute. You can use the undamage(1M) command to reset this attribute to undamaged. If this attribute has been set by the samfsrestore(1M) utility, it means that no archive copies existed for the file at the time a samfsdump(1M) was taken. You can reset this attribute to undamaged, but the file might still be unrecoverable.	Sun StorEdge SAM-FS
offline	The file data has been released. The releaser sets this attribute. You can also set this attribute by using the release(1) command.	Sun StorEdge SAM-FS

Users can gather information about file states by using the `sls(1)` command, which is described in “Displaying File Information” on page 11.

## Displaying File Information

The Sun StorEdge QFS and Sun StorEdge SAM-FS `sls(1)` command extends the standard UNIX `ls(1)` command and provides more information about a file. CODE EXAMPLE 2-1 shows detailed `sls(1)` command output that displays the inode information for file `hgc2`.

CODE EXAMPLE 2-1 `sls(1)` Output in a Sun StorEdge SAM-FS Environment

```
# sls -D hgc2
hgc2:
mode: -rw-r--r--  links:   1  owner: root      group: other
length:      14971  admin id:      0  inode:      30.5
archdone;
segments 3, offline 0, archdone 3, damaged 0;
```

**CODE EXAMPLE 2-1** `sls(1)` Output in a Sun StorEdge SAM-FS Environment (*Continued*)

copy 1: ----	Jun 13 17:14	2239a.48	1t MFJ192
copy 2: ----	Jun 13 17:15	9e37.48	1t AA0006
access:	Jun 13 17:08	modification:	Jun 13 17:08
changed:	Jun 13 17:08	attributes:	Jun 13 17:10
creation:	Jun 13 17:08	residence:	Jun 13 17:08

TABLE 2-4 describes the meaning of each row of `sls(1)` output shown in CODE EXAMPLE 2-1. In TABLE 2-4, note that lines that pertain to archiving do not appear in `sls(1)` output in a Sun StorEdge QFS environment.

**TABLE 2-4** `sls(1)` Output Explanation

Line Number	First Few Characters	Content
1	mode:	The file's mode and permissions, the number of hard links to the file, the owner of the file, and the group to which the owner belongs.
2	length:	<p>The file's length in bytes, the file's admin ID number, and the file's inode number.</p> <p>By default, the admin ID number is 0. If this number is greater than 0, it indicates the file's accounting category for counting files and blocks. You can set this number to a value greater than 0 even when file system quotas are not enabled on this file system. For information about file system quotas, see "File System Quotas" on page 225.</p> <p>The inode number is a two-part number that contains the inode number itself, followed by a period (.), followed by the inode generation number.</p>
3	archdone;	The file attributes specific to the file. For more information about this line, see the <code>sls(1)</code> man page.
4	segments	<p>The segment index information. This line does not appear unless the file is a segment index. The general format for this line is as follows:</p> <p>segments <i>n</i>, offline <i>o</i>, archdone <i>a</i>, damaged <i>d</i>;</p> <p>segments <i>n</i> shows the total number of data segments for this file. In this example, there are 3.</p> <p>offline <i>o</i> shows the number of data segments offline. In this example, there are no offline segments.</p> <p>archdone <i>a</i> shows the number of segments for which the archiving requirements have been met. In this example, there are 3.</p> <p>damaged <i>d</i> shows the number of damaged segments. In this example, there are no damaged segments.</p>



**TABLE 2-4**    `sls(1)` Output Explanation (*Continued*)

Line Number	First Few Characters	Content
5	copy 1:	The first archive copy line. The <code>sls(1)</code> command displays one archive copy line for each active or expired archive copy. For more information, see “Archive Copy Line Explanation” on page 13.
6	copy 2:	The second archive copy line. For more information, see “Archive Copy Line Explanation” on page 13.
7	access:	The time the file was last accessed and modified.
8	changed:	The time the file content was last changed and since the file’s attributes were last changed.
9	creation:	The time the file was created and became resident in the file system.

## Archive Copy Line Explanation

The fields in the archive copy lines are as follows:

- The first field indicates the archive copy number.
- The second field contains four indicators, each of which is either a dash (-) or a letter. Reading them from left to right, TABLE 2-5 shows the information that the indicators convey.

**TABLE 2-5**    Archive Copy Line Indicators

Position	Meaning
1	Indicates either an expired or active entry. An <code>S</code> indicates that the archive copy is expired. That is, the file was modified and this archive copy is a previous version of the file. A <code>U</code> indicates that the copy has been unarchived. <i>Unarchiving</i> is the process by which archive entries for files or directories are deleted. A dash (-) indicates that the archive copy is active and valid.

**TABLE 2-5** Archive Copy Line Indicators *(Continued)*

Position	Meaning
2	Indicates whether the archive copy is to be rearchived. An <code>r</code> indicates that the archive copy is scheduled to be rearchived by the archiver. A dash (-) indicates that the archive copy is not to be rearchived by the archiver.
3	Unused.
4	Indicates whether the copy is damaged or undamaged. A <code>D</code> indicates that the archive copy is damaged. A damaged archive copy is not a candidate for staging. A dash (-) indicates that the archive copy is not damaged. It is a candidate for staging.

- The third field shows the date and time the archive copy was written to the archive media.
- The fourth field contains two hexadecimal numbers separated by a decimal point (.). The first hexadecimal number (2239a) indicates the position of the beginning of the archive file on the cartridge. The second hexadecimal number (48) is the file byte offset (divided by 512) of this copy in the archive file.
- The fifth and sixth fields in the archive copy line indicate the media type and the Volume Serial Name (VSN) where the archive copy resides.

## Retention Line Explanation

If you are using the optional WORM package, a retention line will also appear in the `sls(1)` output. The format of the retention line is as follows:

```
retention: active retention-period: 3y 0d 0h 0m
```

This indicates whether or not a retention period has been set for this file and the length of the retention period. A `retention-end` date is also displayed in the `sls(1)` output, indicating the date on which the retention period expires. For more information about using the WORM feature, see “WORM File Systems” on page 310.

## Checksum Line Explanation

If a file has checksum-related attributes, the `sls(1)` command returns a checksum line. You can use the `ssum(1)` command to set these attributes (`generate`, `use`, or `valid`). This line appears in `sls(1)` output in Sun StorEdge SAM-FS environments. The format of the checksum line is as follows:

```
checksum: gen use val algo: 1
```

The system displays the preceding line if checksum attributes are set for a file. You can interpret this line as follows:

- If the `generate` attribute is not set, `no_gen` appears in place of `gen`.
- If the `use` attribute is not set, `no_use` appears.
- If the file has been archived and a checksum has been computed, `val` appears.
- If the file has not been archived or if no checksum has been computed, `not_val` appears.
- The keyword `algo` precedes the numeric algorithm indicator that specifies the algorithm that is used to generate the checksum value.

---

## Specifying Disk Allocation Units and Stripe Widths

Disk space is allocated in blocks. These are also called *disk allocation units* (DAUs), which are the basic units of online disk storage. While sectors, tracks, and cylinders describe the physical disk geometry, the DAU describes the file system geometry. Choosing the appropriate DAU size and stripe size can improve performance and optimize magnetic disk usage. The DAU setting is the minimum amount of contiguous space that is used when a file is allocated.

**Example:** Assume that you have a Sun StorEdge SAM-FS file system. Your DAU is set to 16 kilobytes and you have disabled striping by setting `stripe=0`. You are using round-robin allocation (because of the `stripe=0` setting), and you have two files, as follows:

- The first file is a 15-kilobyte file. It occupies one DAU. The file data occupies 15 kilobytes of the DAU, and the other 1 kilobyte is not used.
- The second file is a 20-kilobyte file. It occupies two DAUs. The file data occupies all 16 kilobytes of the first DAU, and 4 kilobytes of the second DAU. The second DAU contains 12 kilobytes that are not used.

The `-a allocation_unit` option on the `sammkfs(1M)` command specifies the DAU setting.

If striped allocation is used, the stripe width mount option determines the maximum number of DAUs written in one I/O event. This setting is specified by the `-o stripe=n` option on the `mount(1M)` command. You must run the `sammkfs(1M)` command before you run the `mount(1M)` command.

The following sections describe how to configure DAU settings and stripe widths.

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**Note** – Unless otherwise noted, Sun StorEdge QFS *file system* information throughout this manual applies to Sun SAM-QFS configurations as well.

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## DAU Settings and File System Geometry

The Sun StorEdge QFS and Sun StorEdge SAM-FS file systems use an adjustable DAU. You can use this configurable DAU to tune the file system to the physical disk storage device. This minimizes the system overhead caused by read-modify-write operations. Applications that manipulate very large files can benefit substantially from this feature. For information about how to control the read-modify-write operation, see “Increasing Large File Transfer Performance” on page 337.

Each file system can have its own unique DAU setting. Thus, several mounted file systems can be active on a server, each with a different DAU setting. The DAU setting is determined when the file system is created using the `sammkfs(1M)` command. It cannot be changed dynamically.

The possible DAU settings differ depending on the file system you are using. The following sections describe the DAU settings for each file system. These sections also introduce the concept of the master configuration (`mcf`) file. You create this ASCII file at system configuration time. It defines the devices and file systems used in your Sun StorEdge QFS or Sun StorEdge SAM-FS environment. The `mcf` file is introduced in the following sections, but it is more thoroughly discussed in “Volume Management” on page 37.

Two file allocation schemes are available to you: a dual allocation scheme and a single allocation scheme. The following sections describe these schemes.

### Dual Allocation Scheme

A Sun StorEdge SAM-FS file system is defined as Equipment Type `ms` in your `mcf` file. The only device type allowed in a Sun StorEdge SAM-FS file system is type `md`. Both metadata and file data are written to the `md` devices in a Sun StorEdge SAM-FS file system. By default, the DAU on an `md` device is 16 kilobytes.

A Sun StorEdge QFS file system is defined as Equipment Type `ma` in your `mcf` file. Metadata is written to `mm` devices. Data can be written to `md`, `mr`, or `gXXX` devices.

The `md` and `mm` devices use a dual allocation scheme and are as follows:

- On `md` data devices, the small allocation is 4 kilobytes, and the large allocation is a DAU. The default DAU is 64 kilobytes in a Sun StorEdge QFS shared file system. The default DAU is 16 kilobytes in a Sun StorEdge QFS (unshared) file system. You can override this default when the file system is initialized by using the `-a allocation_unit` option to the `sammkfs(1M)` command. The DAU size can be either 16, 32, or 64 kilobytes.

When a file is created on an `md` device, the system allocates the first eight addresses of a file in the small allocation. If more space is needed, the file system uses one or more large allocations (DAUs) in expanding the file. As a result, I/O performance improves for large files while minimizing the disk fragmentation that can result from having many small files.

- On `mm` metadata devices, the small allocation is 4 kilobytes, and the large allocation is 16 kilobytes. The dual allocation scheme enables the file system to write metadata to disk more efficiently and helps minimize disk fragmentation.

Depending on the type of file data stored in the file system, selecting a larger DAU size can improve file system performance significantly. For information about tuning file system performance, see “Advanced Topics” on page 303.

## Single Allocation Scheme

Only Sun StorEdge QFS file systems can include devices that use a single allocation scheme. The Sun StorEdge QFS file systems are Equipment Type `ma` in your `mcf` file. These file systems consist of separate metadata devices and data devices, as follows:

- The metadata devices can be defined only as Equipment Type `mm`.
- The data devices can be defined as Equipment Type `md`, `mr`, or `gXXX`. The `md` devices follow the dual allocation scheme of a Sun StorEdge SAM-FS file system and are limited to DAU sizes of 16 kilobytes, 32 kilobytes, or 64 kilobytes.

The `mr` and `gXXX` devices follow a single allocation scheme. You can mix `mr` and `gXXX` devices in a file system, but you cannot mix `md` devices with either `mr` or `gXXX` devices in a file system.

The DAU size for Sun StorEdge QFS file systems that use `mr` and `gXXX` data devices is configurable. The possible DAU sizes that can be used on data devices depend on the Equipment Type assigned to each data device in the `mcf` file.

TABLE 2-6 shows these DAU sizes.

**TABLE 2-6** Sun StorEdge QFS Equipment Types

Equipment Type	DAU Sizes
mr or gXXX	You can specify different DAU sizes by adjusting the default size in 8-kilobyte increments. The DAU size can be from 16 kilobytes to 65,528 kilobytes (64 megabytes). The default DAU for an mr or gXXX device in a Sun StorEdge QFS environment is 64 kilobytes.
md	<p>This type of device uses a dual allocation in the style of a Sun StorEdge SAM-FS file system. The DAU can be configured to be 16, 32, or 64 kilobytes in length. The default DAU for an md device in a Sun StorEdge QFS environment is 64 kilobytes.</p> <p>An md device in a Sun StorEdge QFS file system is used to store data only, not metadata. This is the difference between an md device in a Sun StorEdge QFS file system and an md device in a Sun StorEdge SAM-FS file system.</p>

**Note** – If you did not perform a `sammkfs(1M)` on your file system when the Sun StorEdge QFS software was installed, you are using a version 1 superblock. In the version 1 superblock, the `mm` devices do not use the dual allocation scheme. In the version 1 superblock, the allocation for `mm` devices is 16 kilobytes. Only a version 2 superblock enables you to define `md` devices in a Sun StorEdge QFS file system.

The DAU setting is specified using the `-a allocation_unit` option to the `sammkfs(1M)` command. The following command specifies a DAU of 128 kilobytes:

```
# sammkfs -a 128 samqfs1
```

For more information about the `sammkfs(1M)` command, see the `sammkfs(1M)` man page.

## Allocation Scheme Summary

TABLE 2-7 shows the Equipment Types that can be used in Sun StorEdge QFS and Sun StorEdge SAM-FS file systems.

**TABLE 2-7** Equipment Types for File System Devices

Equipment Types in <small>mcf</small> File	Type of Data Stored	Allocation Scheme	File Systems That Can Include the Equipment Type
md	File data and metadata	Dual	Sun StorEdge SAM-FS
md	File data	Dual	Sun StorEdge QFS
mm	Metadata	Dual	Sun StorEdge QFS
mr	File data	Single	Sun StorEdge QFS
gXXX	File data	Single	Sun StorEdge QFS

Within a Sun StorEdge SAM-FS file system (an ms file system), you can have only md devices.

Within a Sun StorEdge QFS file system (an ma file system), you can mix devices as follows:

- mm and mr devices
- mm and gXXX devices
- mm, mr, and gXXX devices
- mm and md devices

TABLE 2-8 summarizes the allocation schemes used by the various file systems.

**TABLE 2-8** File Allocation

File System and Device Type	Allocation Increments
Sun StorEdge SAM-FS with <small>md</small> devices	Up to eight 4-kilobyte blocks, then DAUs
Sun StorEdge QFS with <small>mr</small> devices	DAUs
Sun StorEdge QFS with <small>gX</small> devices	DAUs
Sun StorEdge QFS with <small>md</small> devices	Up to eight 4-kilobyte blocks, then DAUs

TABLE 2-9 summarizes the DAU defaults.

**TABLE 2-9** Default DAU Sizes

File System and Device Types	Default DAU Size
Sun StorEdge SAM-FS <code>md</code> devices	16 kilobytes
Sun StorEdge QFS <code>mr</code> and <code>md</code> devices	64 kilobytes
Sun StorEdge QFS <code>gX</code> devices	256 kilobytes

## Stripe Widths on Data Disks

Stripe width defaults differ between Sun StorEdge QFS and Sun StorEdge SAM-FS file systems. The stripe width is specified by the `-o stripe=n` option on the `mount(1M)` command. If the stripe width is set to 0, round-robin allocation is used.

The following sections explain the differences that affect stripe widths on the various file systems.

### Sun StorEdge SAM-FS Stripe Widths

On Sun StorEdge SAM-FS file systems, the stripe width is set at mount time.

TABLE 2-10 shows default stripe widths.

**TABLE 2-10** Sun StorEdge SAM-FS Default Stripe Widths

DAU	Default Stripe Width	Amount of Data Written to 1 Disk
16 kilobytes (default)	8 DAUs	128 kilobytes
32 kilobytes	4 DAUs	128 kilobytes
64 kilobytes	2 DAUs	128 kilobytes

For example, if `sammkfs(1M)` is run with default settings, the default large DAU is 16 kilobytes. If no stripe width is specified when the `mount(1M)` command is issued, the default is used, and the stripe width set at mount time is 8.

Note that if you multiply the number in the first column of TABLE 2-10 by the number in the second column, the resulting number is 128 kilobytes. The Sun StorEdge QFS and Sun StorEdge SAM-FS file systems operate more efficiently if the amount of data being written to disk is at least 128 kilobytes.



## Sun StorEdge QFS Stripe Widths – Not Using Striped Groups

On Sun StorEdge QFS file systems, the stripe width that is set at mount time depends on whether or not striped groups are configured. A *striped group* is a collection of devices that are striped as a group. For more information about striped groups, see “File Allocation Methods” on page 23. This section describes stripe widths for Sun StorEdge QFS file systems that are configured without stripe groups.

If striped groups are not configured, the DAU and stripe width relationships are similar to those for Sun StorEdge SAM-FS file systems. The differences being that DAUs larger than 64 kilobytes or greater are possible and that the DAU is configurable in 8-kilobyte blocks. The maximum DAU size is 65528 kilobytes.

By default, if no stripe width is specified, the amount of data written to disk is at or near 128 kilobytes. The Sun StorEdge QFS file systems are more efficient if write operations write at least one whole stripe per I/O request. TABLE 2-11 shows the default stripe widths. These are the widths used if you do not specify a stripe width.

**TABLE 2-11** Default Stripe Widths

DAU	Default Stripe Width	Amount of Data Written to 1 Disk
16 kilobytes	8 DAUs	128 kilobytes
24 kilobytes	5 DAUs	120 kilobytes
32 kilobytes	4 DAUs	128 kilobytes
40 kilobytes	3 DAUs	120 kilobytes
48 kilobytes	2 DAUs	96 kilobytes
56 kilobytes	2 DAUs	112 kilobytes
64 kilobytes (default)	2 DAUs	128 kilobytes
72 kilobytes	1 DAU	72 kilobytes
128 kilobytes	1 DAU	128 kilobytes
> 128 kilobytes	1 DAU	DAU size

## Sun StorEdge QFS Stripe Widths – Using Striped Groups

If striped groups are configured for your Sun StorEdge QFS file system, the minimum amount of space allocated is the DAU multiplied by the number of devices in the striped group. The amount of the allocation can be very large when using striped groups.

When striped groups are used, data is written to several disk devices at once. This allocation treats a group of disks as if they were one device. Allocations on striped groups are logically equal to the DAU size multiplied by the number of elements in the striped group.

The `-o stripe=n` mount option determines the number of allocations that occur on each stripe group before the allocation moves to a different striped group. If a file system is mounted with `-o stripe=0`, the allocation is always to one striped group.

By default, the setting is `-o stripe=0`, which is round robin. The setting can be as low as `-o stripe=0` (which disables striping) or as high as `-o stripe=255`. The system sets `-o stripe=0` if mismatched striped groups are present. When mismatched striped groups are present, a file can reside on only one stripe group.

## Sun StorEdge QFS Data Alignment

*Data alignment* refers to matching the allocation unit of the RAID controller with the allocation unit of the file system. The optimal Sun StorEdge QFS file system alignment formula is as follows:

$$\text{allocation\_unit} = \text{RAID\_stripe\_width} \times \text{number\_of\_data\_disks\_in\_the\_RAID}$$

For example, if a RAID-5 unit has a total of nine disks, with one of the nine being the parity disk, the number of data disks is eight. If the RAID stripe width is 64 kilobytes, then the optimal allocation unit is 64 multiplied by 8, which is 512 kilobytes.

Data files are striped or round-robin through each striped group (`gXXX`) or data disk (`mx` or `md`) defined within the same file system.

A mismatched alignment hurts performance because it can cause a read-modify-write operation. The rest of this chapter provides more information for you to consider when setting DAUs and determining stripe widths.

## Stripe Widths on Metadata Disks

You can use the `-o mm_stripe=n` option to the `mount_samfs(1M)` command to stripe metadata information about the metadata disk. The default stripe width is `-o mm_stripe=1`, which specifies that one 16-kilobyte DAU be written to a metadata disk before switching to the next metadata disk. The small 4-kilobyte DAU is used for metadata disks.

By default, if you have multiple metadata devices, metadata is allocated using striped or round-robin allocation depending what is specified on the

- o `mm_stripe=n` option to the `mount(1M)` command. The setting can be as low as
- o `mm_stripe=0`, which disables striping. It can also be as high as
- o `mm_stripe=255`.



# File Allocation Methods

The Sun StorEdge QFS and Sun StorEdge SAM-FS file systems enable you to specify both round-robin and striped allocation methods. TABLE 2-12 shows the default file allocation methods used.

**TABLE 2-12** Default Allocation Methods

File System	Metadata	File Data
Sun StorEdge SAM-FS	Striped	Striped
Sun StorEdge QFS	Striped	Striped
Sun StorEdge QFS (striped groups)	Striped	Round-robin
Sun StorEdge QFS shared file system	Striped	Round-robin

The following sections describe allocation in more detail.

## Metadata Allocation

Metadata allocation differs depending on the type of file system you have.

- For Sun StorEdge SAM-FS file systems, metadata is allocated across the `md` devices.
- For Sun StorEdge QFS file systems, metadata is allocated across the `mm` devices.

No file data is allocated on the `mm` devices in Sun StorEdge QFS file systems.

Inodes are 512 bytes in length. Directories are initially 4 kilobytes in length. TABLE 2-13 shows how the system allocates metadata.

**TABLE 2-13** Metadata Allocation

Metadata Type	Allocation Increments for Sun StorEdge QFS File Systems	Allocation Increments for Sun StorEdge SAM-FS File Systems
Inodes (.inodes file)	16-kilobyte DAU	16, 32, or 64-kilobyte (DAU)
Indirect blocks	16-kilobyte DAU	16, 32, or 64-kilobyte (DAU)
Directories	4-kilobyte blocks and 16-kilobyte DAUs	4 kilobytes, up to a 32-kilobyte total, then DAU size

## Round-Robin Allocation

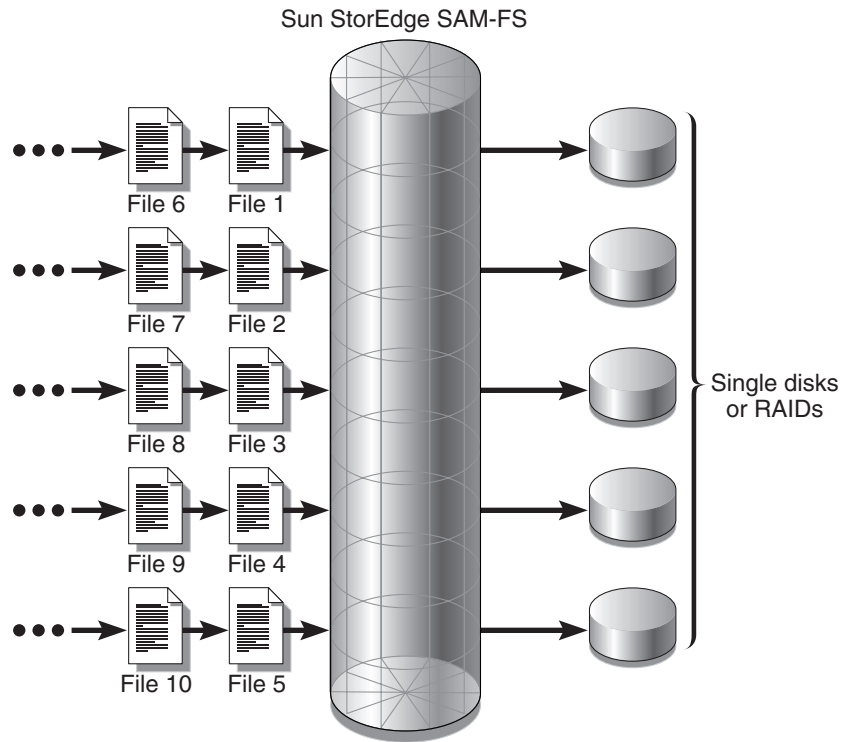
The round-robin allocation method writes one data file at a time to each successive device in the family set. Round-robin allocation is useful for multiple data streams because aggregate performance can exceed striping performance in this type of environment.

Round-robin disk allocation enables a single file to be written to a logical disk. The next file is written to the next logical disk. When the number of files written equals the number of devices defined in the family set, the file system starts over again with the first device selected. If a file exceeds the size of the physical device, the first portion of the file is written to the first device, and the remainder of the file is written to the next device with available storage.

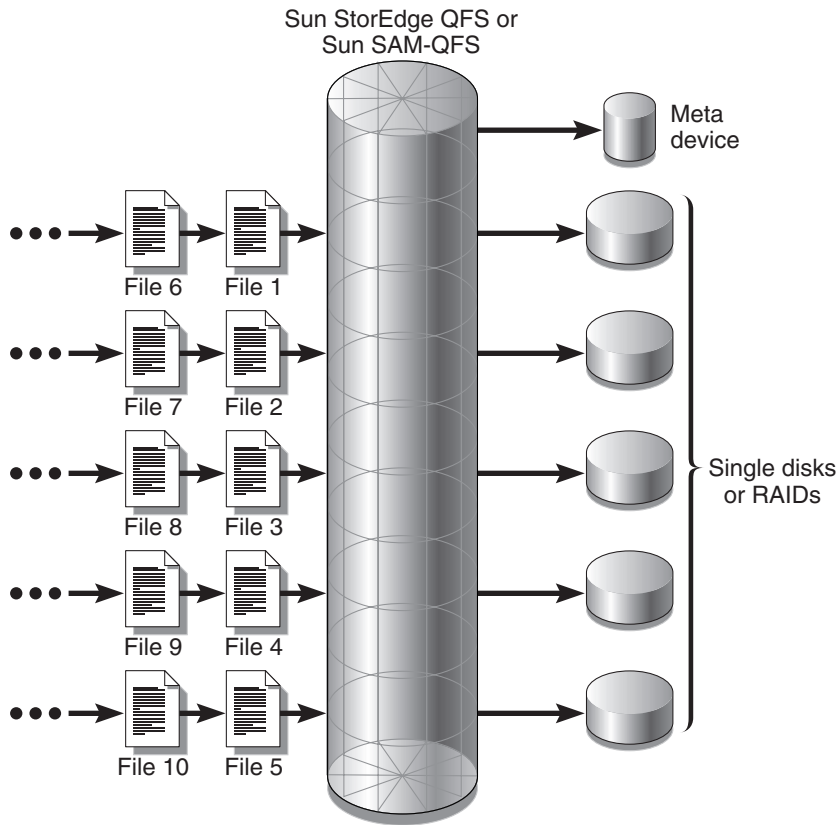
The size of the file being written determines the I/O size. You can specify round-robin allocation explicitly in the `/etc/vfstab` file by entering `stripe=0`.

The following figures depict round-robin allocations. In these figures, file 1 is written to disk 1, file 2 is written to disk 2, file 3 is written to disk 3, and so on. When file 6 is created, it is written to disk 1, starting the round-robin allocation scheme over again.

FIGURE 2-1 depicts a Sun StorEdge SAM-FS file system using round-robin allocation on five devices. FIGURE 2-2 depicts a Sun StorEdge QFS file system using round-robin allocation on five devices.



**FIGURE 2-1** Round-Robin Sun StorEdge SAM-FS File System Using Five Devices



**FIGURE 2-2** Round-Robin Sun StorEdge QFS File System Using Five Devices

## Striped Allocation

By default, Sun StorEdge QFS and Sun StorEdge SAM-FS file systems use a striped allocation method to spread data over all the devices in the file system family set. Striping is a method of writing files in an interlaced fashion across multiple devices concurrently.

Striping is used when performance for one file requires the additive performance of all the devices. A file system that is using striped devices addresses blocks in an interlaced fashion rather than sequentially. Striping generally increases performance because disk reads and writes are spread concurrently across disk heads. Striped disk access enables multiple I/O streams to simultaneously write a file across multiple disks. The DAU and the stripe width determine the size of the I/O transmission.

In a file system using striping, file 1 is written to disk 1, disk 2, disk 3, disk 4, and disk 5. File 2 is written to disks 1 through 5 as well. The DAU multiplied by the stripe width determines the amount of data written to each disk in a block.

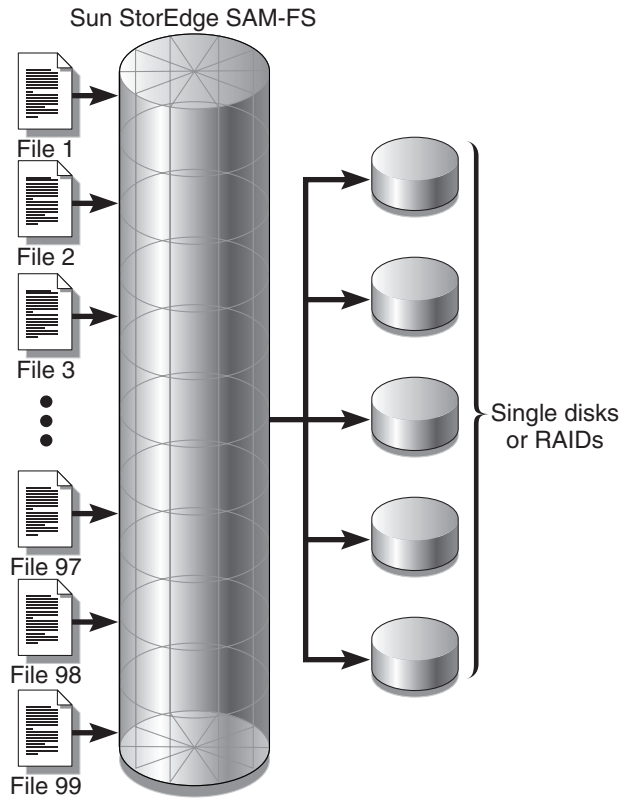
When a Sun StorEdge QFS or Sun StorEdge SAM-FS file system starts to write a file to an `md` device, it first assumes that the file will fit into a small DAU, which is 4 kilobytes. If the file does not fit into the first eight small DAUs (32 kilobytes) allocated, the file system writes the remainder of the file into one or more large DAUs.

When a Sun StorEdge QFS file system starts to write a file to an `mr` device, it writes first to one DAU, then another, and so on. The `mr` devices have only one DAU size. A Sun StorEdge QFS file system can also write metadata to striped `mm` devices.

Multiple active files cause significantly more disk head movement if striped allocation is used. If I/O is to occur to multiple files simultaneously, use round-robin allocation.

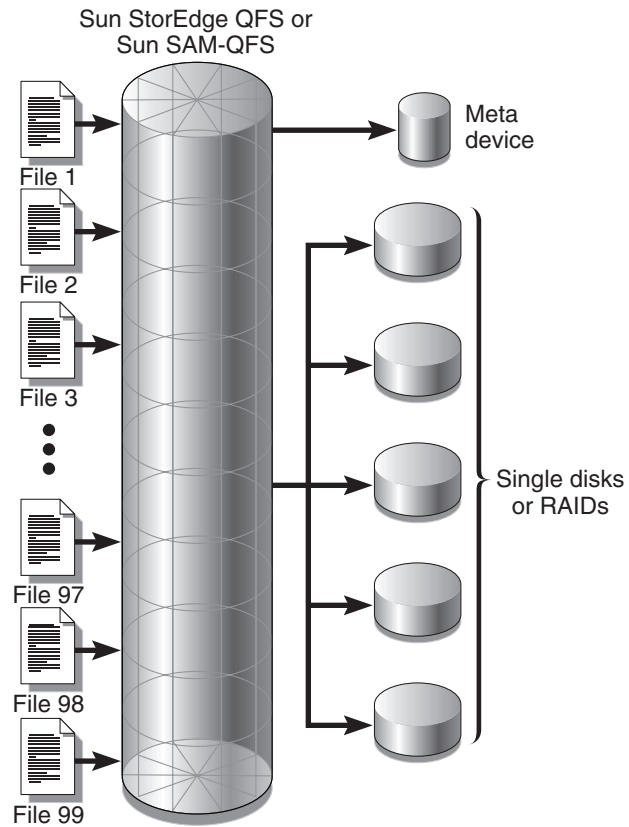
The following figures depict file systems using striped allocations. In these figures,  $\text{DAU} \times \text{stripe\_width}$  bytes of the file are written to disk 1.  $\text{DAU} \times \text{stripe\_width}$  bytes of the file are written to disk 2.  $\text{DAU} \times \text{stripe\_width}$  bytes of the file are written to disk 3, and so on. The order of the stripe is first-in-first-out for the files. Striping spreads the I/O load over all the disks.

FIGURE 2-3 depicts a Sun StorEdge SAM-FS file system using five striped devices.  
FIGURE 2-4 depicts a Sun StorEdge QFS file system using five striped devices.



**FIGURE 2-3** Sun StorEdge SAM-FS File System Using Five Striped Devices





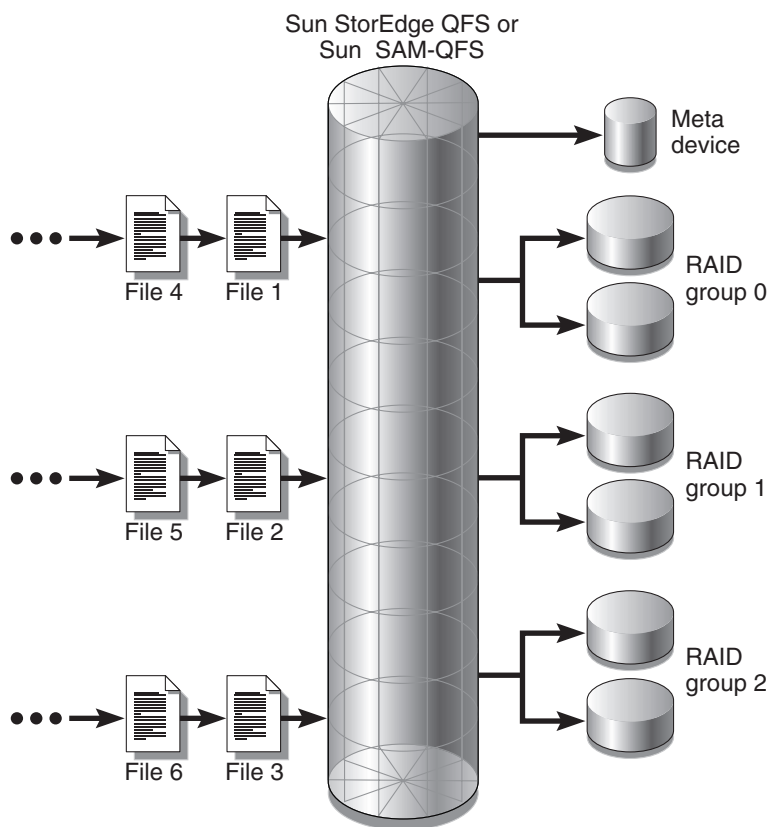
**FIGURE 2-4** Sun StorEdge QFS File System Using Five Striped Devices

## Striped Groups (Sun StorEdge QFS File Systems Only)

A *striped group* is a special Sun StorEdge QFS allocation method designed for file systems that have extremely large I/O requirements and terabytes of disk cache. A striped group enables you to designate an Equipment Type that contains multiple physical disks. Multiple striped group Equipment Types can make up a single Sun StorEdge QFS file system. Striped groups save bit map space and system update time for very large RAID configurations.

A striped group is a collection of devices within a Sun StorEdge QFS file system. Striped groups must be defined in the `mcf` file as `gXXX` devices. Striped groups enable one file to be written to and read from two or more devices. You can specify up to 128 striped groups within a file system.

FIGURE 2-5 depicts a Sun StorEdge QFS file system using striped groups and a round-robin allocation. In FIGURE 2-5, files written to the `qfs1` file system are round-robin between groups `g0`, `g1`, and `g2`. Three striped groups are defined (`g0`, `g1`, and `g2`). Each group consists of two physical RAID devices.



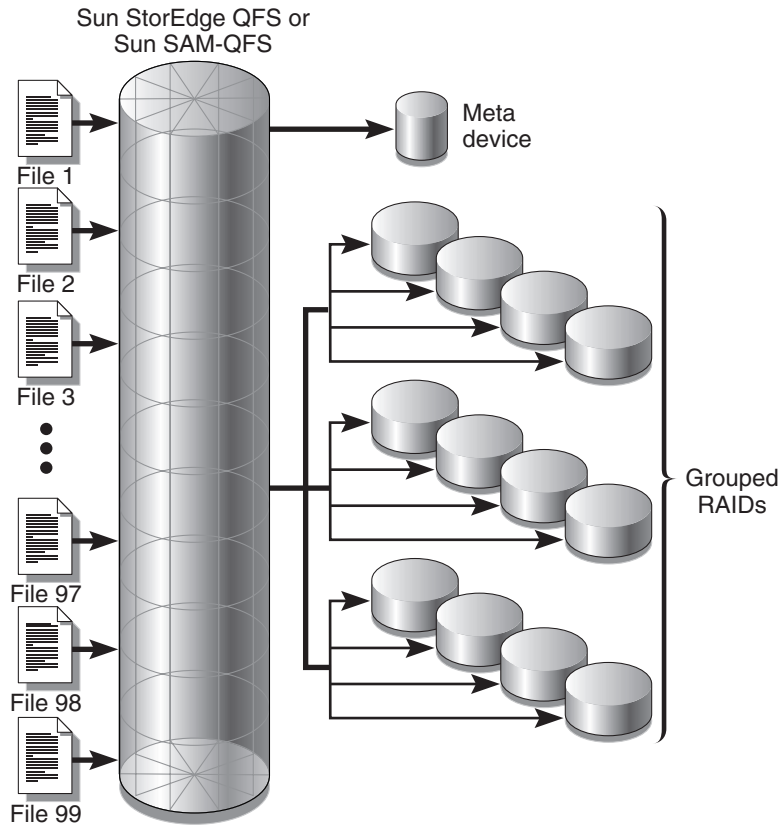
**FIGURE 2-5** Sun StorEdge QFS Round-Robin Striped Groups

For the configuration in FIGURE 2-5, the mount point option in `/etc/vfstab` is set to `stripe=0`. CODE EXAMPLE 2-2 shows the `mcf` file that declares these striped groups.

**CODE EXAMPLE 2-2** Example `mcf` File Showing Striped Groups

# Equipment	Eq	Eq	Fam	Dev	Additional
# Identifier	Ord	Type	Set	State	Parameters
#					
qfs1	10	ma	qfs1		
/dev/dsk/c0t1d0s6	11	mm	qfs1	-	
/dev/dsk/c1t1d0s2	12	g0	qfs1	-	
/dev/dsk/c2t1d0s2	13	g0	qfs1	-	
/dev/dsk/c3t1d0s2	14	g1	qfs1	-	
/dev/dsk/c4t1d0s2	15	g1	qfs1	-	
/dev/dsk/c5t1d0s2	16	g2	qfs1	-	
/dev/dsk/c6t1d0s2	17	g2	qfs1	-	

FIGURE 2-6 depicts a Sun StorEdge QFS file system using striped groups in which the data is striped across groups. In FIGURE 2-6, files written to the `qfs1` file system are striped through groups `g0`, `g1`, and `g2`. Each group includes four physical RAID devices. The mount point option in `/etc/vfstab` is set to `stripe=1` or greater.



**FIGURE 2-6** Sun StorEdge QFS Striped Group Allocation

# Mismatched Striped Groups (Sun StorEdge QFS File Systems Only)

It is possible to build a file system with mismatched striped groups. File systems with mismatched striped groups are those that contain multiple striped groups with different numbers of devices in each group. Sun StorEdge QFS file systems support mismatched striped groups, but they do not support striping on mismatched groups. File systems with mismatched striped groups are mounted as round-robin file systems.

---

**Note** – If a file system contains mismatched striped groups, a single file can never span more than one stripe group. If the stripe group on which the file resides fills, it cannot be extended. If mismatched stripe groups are present, use the `setfa(1)` command's `-g` option to direct files into the desired group. For more information, see the `setfa(1)` man page.

To determine how full a stripe group is, use the `samu(1M)` operator utility, and access the `m display` to display the status of mass storage.

---

The following example shows how a file system can be set up to store different types of files.

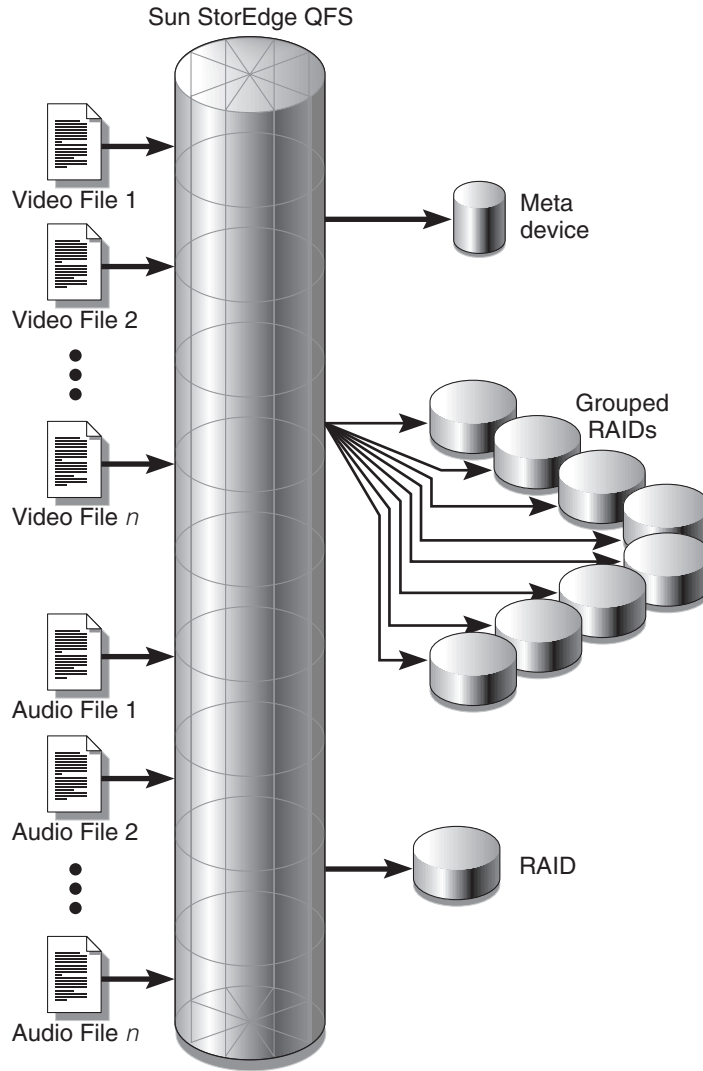
## Example

Assume that you have a Sun StorEdge QFS license, and you need to create a file system at your site that contains both video and audio data.

Video files are quite large and require greater performance than audio files. You want to store them in a file system with a large striped group because striped groups maximize performance for very large files.

Audio files are smaller and require lower performance than video files. You want to store them in a small striped group. One file system can support both video and audio files.

FIGURE 2-7 depicts the file system needed. It is a Sun StorEdge QFS file system using mismatched striped groups in a striped allocation.



**FIGURE 2-7** Sun StorEdge QFS File System Using Mismatched Striped Groups in a Striped Allocation

TABLE 2-14 shows the characteristics of this file system.

**TABLE 2-14** File System `avfs` Characteristics

Characteristics	Notes
File system name	<code>avfs</code> .
Number of stripe groups	Two. The video file group is <code>g0</code> . The audio file group is <code>g1</code> .
Stripe width	0.
DAU	128 kilobytes.
Number of disks for <code>g0</code>	Eight.
Minimum block size for <code>g0</code>	Eight disks x 128-kilobyte DAU = 1024 kilobytes. This is the amount of data written in one block write. Each disk receives 128 kilobytes of data, so the total amount written to all disks at one time is 1024 kilobytes.
Number of disks for <code>g1</code>	One.
Minimum block size for <code>g1</code>	One disk x 128-kilobyte DAU = 128 kilobytes.

Add the following line to the `/etc/vfstab` file so the environment recognizes the `avfs` file system:

<code>avfs</code>	<code>-</code>	<code>/avfs</code>	<code>saufs</code>	<code>-</code>	<code>no</code>	<code>stripe=0</code>
-------------------	----------------	--------------------	--------------------	----------------	-----------------	-----------------------

Note that in the `/etc/vfstab` file, `stripe=0` is used to specify a round-robin file system. This is used because a value greater than 0 (`stripe > 0`) is not supported for mismatched striped groups.

CODE EXAMPLE 2-3 shows the `mcf` file for file system `avfs`.

**CODE EXAMPLE 2-3** The `mcf` File for File System `avfs`

# Equipment	Eq	Eq	Fam	Dev	Additional
# Identifier	Ord	Type	Set	State	Parameters
#					
<code>avfs</code>	100	<code>ma</code>	<code>avfs</code>		
<code>/dev/dsk/c00t1d0s6</code>	101	<code>mm</code>	<code>avfs</code>	<code>-</code>	
#					
<code>/dev/dsk/c01t0d0s6</code>	102	<code>g0</code>	<code>avfs</code>	<code>-</code>	
<code>/dev/dsk/c02t0d0s6</code>	103	<code>g0</code>	<code>avfs</code>	<code>-</code>	
<code>/dev/dsk/c03t0d0s6</code>	104	<code>g0</code>	<code>avfs</code>	<code>-</code>	
<code>/dev/dsk/c04t0d0s6</code>	105	<code>g0</code>	<code>avfs</code>	<code>-</code>	
<code>/dev/dsk/c05t0d0s6</code>	106	<code>g0</code>	<code>avfs</code>	<code>-</code>	
<code>/dev/dsk/c06t0d0s6</code>	107	<code>g0</code>	<code>avfs</code>	<code>-</code>	
<code>/dev/dsk/c07t0d0s6</code>	108	<code>g0</code>	<code>avfs</code>	<code>-</code>	

**CODE EXAMPLE 2-3** The `mcf` File for File System `avfs` (Continued)

```
/dev/dsk/c08t0d0s6 109 g0 avfs -  
#  
/dev/dsk/c09t1d0s6 110 g1 avfs -
```

After the `mcf` file for this file system is ready, you can enter the `sammkfs(1M)` and `mount(1M)` commands shown in CODE EXAMPLE 2-4 to create and mount the `avfs` file system.

**CODE EXAMPLE 2-4** Commands to Create and Mount File System `avfs`

```
# sammkfs -a 128 avfs  
# mount avfs
```

After the file system is mounted, you can use the commands shown in CODE EXAMPLE 2-5 to create two directories for the two types of files.

**CODE EXAMPLE 2-5** Commands to Create Directories in File System `avfs`

```
# cd /avfs  
# mkdir video  
# mkdir audio
```

After the directories are created, you can use the `setfa(1)` commands shown in CODE EXAMPLE 2-6 to assign the large striped group to `video` and to assign the small striped group to `audio`. Files created in these directories are allocated on their respective striped groups because attributes are inherited.

**CODE EXAMPLE 2-6** Commands to Set File Attributes

```
# setfa -g0 video  
# setfa -g1 audio
```

For more information about the `sammkfs(1M)` command, see the `sammkfs(1M)` man page. For more information about the `mount(1M)` commands, see the `mount_samfs(1M)` man page. For more information about the `setfa(1)` command, see the `setfa(1)` man page.



## Volume Management

---

The master configuration file (`mcf`) describes all devices that are under the control of, or used by, the Sun StorEdge QFS or Sun StorEdge SAM-FS software. When you create this file, you declare attributes for each device, and you group the devices comprising each file system into family sets.

The installation and configuration process is described completely in the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*. This chapter provides additional information about configuring the file systems used in the Sun StorEdge QFS and Sun StorEdge SAM-FS environments. This chapter contains the following sections:

- “Creating the `mcf` File” on page 38
- “Examples of `mcf` Files” on page 42
- “Interactions Between File Settings, Options, and Directives” on page 45
- “Initializing a File System” on page 46
- “Configuration Examples” on page 47

---

**Note** – References to Sun StorEdge SAM-FS also apply to Sun SAM-QFS configurations when talking about storage and archive management. References to Sun StorEdge QFS also apply to Sun SAM-QFS configurations when talking about file system design and capabilities. This section refers to *Sun SAM-QFS* only when needed for clarity.

---

# Creating the mcf File

The first step toward configuring a Sun StorEdge QFS or Sun StorEdge SAM-FS file system is to create a master configuration file in `/etc/opt/SUNWsamfs/mcf`. The `mcf` file contains the information that these file systems need in order to identify and organize RAID and disk devices into file systems. It also contains entries for each automated library or device included in a file system. A sample `mcf` file is located in `/opt/SUNWsamfs/examples/mcf`.

An `mcf` file is an ASCII file that consists of lines of specification code divided into six columns, or fields. CODE EXAMPLE 3-1 shows the six fields in an `mcf` file line.

**CODE EXAMPLE 3-1** Fields in an `mcf` File

Equipment Identifier	Equipment Ordinal	Equipment Type	Family Set	Device State	Additional Parameters
----------------------	-------------------	----------------	------------	--------------	-----------------------

The following rules pertain to how data can be entered in the `mcf` file:

- Enter either space or tab characters between the fields in the file.
- You can include comment lines in an `mcf` file. Comment lines start with a pound character (#).
- Some fields do not need to contain useful information. Use a dash character (-) to indicate that an optional field contains no meaningful information.

For more information about writing the `mcf` file, see the `mcf(4)` man page. You can also use the SAM-QFS Manager to create an `mcf` file. For information about installing SAM-QFS Manager, see *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*. For information about using SAM-QFS Manager, see its online help.

The following sections describe each field in an `mcf` file:

- “The Equipment Identifier Field” on page 39
- “The Equipment Ordinal Field” on page 40
- “The Equipment Type Field” on page 40
- “The Family Set Field” on page 41
- “The Device State Field” on page 41
- “The Additional Parameters Field” on page 41

# The Equipment Identifier Field

The Equipment Identifier field is a required field. Use the Equipment Identifier field to specify the following kinds of information:

- The file system name. If this field contains a file system name, it must be identical to the Family Set name, and the subsequent lines in the `mcf` file must define all the disks or devices included in the file system. More than one file system can be declared in an `mcf` file. Typically, the first data line in an `mcf` file declares the first file system, and subsequent lines specify the devices included in the file system. Other file systems declared in the `mcf` file can be preceded by a blank comment line for readability. File system names must start with an alphabetic character and can contain only alphabetic characters, numeric characters, or underscore (`_`) characters.
- The `nodev` keyword. If this field contains the keyword `nodev`, the `mcf` file is being used as a client host in a Sun StorEdge QFS shared file system on a Solaris host. Do not use this keyword if you are running in a Sun Cluster environment. This keyword can appear in this field only as the Equipment Identifier for one or more metadata devices that reside on the metadata server. For more information about creating an `mcf` file for the members of a Sun StorEdge QFS shared file system, see the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.
- A disk partition or slice description. A `/dev/` entry in this field identifies a disk partition or slice.
- An automated library or optical drive description. If this field is a `/dev/samst` entry, it identifies an automated library or optical drive. If you are configuring a network-attached automated library, see the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide* and the *Sun StorEdge SAM-FS Storage and Archive Management Guide* for more information.
- A tape drive description. If the field is a tape drive, the entry can be in one of two forms:
  - The field can contain a `/dev/rmt` entry.
  - The field can contain a path to a symbolic link that points to the same special file that the `/dev/rmt` link points to. If you specify a tape drive in this manner, make sure you create the link before mounting the file system.

If the Equipment Identifier field contains the name of a Family Set, it is limited to 31 characters. For all other content, this field is limited to 127 characters.

# The Equipment Ordinal Field

For each row in the `mcf` file, the Equipment Ordinal field must contain a numeric identifier for the file system component or device being defined. Specify a unique integer such that  $1 \leq eq\_ord \leq 65534$ . This is a required field.

## The Equipment Type Field

Enter a 2-, 3-, or 4-character code for the Equipment Type field. This is a required field.

As TABLE 3-1 shows, a Sun StorEdge SAM-FS file system can contain either `ms` or `md` in the Equipment Type field.

**TABLE 3-1** Sun StorEdge SAM-FS Equipment Type Field

Equipment Type Field Content	Meaning
<code>ms</code>	Defines a Sun StorEdge SAM-FS file system.
<code>md</code>	Defines a striped or round-robin device for storing file data and metadata information.

As TABLE 3-2 shows, a Sun StorEdge QFS or Sun SAM-QFS file system can contain either `ma`, `md`, `mm`, `mr`, or `gXXX` in the Equipment Type field.

**TABLE 3-2** Sun StorEdge QFS or Sun SAM-QFS Equipment Type Field

Equipment Type Field Content	Meaning
<code>ma</code>	Defines a Sun StorEdge QFS or Sun SAM-QFS file system.
<code>md</code>	Defines a striped or round-robin device for storing file data.
<code>mm</code>	Defines a metadata device for storing inode and other nondata information.
<code>mr</code>	Defines a round-robin or striped data device.
<code>gXXX</code>	Striped group data device. Striped groups start with the letter <code>g</code> followed by a number. The number must be an integer such that $0 \leq XXX \leq 127$ . For example, <code>g12</code> . All members in a striped group must be the same type and size. Different striped groups within one file system are not required to have the same number of members. <code>md</code> , <code>mr</code> , and <code>gXXX</code> devices cannot be mixed in one file system.

Besides the file system equipment types, other codes are used to identify automated libraries and other devices. For more information about specific equipment types, see the `mcf(4)` man page.

## The Family Set Field

The Family Set field contains the name for a group of devices. This is a required field.

Family Set names must start with an alphabetic character and can contain only alphabetic characters, numeric characters, or underscore (`_`) characters.

For lines that define a file system, the lines that define the disk devices in a file system must all contain the same Family Set name. The software uses the Family Set to group devices with the same Family Set name together as a file system. It physically records the Family Set name on all of the devices in the file system when the `sammkfs(1M)` command is issued. You can change this name by using the `-F` and `-R` options together on the `samfsck(1M)` command. For more information about the `sammkfs(1M)` command, see the `sammkfs(1M)` man page. For more information about the `samfsck(1M)` command, see the `samfsck(1M)` man page.

For lines that define an automated library and its associated drives, the lines defining the devices must contain the same Family Set name.

For a standalone, manually loaded removable media device, this field can contain a dash (`-`).

## The Device State Field

The Device State field specifies the state of the device when the file system is initialized. Valid device states are `on` and `off`. This is an optional field. If you do not want to enter `on` or `off`, enter a dash (`-`) character to indicate that this field is omitted.

## The Additional Parameters Field

For a Sun StorEdge SAM-FS file system, the Additional Parameters field is optional and can be left completely blank. By default, library catalog files are written to `/var/opt/SUNWsamfs/catalog/family_set_name`. Use this field if you want to specify an alternate path to the library catalog file.

For a Sun StorEdge QFS shared file system, this field must contain the keyword `shared`.

For a Sun StorEdge QFS unshared file system, enter a dash or leave this field blank.

# Examples of mcf Files

Each file system configuration is unique. System requirements and actual hardware differ from site to site. The following sections show sample mcf files.

## Sun StorEdge SAM-FS Volume Management Example

For the Sun StorEdge SAM-FS file system, you can define family sets in the /etc/opt/SUNWsamfs/mcf file in the Equipment Type field using the following equipment types:

- ms for the Sun StorEdge SAM-FS file system type.
- md for the devices. Data is striped or round-robin across these devices. The stripe width is set with the -o stripe=*n* option on the mount(1M) command. The default stripe width is set based on the DAU size. For more information about stripe widths and DAU sizes, see “File System Design” on page 7.

Both metadata (including inodes, directories, allocation maps, and so on) and file data on Sun StorEdge SAM-FS file systems are located on the same disk. Data files are striped or round-robin through each disk partition defined within the same file system.

CODE EXAMPLE 3-2 shows an mcf file for a Sun StorEdge SAM-FS file system.

**CODE EXAMPLE 3-2** Example mcf File for a Sun StorEdge SAM-FS File System

# Sun StorEdge SAM-FS file system configuration example					
#					
# Equipment	Eq	Eq	Fam.	Dev.	Additional
# Identifier	Ord	Type	Set	State	Parameters
#-----	---	--	-----	-----	-----
samfs1	10	ms	samfs1		
/dev/dsk/c1t1d0s6	11	md	samfs1	-	
/dev/dsk/c2t1d0s6	12	md	samfs1	-	
/dev/dsk/c3t1d0s6	13	md	samfs1	-	
/dev/dsk/c4t1d0s6	14	md	samfs1	-	
/dev/dsk/c5t1d0s6	15	md	samfs1	-	

# Sun StorEdge QFS and Sun SAM-QFS Volume Management Examples

For the Sun StorEdge QFS and Sun SAM-QFS file systems, family sets are defined in the `/etc/opt/SUNWsamfs/mcf` file in the Equipment Type field using the following equipment types:

- `ma` for the Sun StorEdge QFS or Sun SAM-QFS file system type.
- `mm` for a metadata device. File data is not written to this device. You can specify multiple metadata devices. Metadata (including inodes, directories, allocation maps, and so on) on Sun StorEdge QFS and Sun SAM-QFS file systems is located on the metadata device(s) and is separated from the file data devices. By default, metadata is allocated using round-robin allocation if you have multiple metadata devices.
- `mr` or `md` for devices upon which file data is to be striped or round-robin.
- `gXXX` for devices upon which file data is to be striped as a group. A striped group is a logical group of devices that are striped as a unit. Data is striped across the members of each group.

Groups are specified with `g0` through `g127` equipment type numbers, with the stripe width on each device being the DAU. All devices in a striped group must be the same size. Different striped groups within one file system are not required to have the same number of members. `mr` and `gXXX` devices can be mixed in a file system, but `md` devices cannot be mixed with either `mr` or `gXXX` devices in a file system.

Data can be striped (if all groups contain the same number of devices) or round-robin between groups. The default is round robin.

Data files are striped or round-robin through each data disk partition (`mr` or `gXXX`) defined within the same file system.

## Example 1

CODE EXAMPLE 3-3 shows an `mcf` file for a Sun StorEdge QFS or Sun SAM-QFS file system with two striped groups.

**CODE EXAMPLE 3-3** Example `mcf` File Showing Striped Groups

# Sun StorEdge QFS file system configuration					
#					
# Equipment	Eq	Eq	Fam.	Dev.	Additional
# Identifier	Ord	Type	Set	State	Parameters
#-----	---	--	-----	-----	-----
qfs1	10	ma	qfs1	-	
/dev/dsk/c2t1d0s7	11	mm	qfs1	-	

**CODE EXAMPLE 3-3** Example mcf File Showing Striped Groups (Continued)

/dev/dsk/c3t0d0s6	12	g0	qfs1	-
/dev/dsk/c3t0d1s6	13	g0	qfs1	-
/dev/dsk/c4t0d0s6	14	g1	qfs1	-
/dev/dsk/c4t0d1s6	15	g1	qfs1	-

## Example 2

CODE EXAMPLE 3-4 shows an mcf file with three Sun SAM-QFS file systems.

**CODE EXAMPLE 3-4** Example mcf File Showing Three Sun SAM-QFS File Systems

# Sun SAM-QFS file system configuration example					
#					
# Equipment	Eq	Eq	Fam.	Dev.	Additional
# Identifier	Ord	Type	Set	State	Parameters
#-----	---	--	-----	-----	-----
qfs1	10	ma	qfs1	-	
/dev/dsk/c1t13d0s6	11	mm	qfs1	-	
/dev/dsk/c1t12d0s6	12	mr	qfs1	-	
#					
qfs2	20	ma	qfs2	-	
/dev/dsk/c1t5d0s6	21	mm	qfs2	-	
/dev/dsk/c5t1d0s6	22	mr	qfs2	-	
#					
qfs3	30	ma	qfs3	-	
/dev/dsk/c7t1d0s3	31	mm	qfs3	-	
/dev/dsk/c6t1d0s6	32	mr	qfs3	-	
/dev/dsk/c6t1d0s3	33	mr	qfs3	-	
/dev/dsk/c5t1d0s3	34	mr	qfs3	-	

## Example 3

CODE EXAMPLE 3-5 shows an mcf file with one Sun SAM-QFS file system that uses md devices. This mcf file also defines a tape library.

**CODE EXAMPLE 3-5** Example mcf File Showing a Sun SAM-QFS File System and a Library

# Sun SAM-QFS file system configuration example					
#					
# Equipment	Eq	Eq	Fam.	Dev.	Additional
# Identifier	Ord	Type	Set	State	Parameters
#-----	---	--	-----	-----	-----



**CODE EXAMPLE 3-5** Example `mcf` File Showing a Sun SAM-QFS File System and a Library (Continued)

<code>samfs1</code>	<code>10</code>	<code>ma</code>	<code>samfs1</code>	<code>-</code>
<code>/dev/dsk/c1t2d0s6</code>	<code>11</code>	<code>mm</code>	<code>samfs1</code>	<code>-</code>
<code>/dev/dsk/c1t3d0s6</code>	<code>12</code>	<code>md</code>	<code>samfs1</code>	<code>-</code>
<code>/dev/dsk/c1t4d0s6</code>	<code>13</code>	<code>md</code>	<code>samfs1</code>	<code>-</code>
<code>/dev/dsk/c1t5d0s6</code>	<code>14</code>	<code>md</code>	<code>samfs1</code>	<code>-</code>
<code># scalar 1000 and</code>	<code>12</code>	<code>AIT</code>	<code>tape</code>	<code>drives</code>
<code>/dev/samst/c5t0u0</code>	<code>30</code>	<code>rb</code>	<code>robot1</code>	<code>-</code>
<code>/dev/rmt/4cbn</code>	<code>101</code>	<code>tp</code>	<code>robot1</code>	<code>on</code>
<code>/dev/rmt/5cbn</code>	<code>102</code>	<code>tp</code>	<code>robot1</code>	<code>on</code>
<code>/dev/rmt/6cbn</code>	<code>103</code>	<code>tp</code>	<code>robot1</code>	<code>on</code>
<code>/dev/rmt/7cbn</code>	<code>104</code>	<code>tp</code>	<code>robot1</code>	<code>off</code>
<code>/dev/rmt/10cbn</code>	<code>105</code>	<code>tp</code>	<code>robot1</code>	<code>on</code>
<code>/dev/rmt/11cbn</code>	<code>106</code>	<code>tp</code>	<code>robot1</code>	<code>on</code>
<code>/dev/rmt/3cbn</code>	<code>107</code>	<code>tp</code>	<code>robot1</code>	<code>on</code>
<code>/dev/rmt/2cbn</code>	<code>108</code>	<code>tp</code>	<code>robot1</code>	<code>on</code>
<code>/dev/rmt/1cbn</code>	<code>109</code>	<code>tp</code>	<code>robot1</code>	<code>on</code>
<code>/dev/rmt/0cbn</code>	<code>110</code>	<code>tp</code>	<code>robot1</code>	<code>on</code>
<code>/dev/rmt/9cbn</code>	<code>111</code>	<code>tp</code>	<code>robot1</code>	<code>on</code>
<code>/dev/rmt/8cbn</code>	<code>112</code>	<code>tp</code>	<code>robot1</code>	<code>on</code>

For more examples showing file system configuration in the `mcf` file, see the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.

---

## Interactions Between File Settings, Options, and Directives

The `mcf` file defines each file system, but file system behavior depends on interactions between default systems settings, settings in the `/etc/vfstab` file, settings in the `samfs.cmd` file, and options on the `mount(1M)` command line.

You can specify some mount options, for example the stripe width, in more than one place. When this happens, settings in one place can override the settings in another.

For information about the various ways to specify mount options, see “Mounting a File System” on page 66.

# Initializing a File System

The `sammkfs(1M)` command constructs new file systems, and its `-a allocation_unit` option allows you to specify the DAU setting. The number specified for `allocation_unit` determines the DAU setting.

The 4.2 releases of these file systems support two different superblock designs. In CODE EXAMPLE 3-6, the `samfsinfo(1M)` command output shows which superblock a file system is using.

**CODE EXAMPLE 3-6** `samfsinfo(1M)` Command Example

# <b>samfsinfo samfs1</b>				
name:	samfs1	version:		2
time:	Wed Feb 21 13:32:18 1996			
count:	1			
capacity:	001240a0	DAU:		16
space:	000d8ea0			
ord	eq	capacity	space	device
0	10	001240a0	000d8ea0	/dev/dsk/c1t1d0s0

The first line of the preceding output indicates that this is a version 2 superblock. Be aware of the following operational and feature differences that pertain to these superblocks:

- Releases before 4.0 support only the version 1 superblock design.
- The 4.0 and later releases support the version 2 superblock. If you installed the 4.0 software as an upgrade, you must use the 4.0 or later `sammkfs(1M)` command to reinitialize your existing file systems before you attempt to use any of the features that depend on the version 2 superblock. Certain features, such as access control lists (ACLs) and the Sun StorEdge QFS shared file system, are supported only in the version 2 superblock. Reinitializing a file system is described as a step in the software installation upgrade process, but you can do this any time after the software is installed.



---

**Caution** – File systems that use a version 2 superblock cannot revert to a release before 4.0. You cannot use 4.3 release software to create a version 1 superblock.

---

For more information about features that require a version 2 superblock, or on using the `sammkfs(1M)` command to create the version 2 superblock, see the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.

## Example

CODE EXAMPLE 3-7 shows using the `sammkfs(1M)` command to initialize a Sun StorEdge SAM-FS file system using a version 2 superblock.

### CODE EXAMPLE 3-7 Initializing a File System with a Version 2 Superblock

```
# sammkfs -a 64 samfs1
Building 'samfs1' will destroy the contents of devices:
    /dev/dsk/c1t9d0s2
    /dev/dsk/c8t1d0s2
    /dev/dsk/c8t5d0s2
    /dev/dsk/c8t6d0s2
Do you wish to continue? [y/N] y
total data kilobytes      = 1715453952
total data kilobytes free = 1715453760
total meta kilobytes      = 17684128
total meta kilobytes free = 17680304
```

For more information about the `sammkfs(1M)` command, see the `sammkfs(1M)` man page.

---

## Configuration Examples

The rest of this chapter presents sample configurations and shows various steps and considerations in setting up the `mcf` file on a server. The following procedures are described:

- “To Create a Sun StorEdge QFS Round-Robin Disk Configuration” on page 48
- “To Create a Sun StorEdge SAM-FS Round-Robin Disk Configuration” on page 49
- “To Create a Sun StorEdge QFS Striped Disk Configuration” on page 50
- “To Create a Sun StorEdge SAM-FS Striped Disk Configuration” on page 52
- “To Create a Sun StorEdge QFS Striped Groups Configuration” on page 53

Note that all sample Sun StorEdge QFS configurations could have automated libraries and other removable media devices defined as well, essentially extending the file system beyond the size of the disk cache. Removable media device configurations are shown in only one example. For information about configuring removable media devices see the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.

The sample configurations assume that the file system is loaded on the system and all file systems are unmounted.

# ▼ To Create a Sun StorEdge QFS Round-Robin Disk Configuration

This sample configuration illustrates a Sun StorEdge QFS file system that separates the metadata onto a low-latency disk. Round-robin allocation is used on four partitions. Each disk is on a separate controller.

This procedure assumes the following:

- The metadata device is a single partition (s6) used on controller 5, logical unit number (LUN) 0 of the device designated as Equipment Ordinal 11.
- The data devices consist of four disks attached to four controllers.

1. Use an editor to create the `mcf` file.

CODE EXAMPLE 3-8 shows an example `mcf` file.

CODE EXAMPLE 3-8 Example Sun StorEdge QFS Round Robin `mcf` File

```
# Sun StorEdge QFS disk cache configuration
# Round-robin mcf example

# Equipment      Eq  Eq  Fam.  Dev  Additional
# Identifier     Ord Type Set   State Parameters
#-----
qfs1             1  ma  qfs1
/dev/dsk/c5t0d0s6 11 mm  qfs1  on
/dev/dsk/c1t1d0s6 12 mr  qfs1  on
/dev/dsk/c2t1d0s6 13 mr  qfs1  on
/dev/dsk/c3t1d0s6 14 mr  qfs1  on
/dev/dsk/c4t1d0s6 15 mr  qfs1  on
```

2. Use the `mkdir(1)` command to create the `/qfs` mount point for the `/qfs1` file system.

For example:

```
# mkdir /qfs
```

3. Use the `sammkfs(1M)` command to initialize the file system.

The following example uses the default 64-kilobyte DAU:

```
# sammkfs qfs1
```

**4. Use an editor to modify the `/etc/vfstab` file.**

The Sun StorEdge QFS file system with `mr` data devices uses striped allocation as a default, so you must set `stripe=0` for round-robin allocation. To explicitly set round-robin on the file system, set the `stripe=0`, as follows:

```
qfs1      -      /qfs      samfs      -      yes      stripe=0
```

**5. Use the `mount(1M)` command to mount the file system.**

For example:

```
# mount /qfs
```

## ▼ To Create a Sun StorEdge SAM-FS Round-Robin Disk Configuration

This sample configuration illustrates a Sun StorEdge SAM-FS file system. Striped allocation is used by default on four partitions. You must set `stripe=0` to specify round-robin allocation. The file system is created using the `sammkfs(1M)` command. The data devices consist of four disks attached to four controllers. Each disk is on a separate controller.

**1. Use an editor to create the `mcf` file.**

CODE EXAMPLE 3-9 shows an example `mcf` file.

**CODE EXAMPLE 3-9** Example Sun StorEdge SAM-FS Round Robin `mcf` File

```
# Sun StorEdge SAM-FS disk cache configuration
# Round-robin mcf example

# Equipment      Eq  Eq  Fam.  Dev  Additional
# Identifier      Ord Type Set  State Parameters
#-----
samfs1            1  ms   samfs1
/dev/dsk/c1t1d0s6 11  md   samfs1 on
/dev/dsk/c2t1d0s6 12  md   samfs1 on
/dev/dsk/c3t1d0s6 13  md   samfs1 on
/dev/dsk/c4t1d0s6 14  md   samfs1 on
```

2. Use the `mkdir(1)` command to create the `/samfs` mount point for the `/samfs1` file system.

For example:

```
# mkdir /samfs
```

3. Use the `sammkfs(1M)` command to initialize the file system.

The default DAU is 16 kilobytes, but the following example sets the DAU size to 64 kilobytes:

```
# sammkfs -a 64 samfs1
```

4. Use an editor to modify the `/etc/vfstab` file.

The Sun StorEdge SAM-FS file system uses striped allocation by default, so you must set `stripe=0` for round-robin allocation. To explicitly set round-robin on the file system, set the `stripe=0`, as follows:

```
samfs1      -      /samfs      samfs      -      yes      stripe=0
```

5. Use the `mount(1M)` command to mount the file system.

For example:

```
# mount /samfs
```

## ▼ To Create a Sun StorEdge QFS Striped Disk Configuration

This sample configuration illustrates a Sun StorEdge QFS file system. By default, file data is striped to four data partitions.

This procedure assumes the following:

- The metadata device is a single partition (`s6`) used on controller 0, LUN 1. Metadata is written to equipment ordinal 11 only.
- The data devices consist of four disks attached to four controllers. Each disk is on a separate controller.

1. Use an editor to create the `mcf` file.

CODE EXAMPLE 3-10 shows an example `mcf` file.

**CODE EXAMPLE 3-10** Example Sun StorEdge QFS Striped Disk `mcf` File

```
# Sun StorEdge QFS disk cache configuration
# Striped Disk mcf example

# Equipment      Eq   Eq   Fam.  Dev.  Additional
# Identifier     Ord  Type Set   State Parameters
#-----
qfs1             10   ma   qfs1
/dev/dsk/c0t1d0s6 11   mm   qfs1   on
/dev/dsk/c1t1d0s6 12   mr   qfs1   on
/dev/dsk/c2t1d0s6 13   mr   qfs1   on
/dev/dsk/c3t1d0s6 14   mr   qfs1   on
/dev/dsk/c4t1d0s6 15   mr   qfs1   on
```

2. Use the `mkdir(1)` command to create the `/qfs` mount point for the `/qfs1` file system.

For example:

```
# mkdir /qfs
```

3. Use the `sammkfs(1M)` command to initialize the file system.

The default DAU is 64 kilobytes, but the following example sets the DAU size to 128 kilobytes:

```
# sammkfs -a 128 qfs1
```

With this configuration, any file written to this file system is striped across all of the devices in increments of 128 kilobytes.

4. Use an editor to modify the `/etc/vfstab` file.

The Sun StorEdge SAM-FS file system uses striped allocation by default. This example sets the stripe width as `stripe=1` DAU, which is the default. The following setting stripes data across all four of the `mr` devices with a stripe width of one DAU:

```
qfs1      -      /qfs      samfs      -      yes      stripe=1
```

5. Use the `mount(1M)` command to mount the file system.

For example:

```
# mount /qfs
```

## ▼ To Create a Sun StorEdge SAM-FS Striped Disk Configuration

This sample configuration illustrates a Sun StorEdge SAM-FS file system.

1. Use an editor to create the `mcf` file.

CODE EXAMPLE 3-11 shows an example `mcf` file. The data devices consist of four disks attached to four controllers. Each disk is on a separate LUN.

**CODE EXAMPLE 3-11** Example Sun StorEdge SAM-FS Striped Disk `mcf` File

```
# Sun StorEdge SAM-FS disk cache config
# Striped Disk mcf example

# Equipment      Eq  Eq  Fam.  Dev.  Additional
# Identifier      Ord Type Set  State Parameters
#-----
samfs1            10  ms  samfs1
/dev/dsk/c1t1d0s6 11  md  samfs1  on
/dev/dsk/c2t1d0s6 12  md  samfs1  on
/dev/dsk/c3t1d0s6 13  md  samfs1  on
/dev/dsk/c4t1d0s6 14  md  samfs1  on
```

2. Use the `mkdir(1)` command to create the `/samfs` mount point for the `/samfs1` file system.

For example:

```
# mkdir /samfs
```

3. Use the `sammkfs(1M)` command to initialize the file system.

The following example uses the default 16-kilobyte DAU:

```
# sammkfs samfs1
```

With this striped disk configuration, any file written to this file system is striped across all of the devices in increments of 16 kilobytes.



4. Use an editor to modify the `/etc/vfstab` file.

Specify the mount point for this file system in `/etc/vfstab`.

5. Use the `mount(1M)` command to mount the file system.

For example:

```
# mount /samfs
```

## ▼ To Create a Sun StorEdge QFS Striped Groups Configuration

Striped groups allow you to group RAID devices together for very large files. A DAU is represented by one bit in the bit maps. If the striped group has  $n$  devices,  $n$  multiplied by the DAU is the minimum allocation. Only one bit in the bit maps is used to represent  $n \times$  DAU. This method of writing huge DAUs across RAID devices saves bit map space and system update time. Striped groups are useful for writing very large files to a group of RAID devices and for streaming large amounts of data to and from disk.

---

**Note** – The minimum disk space allocated in a striped group is as follows:

$$\text{minimum\_disk\_space\_allocated} = \text{DAU} \times \text{number\_of\_disks\_in\_the\_group}$$

Writing a single byte of data fills the entire minimum disk space allocated in a striped group. Striped groups are used for very specific applications. Make sure that you understand the effects of using striped groups with your file system.

---

Files with lengths less than the aggregate stripe width times the number of devices (in this example, files less than 128 kilobytes  $\times$  4 disks = 512 kilobytes in length) still use 512 kilobytes of disk space. Files larger than 512 kilobytes have space allocated for them as needed in total space increments of 512 kilobytes.

The devices within a striped group must be the same size. It is not possible to add devices to increase the size of a striped group. You can use the `samgrowfs(1M)` command to add additional striped groups, however. For more information about this command, see the `samgrowfs(1M)` man page.

This sample configuration illustrates a Sun StorEdge QFS file system that separates the metadata onto a low-latency disk. Two striped groups are set up on four drives.

This procedure assumes the following:

- The metadata device is a single partition (s6) used on controller 0, LUN 1.
- The data devices consist of four disks (two groups of two identical disks) attached to four controllers. Each disk is on a separate LUN. The entire disk is used for data storage, assuming that partition 6 occupies the entire disk.

**1. Use an editor to create the mcf file.**

CODE EXAMPLE 3-12 shows an example mcf file.

**CODE EXAMPLE 3-12** Example Sun StorEdge QFS Striped Group mcf File

```
# Sun StorEdge QFS disk cache configuration
# Striped Groups mcf example

# Equipment      Eq   Eq   Fam.  Dev.  Additional
# Identifier      Ord  Type Set   State Parameters
#-----
qfs1              10   ma   qfs1
/dev/dsk/c0t1d0s6 11   mm   qfs1   on
/dev/dsk/c1t1d0s6 12   g0   qfs1   on
/dev/dsk/c2t1d0s6 13   g0   qfs1   on
/dev/dsk/c3t1d0s6 14   g1   qfs1   on
/dev/dsk/c4t1d0s6 15   g1   qfs1   on
```

**2. Use the mkdir(1) command to create the /qfs mount point for the /qfs1 file system.**

For example:

```
# mkdir /qfs
```

**3. Use the sammkfs(1M) command to initialize the file system.**

The following example sets the DAU size to 128 kilobytes:

```
# sammkfs -a 128 qfs1
```

**4. Use an editor to modify the `/etc/vfstab` file.**

The following example uses the default setting of `stripe=0`, which essentially specifies a round-robin allocation from striped group `g0` to striped group `g1`:

```
qfs1      -      /qfs      samfs      -      yes      stripe=0
```

This `/etc/vfstab` file sets the stripe width using the `stripe=` option. In this example, there are two striped groups, `g0` and `g1`. With the `stripe=0` specification, devices 12 and 13 are striped, and files are written round-robin around the two striped groups. You are really treating a striped group as a bound entity. That is, you cannot change the configuration of the striped group, after it is created, without issuing another `sammkfs(1M)` command.

**5. Use the `mount(1M)` command to mount the file system.**

For example:

```
# mount /qfs
```



## File System Operations

---

This chapter presents topics related to file system operations. This chapter contains the following sections:

- “Initializing a File System” on page 58
- “Propagating Configuration File Changes to the System” on page 58
- “Mounting a File System” on page 66
- “Unmounting a File System” on page 69
- “Checking File System Integrity and Repairing File Systems” on page 71
- “Preserving Information for an Upgrade” on page 74
- “Preparing for a Hardware Device Upgrade” on page 78
- “Adding Disk Cache to a File System” on page 80
- “Replacing Disks in a File System” on page 81
- “Upgrading a Host System” on page 84
- “Upgrading the Solaris OS” on page 85

Certain other types of operations and upgrades also need to be performed within Sun StorEdge QFS and Sun StorEdge SAM-FS environments. The following publications describe these other types of operations:

- The *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide* describes installing, upgrading, and configuring Sun StorEdge QFS and Sun StorEdge SAM-FS software. It also describes how to create dump files of Sun StorEdge QFS and Sun StorEdge SAM-FS file systems.
- The *Sun StorEdge SAM-FS Storage and Archive Management Guide* describes how to add slots in an automated library, how to upgrade or replace an automated library, and how to upgrade DLT tape drives.
- The *Sun QFS, Sun SAM-FS, and Sun SAM-QFS Disaster Recovery Guide* describes how to restore Sun StorEdge QFS and Sun StorEdge SAM-FS file systems.

---

# Initializing a File System

You can use the `sammkfs(1M)` command to initialize or reinitialize a Sun StorEdge QFS or Sun StorEdge SAM-FS file system. The following example shows the `sammkfs(1M)` command in its simplest form, with the file system name as its only argument:

```
# sammkfs samqfs1
```

The preceding command builds a version 2 superblock for a standalone Sun StorEdge QFS or Sun SAM-QFS file system. The Sun StorEdge QFS and Sun StorEdge SAM-FS file systems support two different superblocks. The Sun StorEdge QFS and Sun StorEdge SAM-FS 4.3 releases support existing file systems with version 1 superblocks but do not allow you to create a version 1 superblock.

For more information about the `sammkfs(1M)` command, its options, and the implications of the version 1 and version 2 superblocks, see “Initializing a File System” on page 46, or see the `sammkfs(1M)` man page. For information about using the `sammkfs(1M)` command to initialize a shared Sun StorEdge QFS file system, see the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.

---

# Propagating Configuration File Changes to the System

This section contains procedures that describe how to propagate configuration file changes out to the system. The procedures describe propagating changes for the following files:

- `mcf` file
- `defaults.conf` file
- `archiver.cmd` file (Sun SAM-QFS file systems only)
- `stager.cmd` file (Sun SAM-QFS file systems only)
- shared hosts file (Sun StorEdge QFS shared and Sun SAM-QFS shared file systems only)

You must perform these procedures under the following circumstances:

- If you update any of these files in order to add, delete, or correct information.
- If you create or update an `archiver.cmd`, `defaults.conf`, or `stager.cmd` file after your Sun StorEdge QFS or Sun StorEdge SAM-FS system is already operational.

The following sections describe the procedures:

- “To Change `mcf(4)` or `defaults.conf(4)` Information in a Sun StorEdge QFS Environment” on page 59
- “To Change `mcf(4)` or `defaults.conf(4)` File System Information in a Sun StorEdge SAM-FS or Sun SAM-QFS Environment” on page 60
- “To Change `mcf(4)` or `defaults.conf(4)` Removable Media Drive Information” on page 61
- “To Change `archiver.cmd(4)` or `stager.cmd(4)` Information” on page 63
- “To Change the Shared Hosts File Information on a Mounted File System” on page 63
- “To Change the Shared Hosts File Information on an Unmounted File System” on page 64

## ▼ To Change `mcf(4)` or `defaults.conf(4)` Information in a Sun StorEdge QFS Environment

To change the `mcf` or the `defaults.conf` information for a shared file system that is configured for high availability in a Sun Cluster environment, perform this procedure on all participating nodes in the Sun Cluster.

1. Use `vi(1)` or another editor to edit the file and change the file system information.
2. Use the `sam-fsd(1M)` command to check the `mcf` file for errors. (Optional)

Perform this step if you are changing an `mcf` file. The format of this command is as follows:

```
# sam-fsd
```

If the output from this command shows errors, correct them before proceeding to the next step.

3. Use the `samd(1M)` `config` command to propagate the `mcf` or `defaults.conf` file changes.

For example:

```
# samd config
```

For more information about these files, see the `defaults.conf(4)` or `mcf(4)` man pages.

## ▼ To Change `mcf(4)` or `defaults.conf(4)` File System Information in a Sun StorEdge SAM-FS or Sun SAM-QFS Environment

1. Use `vi(1)` or another editor to edit the file and change the file system information.
2. Use the `sam-fsd(1M)` command to check the `mcf` file for errors. (Optional)

Perform this step if you are changing an `mcf` file. The format of this command is as follows:

```
# sam-fsd
```

If the output from this command shows errors, correct them before proceeding to the next step.

3. Issue a `samcmd(1M)` `aridle` command to idle the archiver for each file system defined in the `mcf` file. (Optional)

You must perform this step if you are removing or changing information related to one or more file systems. Use this command in the following format:

```
samcmd aridle fs.fsname
```

For *fsname*, specify the name of a file system defined in the `mcf` file. Issue this command for every file system in the `mcf` file that is affected by the change.



4. **Issue a `samcmd(1M)` `idle` command to idle the archiver for each equipment ordinal assigned to a drive in the `mcf` file. (Optional)**

You must perform this step if you are removing or changing information related to one or more drives. Use this command in the following format:

```
samcmd idle eq
```

For *eq*, specify the Equipment Ordinal of a drive defined in the `mcf` file. Repeat this command as necessary for all drives in your `mcf` file affected by the change.

5. **Issue the `umount(1M)` command to unmount the file system(s) affected by the changes.**

For more information about unmounting the file system, see “Unmounting a File System” on page 69.

6. **Use the `samd(1M)` `config` command to propagate the changes.**

For example:

```
# samd config
```

7. **Use the `mount(1M)` command to remount the file system(s) you unmounted.**

For more information about these files, see the `defaults.conf(4)` or `mcf(4)` man pages.

## ▼ To Change `mcf(4)` or `defaults.conf(4)` Removable Media Drive Information

1. **Edit the file and change the removable media drive information.**
2. **Use the `sam-fsd(1M)` command to check the `mcf` file for errors. (Optional)**

Perform this step if you are changing an `mcf` file. Use this command in the following format:

```
# sam-fsd
```

If the output from this command shows errors, correct them before proceeding to the next step.

**3. Issue a `samcmd(1M)` `aridle` command to idle the archiver for each file system defined in the `mcf` file. (Optional)**

Perform this step if you are removing or changing information related to one or more file systems. Use this command in the following format:

```
samcmd aridle fs.fsname
```

For *fsname*, specify the name of a file system defined in the `mcf` file. Issue this command for every file system in the `mcf` file that is affected by the change.

**4. Issue a `samcmd(1M)` `idle` command for each Equipment Ordinal assigned to a drive in the `mcf` file. (Optional)**

Perform this step if you are removing or changing information related to one or more drives. Use this command in the following format:

```
samcmd idle eq
```

For *eq*, specify the Equipment Ordinal of a drive defined in the `mcf` file. Repeat this command as necessary for all drives in your `mcf` file affected by the change.

**5. Use the `samd(1M)` `stop` command to stop all removable media activity.**

For example:

```
# samd stop
```

**6. Use the `samd(1M)` `config` command to propagate the changes and restart the system.**

For example:

```
# samd config
```

**7. Use the `samd(1M)` `start` command to start all removable media activity.**

For example:

```
# samd start
```

For more information about these files, see the `defaults.conf(4)` or `mcf(4)` man pages.

## ▼ To Change `archiver.cmd(4)` or `stager.cmd(4)` Information

1. Use `vi(1)` or another editor to edit the `archiver.cmd(4)` or `stager.cmd(4)` file.
2. Use the `archiver(1M) -lv` command to validate the changes you made in the `archiver.cmd(4)` file. (Optional)  
Perform this step only if you are changing an existing `archiver.cmd(4)` file.
3. Save and close the file.
4. Use the `samd(1M) config` command to propagate the file changes and restart the system.

For example:

```
# samd config
```

## ▼ To Change the Shared Hosts File Information on a Mounted File System

Use this procedure to add new host entries or change columns 2 through 5 of the existing shared hosts file entries.

1. If you do not know the host that is acting as the metadata server, issue the `samsharefs(1M) file-system-name` command to view the metadata server name.  
Issue this command from any host that has the file system configured.

For example:

```
# samsharefs sharefs1
```

2. On the metadata server, save the shared hosts file to a temporary working file.

For example:

```
# samsharefs sharefs1 > /tmp/file
```

### 3. Save a copy of the shared hosts file. (Optional)

For example:

```
# cp /tmp/file /var/opt/SUNWsamfs/hosts.date
```

### 4. Use vi(1) or another editor to edit the /tmp/file file.

For mounted file systems, you can add new host entries to the end of the file and you can make changes to columns 2 through 5 of the existing entries.

---

**Note** – You cannot change the host names, reorder the entries, or insert entries in the shared hosts file on a mounted file system. To make these changes, unmount the file system on all clients, unmount the metadata server, and then follow the instructions in “To Change the Shared Hosts File Information on an Unmounted File System” on page 64.

---

### 5. Save and close the shared hosts file.

### 6. Copy the new shared hosts file to the SUNWsamfs directory.

For example:

```
# cp /tmp/file /var/opt/SUNWsamfs/hosts.sharefs1
```

### 7. Apply the new shared hosts file to the file system.

For example:

```
# samsharefs -u sharefs1
```

## ▼ To Change the Shared Hosts File Information on an Unmounted File System

Use this procedure to change host names, reorder entries, and insert entries in the shared hosts file.

1. If you do not know the host that is acting as the metadata server, issue the `samsharefs(1M) -R file-system-name` command to view the metadata server name. Issue this command from any host that has the file system configured. For example:

```
# samsharefs -R sharefs1
```

2. Unmount the file system on each participating client, and then on the metadata server.
3. On the metadata server, save the shared hosts file to a temporary working file. For example:

```
# samsharefs -R sharefs1 > /tmp/file
```

4. Save a copy of the shared hosts file. (Optional) For example:

```
# cp /tmp/file /var/opt/SUNWsamfs/hosts.date
```

5. Use `vi(1)` or another editor to edit the `/tmp/file` file. For unmounted file systems, you can change host names, reorder entries, insert entries, add new host entries, and edit columns 2 through 5 of existing entries.
6. Save and close the shared hosts file.
7. Copy the new shared hosts file to the `SUNWsamfs` directory. For example:

```
# cp /tmp/file /var/opt/SUNWsamfs/hosts.sharefs1
```

8. Apply the new shared hosts file to the file system. For example:

```
# samsharefs -uR sharefs1
```

9. Mount the file system on the metadata server, and then on the clients.

---

# Mounting a File System

You can mount a Sun StorEdge QFS or Sun StorEdge SAM-FS file system by using the Solaris OS `mount(1M)` command. This section describes the various ways that mount options can be specified.

Mount parameters are used to manipulate file system characteristics. There are several ways to specify mount parameters, and some specification methods override others. You can specify mount options in the following ways:

- With the `mount(1M)` command using command line options. Highest priority. Options specified on the Solaris OS `mount(1M)` command line override other options specified in the `/etc/vfstab` file, directives specified in the `samfs.cmd` file, and system default settings.
- As `/etc/vfstab` file settings. Second priority.
- In the `samfs.cmd` file using directives. Third priority.
- System defaults. Fourth (lowest) priority. The default system settings are the configurable settings already defined for your Solaris OS. You can override the system settings with specifications in the `samfs.cmd` file, in the `/etc/vfstab` file, and on the `mount(1M)` command.

You can also specify mount options by using the `samu(1M)` operator utility or the `samcmd(1M)` command. Mount options enabled or disabled by using any of these utilities persist until the file system is unmounted.

The following sections describe the ways to specify mount options in more detail, explain when to use these files and commands, and show the order in which they take precedence. In addition to the following sections, the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide* includes information about mounting a file system.

## The `mount(1M)` Command

The Solaris OS `mount(1M)` command mounts the file system and enables you to specify settings that override the settings specified in the `/etc/vfstab` file and in the `/etc/opt/SUNWsamfs/samfs.cmd` file. For example, you can specify the stripe width, readahead, writebehind, high and low water marks for disk cache utilization, and so on.

One way to use the `mount(1M)` command in conjunction with the `samfs.cmd` file is to use the `samfs.cmd` file as your main location for mount options and to use options on the `mount(1M)` command when experimenting with or tuning your system. The `mount(1M)` command options override both the `/etc/vfstab` entries and the directives in the `samfs.cmd` file.

**Example.** The following command mounts file system `qfs1` at `/work` with `setuid` execution disallowed and `qwrite` enabled. The `qfs1` file system name is the Equipment Identifier. This also appears in the `mcf` file's Equipment Identifier field for this file system. To specify more than one mount option, separate each with a comma.

```
# mount -o nosuid,qwrite qfs1 /work
```

If you are mounting a Sun StorEdge QFS or Sun SAM-QFS shared file system, you must mount the file system on the metadata server first, and then mount the file system on each participating client host. Include the `shared` option with the `mount` command, and keep in mind that the command is identical on the metadata server and on the participating hosts.

For more information about the `mount(1M)` command, see the `mount_samfs(1M)` man page.

## The /etc/vfstab File

The `/etc/vfstab` Solaris OS system file must contain a line for each Sun StorEdge QFS or Sun StorEdge SAM-FS file system that is defined in the `mcf` file. This is required to mount the file system. For each file system, you must provide information for the seven fields shown in TABLE 4-1.

**TABLE 4-1** Fields in the `/etc/vfstab` File

Field Number	Content
1	The file system family set name.
2	The file system to <code>samfsck(1M)</code> .
3	The mount point.
4	The file system type. This is always <code>samfs</code> , even for Sun StorEdge QFS file systems.
5	The <code>samfsck(1M)</code> pass.
6	Mount at boot options.
7	Mount parameters.

The fields in the `/etc/vfstab` file must be separated by either space or tab characters. The mount parameters in the seventh field, however, must each be separated by a comma character (,) without any intervening spaces.

**Example.** The following is an example of an `/etc/vfstab` file.

<code>qfs1</code>	<code>-</code>	<code>/qfs</code>	<code>samfs</code>	<code>-</code>	<code>yes</code>	<code>stripe=0</code>
-------------------	----------------	-------------------	--------------------	----------------	------------------	-----------------------

The mount parameters field can contain any of the mount parameters listed as arguments to the `-o` option on the `mount_samfs(1M)` man page. These parameters are nearly identical to those that you can specify as directive lines in the `samfs.cmd` file or as arguments to the `-o` option on the `mount(1M)` command. As with the `samfs.cmd` file, you can include specifications for various I/O settings, readahead, writebehind, the stripe width, various storage and archive management (SAM) settings, Qwrite, and other features.

For more information about possible mount parameters, see the `mount_samfs(1M)` man page. For more information about modifying the `/etc/vfstab` file, see the `vfstab(4)` man page.

## The `samfs.cmd` File

The `/etc/opt/SUNWsamfs/samfs.cmd` file enables you to specify mount parameters for all your Sun StorEdge QFS and Sun StorEdge SAM-FS file systems. This file can be useful when you have multiple file systems configured and you want to specify the same mount parameters for them.

The list of possible mount parameters is very comprehensive. The possible mount parameters you can specify pertain to I/O settings, readahead, writebehind, the stripe width, various storage and archive management (SAM) settings, Qwrite, and other features.

Using this file enables you to define all your mount parameters in one place in an easily readable format. Directives specified toward the beginning of this file are global directives, and they apply to all Sun StorEdge QFS and Sun StorEdge SAM-FS file systems. The second part of this file enables you to indicate the specific parameters that you want to apply to each individual file system. The ability to specify the common parameters once, and only in one place, differentiates this file from the `/etc/vfstab` file, in which you must specify all mount parameters for each file system in the seventh field.

The mount parameters that can be specified in the `samfs.cmd` file are nearly identical to those that you can specify in the `/etc/vfstab` file or as arguments to the `-o` option on the `mount(1M)` command. For more information about the mount parameters that can be specified in this file, see the `samfs.cmd(4)` man page.



In the `samfs.cmd` file, the directives are written one per line. The file can contain comments, which must begin with a pound character (`#`). Characters that appear to the right of the pound character are treated as comments.

Directives that appear before any `fs =` line apply globally to all file systems. A line that starts with `fs =` must precede directives that are specific to a particular file system. Directives specific to a particular file system override global directives.

CODE EXAMPLE 4-1 is a sample `samfs.cmd` file that sets the low and high water marks for disk cache utilization and specifies individualized parameters for two file systems.

**CODE EXAMPLE 4-1** Example `samfs.cmd` File

```
low = 50
high = 75
fs = samfs1
    high = 65
    writebehind = 512
    readahead = 1024
fs = samfs5
    partial = 64
```

The directives in the `samfs.cmd` file serve as defaults and override any default system settings, but arguments to the `mount(1M)` command override any directives in this file. Entries in the `/etc/vfstab` file also override directives specified in the `samfs.cmd` file.

For information about which directives can be entered in the `samfs.cmd` file, see the `samfs.cmd(4)` man page. For information about the `mount(1M)` command, see the `mount_samfs(1M)` man page.

---

## Unmounting a File System

You can use the Solaris OS `umount(1M)` command to unmount Sun StorEdge QFS and Sun StorEdge SAM-FS file systems.

On Sun StorEdge SAM-FS and Sun SAM-QFS file systems, you must issue commands to stop the archiver before unmounting the file system. The following procedure shows you how to idle the archiver and unmount the file system. You do not need to idle the archiver if you are using a Sun StorEdge QFS file system.

## ▼ To Unmount Standalone Sun StorEdge SAM-FS and Sun SAM-QFS File Systems

### 1. Issue a `samcmd(1M)` `aridle fs.fsname` command for the file system. (Optional)

Perform this step if you are unmounting a Sun StorEdge SAM-FS or Sun SAM-QFS file system. For example:

```
# samcmd aridle fs.samqfs2
```

This step in the procedure cleanly halts the archiving for file system `samqfs2`. Specifically, it allows archiving operations to halt at a logical place before stopping the daemons.

### 2. Issue a `samd(1M)` `stop` command. (Optional)

For example:

```
# samd stop
```

### 3. Unmount the file system.

```
# umount /samqfs
```

Several conditions can be present in a file system at unmounting time, so you might need to issue the `umount(1M)` command a second time. If the file system still does not unmount, use `unshare(1M)`, `fuser(1M)`, or other commands in conjunction with the `umount(1M)` command. Unmounting procedures are also described in the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.

## ▼ To Unmount Sun StorEdge QFS and Sun SAM-QFS Shared File Systems

The `umount(1M)` command unmounts a shared file system from a Solaris system. For more information about the `umount(1M)` command, see the `umount(1M)` man page.

1. Use the `umount(1M)` command to unmount the file system on every participating client host.

```
# umount /samqfs
```

2. On the metadata server, halt the archiving for the file system at a logical place by issuing the `samcmd(1M) aridle fs.fsname` command. (Optional)

Perform this step in a Sun SAM-QFS file system environment.

For example:

```
# samcmd aridle fs.samqfs2
```

This example halts the archiving for file system `samqfs2`.

3. Unmount the file system on the metadata server.

```
# umount /samqfs
```

Unmount the metadata server only after unmounting all client hosts.

Several conditions can be present in a file system at unmounting time, so you might need to issue the `umount(1M)` command a second time. If the file system still does not unmount, use `unshare(1M)`, `fuser(1M)`, or other commands in conjunction with the `umount(1M)` command. Unmounting procedures are also described in the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.

---

## Checking File System Integrity and Repairing File Systems

Sun StorEdge QFS and Sun StorEdge SAM-FS file systems write validation records in the following records that are critical to file system operations: directories, indirect blocks, and inodes. If the file system detects corruption while searching a directory,

it issues an EDOM error, and the directory is not processed. If an indirect block is not valid, it issues an ENOCSI error, and the file is not processed. TABLE 4-2 summarizes these error indicators.

**TABLE 4-2** Error Indicators

Error	Solaris OS Meaning	Sun StorEdge QFS and Sun StorEdge SAM-FS Meaning
EDOM	Argument is out of domain.	Values in validation records are out of range.
ENOCSI	No CSI structure is available.	Links between structures are invalid.

In addition, inodes are validated and cross checked with directories.

You should monitor the following files for error conditions:

- The log file specified in `/etc/syslog.conf` for the errors shown in TABLE 4-2.
- The `/var/adm/messages` file for device errors.

If a discrepancy is noted, you should unmount the file system and check it using the `samfscck(1M)` command.

---

**Note** – The `samfscck(1M)` command can be issued on a mounted file system, but the results cannot be trusted. Because of this, you are encouraged to run the command on an unmounted file system only.

---

## ▼ To Check a File System

- **Use the `samfscck(1M)` command to perform a file systems check.**

Use this command in the following format:

```
samfscck -v family_set_name
```

For *family\_set\_name*, specify the name of the file system as specified in the `mcf` file.

You can send output from `samfscck(1M)` to both your screen and to a file by using it in conjunction with the `tee(1)` command, as follows.

- C shell:

```
# samfscck -v family_set_name |& tee file
```

- Bourne shell:

```
# samfsck -v family_set_name 2>&1 | tee file
```

Nonfatal errors returned by `samfsck(1M)` are preceded by `NOTICE`. Nonfatal errors are lost blocks and orphans. The file system is still consistent if `NOTICE` errors are returned. You can repair these nonfatal errors during a convenient, scheduled maintenance outage.

Fatal errors are preceded by `ALERT`. These errors include duplicate blocks, invalid directories, and invalid indirect blocks. The file system is not consistent if these errors occur. Notify Sun if the `ALERT` errors cannot be explained by a hardware malfunction.

If the `samfsck(1M)` command detects file system corruption and returns `ALERT` messages, you should determine the reason for the corruption. If hardware is faulty, repair it before repairing the file system.

For more information about the `samfsck(1M)` and `tee(1)` commands, see the `samfsck(1M)` and `tee(1)` man pages.

## ▼ To Repair a File System

1. Use the `umount(1M)` command to unmount the file system.

Run the `samfsck(1M)` command when the file system is not mounted. For information about unmounting a file system, see “Unmounting a File System” on page 69.

2. Use the `samfsck(1M)` command to repair a file system. If you are repairing a shared file system, issue the command from the metadata server.

You can issue the `samfsck(1M)` command in the following format to repair a file system:

```
# samfsck -F -v fsname
```

For *fsname*, specify the name of the file system as specified in the `mcf` file.

---

# Preserving Information for an Upgrade

If you are about to add or change disks, controllers, or other equipment in your environment, it can be difficult to correct or regenerate all the file system descriptions in the `mcf` file. The `samfsconfig(1M)` command can help you by generating information about your file system and file system components after making these changes.

The `samfsconfig(1M)` command examines devices and determines if any of them have Sun StorEdge QFS or Sun StorEdge SAM-FS superblocks on them. It uses information from the discovered superblocks and aggregates the devices into a format similar to a `mcf` file. You can save this format and edit it to recreate a damaged, missing, or incorrect `mcf` file.

This command returns information about each device that you specify and writes this information to `stdout`. The command can retrieve the family set number of the base device (the file system itself), the file system type (`ma` or `ms`), and whether the file system is a Sun StorEdge QFS shared file system.

Irregularities are flagged with one of the following:

- A pound sign (`#`). This indicates incomplete family set information.
- A greater-than sign (`>`). This indicates that more than one device name refers to a particular file system element.

If necessary, this command's output can be used to help regenerate the file system portions of your `mcf` file if your system is reconfigured or experiences a disaster. The following examples show output from the `samfsconfig(1M)` command.

## Example 1

In this example, the system administrator has put a list of device names into a file. These device names are not accounted for in the environment. The system administrator wants to examine only these devices for Sun StorEdge QFS and Sun StorEdge SAM-FS family sets. The results show some old fragments of family sets and several complete instances.

**CODE EXAMPLE 4-2** Example 1 - Output From `samfsconfig(1M)` Command

```
mn# samfsconfig -v `cat /tmp/dev_files`  
Device '/dev/dsk/c0t0d0s0' doesn't have a SAM-FS superblock (SBLK).  
Device '/dev/dsk/c0t0d0s1' doesn't have a SAM-FS superblock (SBLK).  
Device '/dev/dsk/c0t0d0s3' doesn't have a SAM-FS superblock (SBLK).  
Device '/dev/dsk/c0t0d0s4' doesn't have a SAM-FS superblock (SBLK).
```

**CODE EXAMPLE 4-2** Example 1 - Output From samfsconfig(1M) Command (Continued)

```
Device '/dev/dsk/c0t0d0s5' doesn't have a SAM-FS superblock (SBLK).
Device '/dev/dsk/c0t0d0s6' doesn't have a SAM-FS superblock (SBLK).
Device '/dev/dsk/c0t0d0s7' doesn't have a SAM-FS superblock (SBLK).
Couldn't open '/dev/dsk/c0t1d0s0'; errno=5.
Couldn't open '/dev/dsk/c0t1d0s1'; errno=5.
Device '/dev/dsk/c0t1d0s3' doesn't have a SAM-FS superblock (SBLK).
Device '/dev/dsk/c0t1d0s4' has a SAM-FS superblock.
Device '/dev/dsk/c0t1d0s5' has a SAM-FS superblock.
Device '/dev/dsk/c0t1d0s6' has a SAM-FS superblock.
Couldn't open '/dev/dsk/c0t1d0s7'; errno=5.
Couldn't open '/dev/dsk/c0t6d0s0'; errno=16.
Couldn't open '/dev/dsk/c0t6d0s1'; errno=16.
Couldn't open '/dev/dsk/c0t6d0s3'; errno=16.
Couldn't open '/dev/dsk/c0t6d0s4'; errno=16.
Couldn't open '/dev/dsk/c0t6d0s5'; errno=16.
Couldn't open '/dev/dsk/c0t6d0s6'; errno=16.
Couldn't open '/dev/dsk/c0t6d0s7'; errno=16.
Couldn't open '/dev/dsk/c1t0d0s3'; errno=5.
Couldn't open '/dev/dsk/c1t0d0s4'; errno=5.
Couldn't open '/dev/dsk/c1t0d0s5'; errno=5.
Device '/dev/dsk/c1t0d0s6' doesn't have a SAM-FS superblock (SBLK).
Couldn't open '/dev/dsk/c1t0d0s7'; errno=5.
Couldn't open '/dev/dsk/c1t1d0s0'; errno=2.
Couldn't open '/dev/dsk/c1t2d0s3'; errno=5.
Couldn't open '/dev/dsk/c1t2d0s4'; errno=5.
Couldn't open '/dev/dsk/c1t2d0s5'; errno=5.
Device '/dev/dsk/c1t2d0s6' doesn't have a SAM-FS superblock (SBLK).
Couldn't open '/dev/dsk/c1t2d0s7'; errno=5.
Could not read from device '/dev/dsk/c1t3d0s0'; errno=5.
Couldn't open '/dev/dsk/c1t4d0s3'; errno=5.
Couldn't open '/dev/dsk/c1t4d0s4'; errno=5.
Couldn't open '/dev/dsk/c1t4d0s5'; errno=5.
Device '/dev/dsk/c1t4d0s6' doesn't have a SAM-FS superblock (SBLK).
Device '/dev/dsk/c1t4d0s7' doesn't have a SAM-FS superblock (SBLK).
Couldn't open '/dev/dsk/c1t5d0s3'; errno=5.
Couldn't open '/dev/dsk/c1t5d0s4'; errno=5.
Couldn't open '/dev/dsk/c1t5d0s5'; errno=5.
Device '/dev/dsk/c1t5d0s6' doesn't have a SAM-FS superblock (SBLK).
Couldn't open '/dev/dsk/c1t5d0s7'; errno=5.
Device '/dev/dsk/c3t0d0s0' doesn't have a SAM-FS superblock (SBLK).
Device '/dev/dsk/c3t0d0s1' doesn't have a SAM-FS superblock (SBLK).
Device '/dev/dsk/c3t0d0s3' has a SAM-FS superblock.
Device '/dev/dsk/c3t0d0s4' has a SAM-FS superblock.
Couldn't open '/dev/dsk/c3t0d0s7'; errno=5.
Device '/dev/dsk/c3t1d0s0' doesn't have a SAM-FS superblock (SBLK).
Device '/dev/dsk/c3t1d0s1' doesn't have a SAM-FS superblock (SBLK).
Device '/dev/dsk/c3t1d0s3' has a SAM-FS superblock.
```

**CODE EXAMPLE 4-2** Example 1 - Output From samfsconfig(1M) Command (*Continued*)

```
Device '/dev/dsk/c3t1d0s4' has a SAM-FS superblock.
Couldn't open '/dev/dsk/c3t1d0s7'; errno=5.
Device '/dev/dsk/c4t0d0s0' has a SAM-FS superblock.
Could not read from device '/dev/dsk/c4t0d0s1'; errno=5.
Could not read from device '/dev/dsk/c4t0d0s3'; errno=5.
Could not read from device '/dev/dsk/c4t0d0s4'; errno=5.
Could not read from device '/dev/dsk/c4t0d0s5'; errno=5.
Device '/dev/dsk/c4t0d0s6' has a SAM-FS superblock.
Device '/dev/dsk/c4t0d0s7' has a SAM-FS superblock.
Device '/dev/dsk/c4t1d0s0' has a SAM-FS superblock.
Could not read from device '/dev/dsk/c4t1d0s1'; errno=5.
Could not read from device '/dev/dsk/c4t1d0s3'; errno=5.
Could not read from device '/dev/dsk/c4t1d0s4'; errno=5.
Could not read from device '/dev/dsk/c4t1d0s5'; errno=5.
Device '/dev/dsk/c4t1d0s6' has a SAM-FS superblock.
Device '/dev/dsk/c4t1d0s7' has a SAM-FS superblock.
Device '/dev/dsk/c4t2d0s0' has a SAM-FS superblock.
Could not read from device '/dev/dsk/c4t2d0s1'; errno=5.
Could not read from device '/dev/dsk/c4t2d0s3'; errno=5.
Could not read from device '/dev/dsk/c4t2d0s4'; errno=5.
Could not read from device '/dev/dsk/c4t2d0s5'; errno=5.
Device '/dev/dsk/c4t2d0s6' has a SAM-FS superblock.
Device '/dev/dsk/c4t2d0s7' has a SAM-FS superblock.
Device '/dev/dsk/c4t3d0s0' has a SAM-FS superblock.
Could not read from device '/dev/dsk/c4t3d0s1'; errno=5.
Could not read from device '/dev/dsk/c4t3d0s3'; errno=5.
Could not read from device '/dev/dsk/c4t3d0s4'; errno=5.
Could not read from device '/dev/dsk/c4t3d0s5'; errno=5.
Device '/dev/dsk/c4t3d0s6' has a SAM-FS superblock.
Device '/dev/dsk/c4t3d0s7' has a SAM-FS superblock.
19 SAM-FS devices found.
#
# Family Set 'samfs2' Created Mon Jun 25 10:37:52 2001
#
# Missing slices
# Ordinal 1
# /dev/dsk/c0t1d0s6      12      md      samfs2      -
#
# Family Set 'samfs1' Created Wed Jul 11 08:47:38 2001
#
# Missing slices
# Ordinal 1
# /dev/dsk/c0t1d0s4      12      md      samfs1      -
# Ordinal 2
# /dev/dsk/c0t1d0s5      13      md      samfs1      -
#
# Family Set 'samfs2' Created Sat Nov  3 17:22:44 2001
```



**CODE EXAMPLE 4-2** Example 1 - Output From `samfsconfig(1M)` Command (*Continued*)

```
#
samfs2 ma 30 samfs2 - shared
/dev/dsk/c4t0d0s6      31      mm      samfs2  -
/dev/dsk/c4t1d0s6      32      mr      samfs2  -
/dev/dsk/c4t2d0s6      33      mr      samfs2  -
#
# Family Set 'qfs1' Created Wed Nov  7 15:16:19 2001
#
qfs1 ma 10 qfs1 -
/dev/dsk/c3t0d0s3      11      mm      qfs1    -
/dev/dsk/c3t0d0s4      12      g0      qfs1    -
/dev/dsk/c3t1d0s3      13      g0      qfs1    -
/dev/dsk/c3t1d0s4      14      g0      qfs1    -
#
# Family Set 'sharefsx' Created Wed Nov  7 16:55:19 2001
#
sharefsx ma 200 sharefsx - shared
/dev/dsk/c4t0d0s0      210     mm      sharefsx -
/dev/dsk/c4t1d0s0      220     mr      sharefsx -
/dev/dsk/c4t2d0s0      230     mr      sharefsx -
/dev/dsk/c4t3d0s0      240     mr      sharefsx -
#
# Family Set 'samfs5' Created Tue Nov 27 16:32:28 2001
#
samfs5 ma 80 samfs5 -
/dev/dsk/c4t3d0s6      82      mm      samfs5  -
/dev/dsk/c4t3d0s7      83      g0      samfs5  -
/dev/dsk/c4t0d0s7      84      g0      samfs5  -
/dev/dsk/c4t1d0s7      85      g1      samfs5  -
/dev/dsk/c4t2d0s7      86      g1      samfs5  -
```

## Example 2

In this example, the devices flagged with a greater-than sign (>) are duplicated. The s0 slice starts at the start of disk, as does the whole disk (s2) slice. This is the style of output obtained in a Solaris 9 OS.

CODE EXAMPLE 4-3 shows the `samfsconfig(1M)` command and output.

**CODE EXAMPLE 4-3** Example 2 - Output from `samfsconfig` Command

```
# samfsconfig /dev/dsk/c3t*
#
# Family Set 'shsam1' Created Wed Oct 17 14:57:29 2001
#
shsam1 160 ma shsam1 shared
```

**CODE EXAMPLE 4-3** Example 2 - Output from `samfsconfig` Command (Continued)

```
> /dev/dsk/c3t50020F23000055A8d0s2 161 mm shsam1 -
> /dev/dsk/c3t50020F23000055A8d0s0 161 mm shsam1 -
/dev/dsk/c3t50020F23000055A8d0s1 162 mr shsam1 -
> /dev/dsk/c3t50020F23000078F1d0s0 163 mr shsam1 -
> /dev/dsk/c3t50020F23000078F1d0s2 163 mr shsam1 -
/dev/dsk/c3t50020F23000078F1d0s1 164 mr shsam1 -
```

## Example 3

In this example, the whole disk slice (slice 2) is left off of the command line. This is the style of output obtained in a Solaris 9 OS.

CODE EXAMPLE 4-4 shows the `samfsconfig(1M)` command and output.

**CODE EXAMPLE 4-4** Example 3 - Output from `samfsconfig(1M)` Command

```
# samfsconfig /dev/dsk/c3t*s[013-7]
#
# Family Set 'shsam1' Created Wed Oct 17 14:57:29 2001
#
shsam1 160 ma shsam1 shared
/dev/dsk/c3t50020F23000055A8d0s0 161 mm shsam1 -
/dev/dsk/c3t50020F23000055A8d0s1 162 mr shsam1 -
/dev/dsk/c3t50020F23000078F1d0s0 163 mr shsam1 -
/dev/dsk/c3t50020F23000078F1d0s1 164 mr shsam1 -
```

For more information about this command, see the `samfsconfig(1M)` man page.

---

## Preparing for a Hardware Device Upgrade

Whether upgrading a server, adding a new tape drive, adding an automated library, or installing a different drive into an existing automated library, it is best to plan in advance. This section prepares you for hardware upgrades to devices within your environment.

Sun Microsystems recommends the following actions before the upgrade:

- Determine if the hardware addition or change requires a new license from Sun Microsystems.

Examples of changes that do not require a license upgrade include adding memory and increasing disk cache. Examples of changes that require a license upgrade include adding more slots in an automated library and changing the model of your server.

- Read the hardware manufacturer's installation instructions carefully. Also read the documentation on adding hardware in your Solaris OS system administrator documentation.
- Check the Equipment Ordinals between your old and new `mcf` files. For information about the `mcf` file, see the `mcf(4)` man page.
- Decide whether or not the backup copies you have on hand are sufficient. For information about backing up your data and metadata, see the procedures described in the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.
  - In a Sun StorEdge QFS environment, the `qfsdump(1M)` command dumps all data and metadata. For more information about this process, see the `qfsdump(1M)` man page.
  - In Sun StorEdge SAM-FS and Sun SAM-QFS environments, the `samfsdump(1M)` command dumps all metadata. You must ensure that all files that need to be archived have an archive copy. Use the `archive_audit(1)` command on each Sun StorEdge SAM-FS or Sun SAM-QFS file system to see which files do not have an archive copy. In the following example, `/sam` is the mount point.

```
# archive_audit /sam
```

- Ensure that the system is quiet with no users logged in.
- In Sun StorEdge SAM-FS and Sun SAM-QFS environments, ensure that the archiver is in `wait` mode. The archiver must be in `wait` mode, and not running, during an upgrade.

You can idle the archiver in one of the following ways:

- By inserting a `wait` directive into the `/etc/opt/SUNWsamfs/archiver.cmd` file. For more information about the `wait` directive and the `archiver.cmd` file, see the `archiver.cmd(4)` man page.
- By using the `samu(1M)` operator utility.
- By issuing the following command:

```
# samcmd aridle
```

For more information, see the `samcmd(1M)` man page.

---

# Adding Disk Cache to a File System

At some point, you might want to add disk partitions or disk drives in order to increase the disk cache for a file system. You accomplish this by updating the `mcf` file and using the `samgrowfs(1M)` command. You do not need to reinitialize or restore the file system.

In Sun StorEdge SAM-FS and Sun SAM-QFS environments, note that when adding disks or partitions, the system might update the Equipment Ordinal of the historian. The system automatically generates the Equipment Ordinal of the historian unless you specifically call it out. For more information, see the `historian(7)` man page.

## ▼ To Add Disk Cache to a File System

1. **Use the `umount(1M)` command to unmount the file system you want to expand. If the file system is shared, unmount the file system on all client hosts and then on the metadata server. You can then perform the remaining steps in this procedure on the metadata server.**

For information about unmounting a file system, see “Unmounting a File System” on page 69.

2. **If you want to rename the file system during this procedure, use the `samfscck(1M)` command with its `-R` and `-F` options to rename the file system. (Optional)**

For more information about this command, see the `samfscck(1M)` man page.

3. **Edit the `/etc/opt/SUNWsamfs/mcf` file.**

You can configure up to 252 disk partitions in a file system.

To increase the size of a Sun StorEdge QFS file system, at least one new metadata partition must be added. Metadata partitions require an Equipment Type of `mm`. Zero or more data partitions can be added.

If you want to add new partitions for metadata or for data, add them to the `mcf` file after the existing disk partitions. Save the changes, and quit the editor.

Do not change the Equipment Identifier name in the `/etc/opt/SUNWsamfs/mcf` file. If the name in the `mcf` file does not match the name in the superblock, the file systems can no longer be mounted. Instead, the following message is logged in `/var/adm/messages`:

```
WARNING SAM-FS superblock equipment identifier <id>s on eq <eq>
does not match <id> in mcf
```

4. **Type the `sam-fsd(1M)` command to check for errors in the `mcf` file.**

For example:

```
# sam-fsd
```

If the `sam-fsd(1M)` command output indicates that there are errors in the `mcf` file, fix them before proceeding to the next step in this procedure.

5. **Type the `samd(1M) config` command to propagate the `mcf` file changes to the system.**

For example:

```
# samd config
```

For more information about the `samd(1M)` command, see the `samd(1M)` man page.

6. **Type the `samgrowfs(1M)` command on the file system that is being expanded.**

For example, type the following command to expand file system `samfs1`:

```
# samgrowfs samfs1
```

If you renamed your file system, run the `samgrowfs(1M)` command on the new name. For more information about this command, see the `samgrowfs(1M)` man page.

7. **Mount the file system.**

If you renamed your file system, enter the new name in the `mcf` file and then issue the `sam-fsd(1M)` and the `samd(1M) config` commands as described in steps 4 and 5.

8. **For Sun StorEdge QFS shared file systems only, edit the `mcf` file on each participating client host to match the metadata server's `mcf` file.**

---

## Replacing Disks in a File System

At some point, you might want to perform the following tasks:

- Change disks or partitions
- Add disks or partitions

- Remove disks or partitions

To accomplish these tasks, you need to back up and recreate the file system by following the steps in this procedure.

## ▼ To Back Up and Recreate a File System

### 1. Back up all site-customized system files and configuration files.

Depending on your software, these files can include `mcf`, `archiver.cmd`, `defaults.conf`, `samfs.cmd`, `inquiry.conf`, and so on. Back up these files for all file systems in your Sun StorEdge QFS and Sun StorEdge SAM-FS environments. Also make sure that you have backup copies of files in the `/etc/opt/SUNWsamfs` directory, files in the `/var/opt/SUNWsamfs` directory, library catalogs, the historian, shared hosts files, and any parameter files for network-attached automated libraries.

In Sun StorEdge SAM-FS and Sun SAM-QFS environments, if you do not know the names and locations of your catalog files, examine the `mcf` file with `vi(1)` or another viewing command and find the first `rb` entry in the `mcf` file. That entry contains the name of the library catalog file. If no catalog file location is specified, then the system is using the default location (`/var/opt/SUNWsamfs/catalog`).

### 2. Ensure that each file system to be modified is backed up.

The file systems should be backed up regularly according to your site's policies. This is described as the last step in the installation procedure. If you are comfortable with the backup files that already exist for your file systems, there is no need to back them up again now. If, however, you need to back up your file systems to preserve information created since the last dump file was created, do so now. For information about how to create a dump file, see the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.

Note that if you are using the Sun StorEdge SAM-FS or Sun SAM-QFS file system, the `samfsdump(1M)` command issues warnings when creating the dump file if it encounters unarchived files in the file system. If warnings are issued, these files need to be archived before unmounting the file systems.

### 3. Unmount the file system.

For information about unmounting a file system, see "Unmounting a File System" on page 69.

### 4. If you want to rename the file system during this procedure, use the `samfsck(1M)` command with its `-R` and `-F` options to rename the file system. (Optional)

For more information about this command, see the `samfsck(1M)` man page.

**5. Edit the `/etc/opt/SUNWsamfs/mcf` file.**

You can configure up to 252 disk partitions in a file system. Edit the `mcf` file to add or delete disks or partitions. New partitions must be added after existing disk partitions. Save the changes, and quit the editor.

To increase the size of a Sun StorEdge QFS file system, at least one new metadata partition must be added. Metadata partitions require an Equipment Type of `mm`. Zero or more data partitions can be added.

Do not change the Equipment Identifier name in the `/etc/opt/SUNWsamfs/mcf` file. If the name in the `mcf` file does not match the name in the superblock, the file systems can no longer be mounted. Instead, the following message is logged in `/var/adm/messages`:

```
WARNING SAM-FS superblock equipment identifier <id>s on eq <eq>
does not match <id> in mcf
```

**6. Type the `sam-fsd(1M)` command to check for errors in the `mcf` file.**

For example:

```
# sam-fsd
```

If the `sam-fsd(1M)` command output indicates that there are errors in the `mcf` file, fix them before proceeding to the next step in this procedure.

For more information, see the `sam-fsd(1M)` man page.

**7. Type the `samd(1M) config` command to propagate the `mcf` file changes.**

For example:

```
# samd config
```

For more information, see the `samd(1M)` man page.

**8. Type the `sammkfs(1M)` command to make a new file system.**

For example, the following command creates `samfs10`:

```
# sammkfs samfs10
```

**9. Type the `mount(1M)` command to mount the file system.**

For information about mounting a Sun StorEdge QFS or Sun StorEdge SAM-FS file system, see the `mount_samfs(1M)` man page.

10. Type the `cd(1)` command to change to the mount point of the file system.
11. Use the `samfsrestore(1M)` or `qfsrestore(1M)` command to restore each file.

Restore from the dump file you had or from the dump file created in Step 2.

For information about using these commands, see the `samfsdump(1M)` or `qfsdump(1M)` man pages, or see the *Sun QFS, Sun SAM-FS, and Sun SAM-QFS Disaster Recovery Guide*.
12. Use the `restore.sh(1M)` script to stage back all files that had been online.

Use this command in the following format:

```
# restore.sh log_file mount_point
```

For *log\_file*, specify the name of the log file that was created by the `sammkfs(1M)` or the `samfsrestore(1M)` commands.

For *mount\_point*, specify the mount point of the file system being restored.

For information about the `restore.sh(1M)` script, see the `restore.sh(1M)` man page.

---

## Upgrading a Host System

When it comes time to upgrade the host system being used for the file system, take the following into account:

- It is wise to move to the new host while the existing host is still in operation. This allows time to install, configure, and test the new hardware platform with your applications.
- Moving to a new host system is equivalent to installing the Sun StorEdge QFS or Sun StorEdge SAM-FS software for the first time. In Sun StorEdge SAM-FS and Sun SAM-QFS environments, you need to reinstall the software and update the configuration files (specifically the `mcf` file, the `/kernel/drv/st.conf` file, and the `/etc/opt/SUNWsamfs/inquiry.conf` file). In addition, you need to copy your existing `archiver.cmd` and `defaults.conf` files to the new system, configure system logging, and so on.

You can use the installation instructions in the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide* when re-installing the software.

- You might need to update your license key. License keys are tied to the CPU host ID. Replacing the system requires a new license.



- Before powering down the old host system, decide whether or not the backup copies you have on hand are sufficient. You might need to create new dump files at this time. A dump file is used to recreate the file system on the new server. For more information about creating a dump file, see the `qfsdump(1M)` or `samfsdump(1M)` man pages or see the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.

---

## Upgrading the Solaris OS

The following sections describe how to upgrade your Solaris OS:

- “To Upgrade Your Solaris OS in a Sun StorEdge SAM-FS or Sun SAM-QFS Environment” on page 85
- “To Upgrade Your Solaris OS in a Sun StorEdge QFS Environment” on page 88

### ▼ To Upgrade Your Solaris OS in a Sun StorEdge SAM-FS or Sun SAM-QFS Environment

Many of the steps involved in upgrading your Solaris OS level are identical to the steps involved in upgrading your Sun StorEdge SAM-FS or Sun SAM-QFS environment. Some of the steps in this procedure reference procedures in the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.

#### 1. Obtain the software upgrade.

The Sun StorEdge SAM-FS and Sun SAM-QFS software supports various levels of the Solaris OS. You should not reinstall your old Sun StorEdge SAM-FS or Sun SAM-QFS software onto your newly upgraded Solaris OS.

In addition, depending on the revision level currently installed and the level to which you are upgrading, you might need a new software license.

Contact your ASP or Sun Microsystems to obtain new copies of the software and to determine whether or not your site needs a new license.

#### 2. Back up all site-customized system files and configuration files.

These files include `mcf`, `archiver.cmd`, `defaults.conf`, `samfs.cmd`, `inquiry.conf`, and so on. Back up these files for all file systems in your Sun StorEdge SAM-FS and Sun SAM-QFS environments.

Also make sure that you have backup copies of files in the `/etc/opt/SUNWsamfs` directory, files in the `/var/opt/SUNWsamfs` directory, library catalogs, the historian, and any parameter files for network-attached automated libraries.

If you do not know the names and locations of your catalog files, examine the `mcf` file with `vi(1)` or another viewing command and find the first `rb` entry in the `mcf` file. That entry contains the name of the library catalog file. If no catalog file location is specified, then the system is using the default location (`/var/opt/SUNWsamfs/catalog`).

### 3. Ensure that each file system affected is backed up.

The file systems should be backed up regularly according to your site's policies. This is one of the last steps in the installation procedure. If you are comfortable with the backup files that already exist for your file systems, there is no need to back them up again now. If, however, you need to back up your file systems to preserve information created since the last dump file was created, do so now.

Note that if you are using the Sun StorEdge SAM-FS or Sun SAM-QFS file system, the `samfsdump(1M)` command issues warnings when creating the dump file if it encounters unarchived files in the file system. If warnings are issued, these files need to be archived before unmounting the file systems.

### 4. Unmount the file systems.

For information about unmounting a file system, see “Unmounting a File System” on page 69.

### 5. Issue a `samd(1M) stop` command to stop all archiving and SAM activity. (Optional)

Perform this step if you are unmounting a Sun StorEdge SAM-FS or Sun SAM-QFS file system. For example:

```
# samd stop
```

### 6. Remove existing Sun StorEdge SAM-FS or Sun SAM-QFS software.

Use the `pkgrm(1M)` command to remove the existing software. You must remove all existing Sun StorEdge SAM-FS and Sun SAM-QFS packages before installing either the new packages or the new operating system level.

For example, the following command removes the `SUNWsamtp`, `SUNWsamfsu`, and the `SUNWsamfsr` packages in a Sun StorEdge SAM-FS or Sun SAM-QFS environment. The `SUNWsamfsr` package must be removed last. Note that the `SUNWsamtp` package is an optional tools package, and it might not be installed on your system. An example `pkgrm(1M)` command is as follows:

```
# pkgrm SUNWsamtp SUNWsamfsu SUNWsamfsr
```

The information in this step assumes that you are removing software packages at the 4.2 release level or later. The software package names changed as of the 4.2 releases. If you have earlier releases of the software packages on your system, see the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide* for information about removing them.

## 7. Upgrade the Solaris OS.

Install the new Solaris OS revision using the Sun Solaris upgrade procedures for the OS level you are installing.

## 8. Add the `SUNWsamfsr` and `SUNWsamfsu` packages that you obtained in Step 1.

The Sun StorEdge SAM-FS and Sun SAM-QFS software packages use the Solaris OS packaging utilities for adding and deleting software. You must be logged in as superuser to make changes to software packages. The `pkgadd(1M)` command prompts you to confirm various actions necessary to upgrade the Sun StorEdge SAM-FS and Sun SAM-QFS package.

On the installation CD-ROM, the Sun StorEdge SAM-FS and Sun SAM-QFS package resides in the `/cdrom/cdrom0` directory.

Run the `pkgadd(1M)` command, as follows, to upgrade the packages, answering *yes* to each question:

```
# pkgadd -d . SUNWsamfsr SUNWsamfsu
```

During the installation, the system detects the presence of conflicting files and prompts you to indicate whether or not you want to continue with the installation. You can go to another window and copy the files you wish to save to an alternate location.

## 9. Update the license keys. (Optional)

Depending on the Sun StorEdge SAM-FS and Sun SAM-QFS software revision you had, and the revision to which you are upgrading, you might need to obtain new license keys for your software. Contact your ASP or Sun Microsystems for help on determining if you need a new license.

If you are upgrading from a release before 4.2, you need to place a new license key in the following file:

```
/etc/opt/SUNWsamfs/LICENSE.4.2
```

For more information, see the licensing information in the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.

## 10. Mount the file system(s). (Optional)

You must perform this step if you have not modified the `/etc/vfstab` file to have `yes` in the Mount at Boot field.

Use the `mount(1M)` command to mount the file systems and continue operation with the upgraded Sun SAM-FS or Sun SAM-QFS software.

In the following example, `samfs1` is the name of the file system to be mounted.

```
# mount samfs1
```

## ▼ To Upgrade Your Solaris OS in a Sun StorEdge QFS Environment

Many of the steps involved in upgrading your Solaris OS level are identical to the steps involved in upgrading your Sun StorEdge QFS environment. Some of the steps in this procedure reference procedures in the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.

### 1. Obtain the software upgrade.

Sun StorEdge QFS software supports various levels of the Solaris OS. You should not reinstall your old Sun StorEdge QFS software onto your newly upgraded Solaris OS.

In addition, depending on the revision level currently installed and the level to which you are upgrading, you may need a new Sun StorEdge QFS license.

Contact your ASP or Sun Microsystems to obtain new copies of the software and to determine whether or not your site needs a new license.

### 2. Back up all site-customized system files and configuration files.

These files include `mcf`, `defaults.conf`, `samfs.cmd`, the shared hosts files, and so on. Back up these files for all file systems in your Sun StorEdge QFS environment. Also make sure that you have backup copies of files in the `/etc/opt/SUNWsamfs` directory.

### 3. Ensure that each file system affected is backed up.

The file systems should be backed up regularly according to your site's policies. This is described as the last step in the installation procedure. If you are comfortable with the backup files that already exist for your file systems, there is no need to back them up again now. If, however, you need to back up your file systems to preserve information created since the last dump file was created, do so now. For information about how to create a dump file, see the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.

### 4. Unmount the file systems.

For information about unmounting a file system, see “Unmounting a File System” on page 69.

### 5. Remove existing Sun StorEdge QFS software.

Use the `pkgrm(1M)` command to remove the existing software. You must remove the existing Sun StorEdge QFS package before installing either the new package or the new operating system level.

For example, the following command removes the Sun StorEdge QFS software:

```
# pkgrm SUNWqfsu SUNWqfsr
```

The information in this step assumes that you are removing a software package at the 4.2 release level or later. The software package names changed as of the 4.2 releases. If you have earlier releases of the software packages on your system, see the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide* for information about removing them.

### 6. Upgrade the Solaris OS.

Install the new Solaris OS revision using the Sun Solaris upgrade procedures for the Solaris OS level you are installing.

### 7. Add the packages that you obtained in Step 1.

The Sun StorEdge QFS software package uses the Solaris OS packaging utilities for adding and deleting software. You must be logged in as superuser to make changes to software packages. The `pkgadd(1M)` command prompts you to confirm various actions necessary to upgrade the Sun StorEdge QFS package.

On the installation CD-ROM, the Sun StorEdge QFS package resides in the `/cdrom/cdrom0` directory.

Run the `pkgadd(1M)` command to upgrade the package, answering *yes* to each question:

```
# pkgadd -d . SUNWqfsr SUNWqfsu
```

During the installation, the system detects the presence of conflicting files and prompts you to indicate whether or not you want to continue with the installation. You can go to another window and copy any files you want to save to an alternate location.

## 8. Update the license keys. (Optional)

Depending on the Sun StorEdge QFS software revision you had, and the revision to which you are upgrading, you might need to obtain new license keys for your Sun StorEdge QFS software. Contact your ASP or Sun Microsystems for help on determining if you need a new license.

If you are upgrading from a Sun StorEdge QFS release before 4.2, you need to place a new license key in the following file:

```
/etc/opt/SUNWsamfs/LICENSE.4.2
```

For more information, see the licensing information in the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.

## 9. Update the `mcf` file. (Optional)

If device names have changed, it might be necessary to update the `mcf` file to match the new device names. Verify the new device names, and then follow the procedure in “Propagating Configuration File Changes to the System” on page 58.

## 10. Mount the file system(s). (Optional)

Perform this step if you have not modified the `/etc/vfstab` file to have *yes* in the Mount at Boot field.

Use the procedure described in “Mounting a File System” on page 66. Continue operation with the upgraded Sun StorEdge QFS software.

# Sun StorEdge QFS Shared File System

---

A Sun StorEdge QFS shared file system is a distributed file system that can be mounted on multiple Solaris operating system (OS) host systems. In a Sun StorEdge QFS shared file system environment, one Solaris OS host acts as the metadata server for the file system, and additional hosts can be configured as clients. You can configure more than one host as a potential metadata server, but only one host can be the metadata server at any one time. There is no limit to the number of Sun StorEdge QFS shared file system mount points.

The advantage of the Sun StorEdge QFS shared file system is that file data passes directly from the Fibre Channel disks to the hosts. Data travels via local path I/O (also known as *direct access I/O*). This is in contrast to the Network File System (NFS), which transfers data over the network.

This chapter describes how to configure and maintain the Sun StorEdge QFS shared file system. This chapter contains the following sections:

- “Overview” on page 92
- “Configuring the Sun StorEdge QFS Shared File System” on page 92
- “Converting an Unshared File System to a Shared File System” on page 93
- “Converting a Shared File System to an Unshared File System” on page 96
- “Mounting and Unmounting Sun StorEdge QFS Shared File Systems” on page 99
- “Adding and Removing a Client Host” on page 100
- “Changing the Metadata Server in a Sun StorEdge QFS Environment” on page 113
- “Daemons” on page 117
- “Mount Options in a Sun StorEdge QFS Shared File System” on page 117
- “Mount Semantics in a Sun StorEdge QFS Shared File System” on page 124
- “File Locking in a Sun StorEdge QFS Shared File System” on page 125
- “Troubleshooting a Failed or Hung `sammkfs(1M)` or `mount(1M)` Command” on page 125

---

# Overview

In a Sun StorEdge QFS shared file system environment, no archiving or staging occurs, so no network connection to archive media is necessary. If you are operating a Sun StorEdge QFS shared file system environment, ignore the information about archive media in this chapter.

In a Sun SAM-QFS shared file system environment, each host that can become the metadata server needs to be connected to the same archive media repository, which can be one of the following:

- A library with removable media devices (tape or magneto-optical drives).
- Disk space in one or more file systems.

You must specify the archive media in the `mcf` file or in the `diskvols.conf` file on each host that can become a metadata server.

In a Sun SAM-QFS shared file system environment, the active metadata server is the only host upon which the staging (`sam-stagerd`) and archiving (`sam-archiverd`) daemons are active. The metadata server is designated as the server from which all file requests are staged.

You cannot configure a Sun SAM-QFS shared file system in a Sun Cluster environment.

This chapter describes how to maintain a Sun StorEdge QFS shared file system. It assumes that you have installed the Sun StorEdge QFS or Sun SAM-QFS software on the host systems according to the instructions in the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.

---

**Note** – The Sun StorEdge QFS shared file system cannot be configured in a Sun StorEdge SAM-FS (an `ms` file system) environment.

---

---

## Configuring the Sun StorEdge QFS Shared File System

To perform initial installation and configuration for a Sun StorEdge QFS shared file system, follow the instructions in the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*. Many examples in this chapter use host names and configuration information that were introduced in that guide.



---

# Converting an Unshared File System to a Shared File System

To convert an unshared Sun StorEdge QFS file system to a Sun StorEdge QFS shared file system, perform the following procedures in the order shown.

## ▼ To Convert an Unshared File System to Shared on the Server

1. **As superuser, log in to the system to be used as the primary metadata server.**

You must have `root` permission to complete the steps in this procedure.

2. **Back up all site-customized system files and configuration files.**

Depending on your software, these files can include `mcf`, `archiver.cmd`, `defaults.conf`, `samfs.cmd`, `inquiry.conf`, and so on. Back up these files for all file systems. Also make sure that you have backup copies of files in the `/etc/opt/SUNWsamfs` directory, files in the `/var/opt/SUNWsamfs` directory, library catalogs, the historian, and any parameter files for network-attached automated libraries.

In Sun SAM-QFS environments, if you do not know the names and locations of your catalog files, look for the automated libraries in the Additional Parameters field of the `mcf` file. If the Additional Parameters field is blank, however, the system uses the default path of `/var/opt/SUNWsamfs/catalog/catalog_name`. For more information about catalog file locations, see the `mcf(4)` man page.

3. **Ensure that each file system to be modified is backed up. (Optional)**

If you want to move files from an existing Sun StorEdge QFS or Sun SAM-QFS file system into a new Sun StorEdge QFS shared file system, make sure that your file systems are backed up. The file systems should be backed up regularly according to your site's policies. This is described as the last step in the installation procedure. If you are comfortable with the backup files that already exist for your file systems, there is no need to back them up again now.

4. **Use the `umount(1M)` command to unmount the file system.**

5. Use the `sammkfs(1M) -F -S fsname` command to convert the file system to a Sun StorEdge QFS shared file system.

For *fsname*, specify the Family Set Name of the file system that you are converting to a new Sun StorEdge QFS shared file system. For example:

```
# sammkfs -S -F sharefs1
```

6. Edit the `/etc/opt/SUNWsamfs/mcf` file to add the `shared` keyword in the file system's **Additional Parameters** field.

For example:

**CODE EXAMPLE 5-1** mcf File for Shared File System, sharefs1

# Equipment	Eq	Eq	Family	Dev	Add
# Identifier	Ord	Type	Set	State	Params
# -----	----	----	-----	-----	-----
sharefs1	10	ma	sharefs1	on	shared
/dev/dsk/c2t50020F23000065EE0s6	11	mm	sharefs1	on	
/dev/dsk/c7t50020F2300005D22d0s6	12	mr	sharefs1	on	
/dev/dsk/c7t50020F2300006099d0s6	13	mr	sharefs1	on	
/dev/dsk/c7t50020F230000651Cd0s6	14	mr	sharefs1	on	

7. Edit the `/etc/vfstab` file to add the `shared` keyword in the file system's **Mount Parameters** field.

For example:

**CODE EXAMPLE 5-2** /etc/vfstab File Example

# File /etc/vfstab						
# FS name	FS to fsck	Mnt pt	FS type	fsck pass	Mt@boot	Mt params
sharefs1	-	/sharefs1	samfs	-	no	shared

8. Create the `/etc/opt/SUNWsamfs/hosts.fsname` hosts configuration file.

For example:

**CODE EXAMPLE 5-3** Sun StorEdge QFS Shared File System Hosts File Example

# File /etc/opt/SUNWsamfs/hosts.sharefs1				
# Host	Host IP	Server	Not	Server
# Name	Addresses	Priority	Used	Host
# ----	-----	-----	-----	-----
host1	172.16.0.129,titan.xyzco.com	1	-	server
host2	172.16.0.130,tethys.xyzco.com	2	-	

9. Run the `samsharefs(1M) -u -R fsname` command to initialize the file system and the host configuration.

For example:

```
# samsharefs -u -R sharefs1
```

10. Run the `samd(1M) config` command.

This informs the `sam-fsd` daemon of the configuration changes. For example:

```
# samd config
```

11. Issue the `mount(1M)` command to mount the file system.

## ▼ To Convert an Unshared File System to Shared on Each Client

1. Use the `mkdir(1)` command to create the mount point for the file system.

For example:

```
# mkdir /sharefs1
```

2. Create an `/etc/opt/SUNWsamfs/hosts.fsname.local` local hosts configuration file. (Optional)

**CODE EXAMPLE 5-4** File `hosts.sharefs1.local`

```
# This is file /etc/opt/SUNWsamfs/hosts.sharefs1.local
# Host Name      Host Interfaces
# -----
titan            172.16.0.129
tethys           172.16.0.130
```

3. Ensure that each file system to be modified is backed up. (Optional)

If you want to move files from an existing Sun StorEdge QFS or Sun SAM-QFS file system into a new Sun StorEdge QFS shared file system, make sure that your file systems are backed up. The file systems should be backed up regularly according to your site's policies. This is described as the last step in the installation procedure. If you are comfortable with the backup files that already exist for your file systems, there is no need to back them up again now.

4. Use the `umount(1M)` command to unmount the file system.
5. Edit the `/etc/vfstab` file to add the `shared` keyword in the file system's Mount Parameters field.

For example:

**CODE EXAMPLE 5-5** `/etc/vfstab` File Example

# File /etc/vfstab						
# FS name	FS to fsck	Mnt pt	FS type	fsck pass	Mt@boot	Mt params
sharefs1	-	/sharefs1	samfs	-	no	shared

6. Create the `/etc/opt/SUNWsamfs/hosts.fsname` hosts configuration file.

For example:

**CODE EXAMPLE 5-6** Sun StorEdge QFS Shared File System Hosts File Example

# File /etc/opt/SUNWsamfs/hosts.sharefs1				
# Host	Host IP	Server	Not	Server
# Name	Addresses	Priority	Used	Host
# ----	-----	-----	----	----
host1	172.16.0.129,titan.xyzco.com	1	-	server
host2	172.16.0.130,tethys.xyzco.com	2	-	

## Converting a Shared File System to an Unshared File System

To convert a Sun StorEdge QFS shared file system to an unshared Sun StorEdge QFS file system, perform the following procedures in the order shown.

### ▼ To Convert a Shared File System to Unshared on Each Client

1. Use the `umount(1M)` command to unmount the file system.
2. Delete the file system's entry from the `/etc/opt/SUNWsamfs/mcf` file.
3. Delete the file system's entry from the `/etc/vfstab` file.

4. Run the `samd(1M) config` command.

This informs the `sam-fsd` daemon of the configuration changes. For example:

```
# samd config
```

5. Delete the mount point for the file system.

## ▼ To Convert a Shared File System to Unshared on the Server

1. As superuser, log in to the metadata server system.

You must have `root` permission to complete the steps in this procedure.

2. Back up all site-customized system files and configuration files.

Depending on your software, these files can include `mcf`, `archiver.cmd`, `defaults.conf`, `samfs.cmd`, `inquiry.conf`, and so on. Back up these files for all file systems. Also make sure that you have backup copies of files in the `/etc/opt/SUNWsamfs` directory, files in the `/var/opt/SUNWsamfs` directory, library catalogs, the historian, and any parameter files for network-attached automated libraries.

In Sun SAM-QFS environments, if you do not know the names and locations of your catalog files, examine the `mcf` file with `vi(1)` or another viewing command and find the entries for the automated libraries. The path to each library's catalog files is in the Additional Parameters field. If the Additional Parameters field is blank, however, the system uses the default path of `/var/opt/SUNWsamfs/catalog/catalog_name`. For more information about catalog file locations, see the `mcf(4)` man page.

3. Ensure that each file system to be modified is backed up. (Optional)

If you want to move files from an existing Sun StorEdge QFS shared or Sun SAM-QFS shared file system into a new Sun StorEdge QFS file system, make sure that your file systems are backed up. The file systems should be backed up regularly according to your site's policies. This is described as the last step in the installation procedure. If you are comfortable with the backup files that already exist for your file systems, there is no need to back them up again now.

4. Use the `umount(1M)` command to unmount the file system.

5. Run the `sammkfs(1M) -F -U fsname` to convert the Sun StorEdge QFS shared file system to an unshared file system.

For *fsname*, specify the Family Set Name of the Sun StorEdge QFS shared file system that you are converting to a new unshared file system. For example:

```
# sammkfs -F -U samfs1
```

6. Edit the `/etc/opt/SUNWsamfs/mcf` file to remove the shared keyword from the file system's Additional Parameters field.

For example:

**CODE EXAMPLE 5-7** mcf File for File System, samfs1

# Equipment	Eq	Eq	Family	Dev	Add
# Identifier	Ord	Type	Set	State	Params
# -----	----	----	-----	-----	-----
samfs1	10	ma	samfs1	on	
/dev/dsk/c2t50020F23000065EE0s6	11	mm	samfs1	on	
/dev/dsk/c7t50020F2300005D22d0s6	12	mr	samfs1	on	
/dev/dsk/c7t50020F2300006099d0s6	13	mr	samfs1	on	
/dev/dsk/c7t50020F230000651Cd0s6	14	mr	samfs1	on	

7. Edit the `/etc/vfstab` file to remove the shared keyword from the file system's Mount Parameters field.

For example:

**CODE EXAMPLE 5-8** /etc/vfstab File Example

# File /etc/vfstab						
# FS name	FS to fsck	Mnt pt	FS type	fsck pass	Mt@boot	Mt params
samfs1	-	/samfs1	samfs	-	no	

8. Delete the `/etc/opt/SUNWsamfs/hosts.fsname` configuration file.

9. Run the `samd(1M) config` command.

This informs the `sam-fsd` daemon of the configuration changes. For example:

```
# samd config
```

10. Use the `mount(1M)` command to mount the file system.

---

# Mounting and Unmounting Sun StorEdge QFS Shared File Systems

When mounting or unmounting a Sun StorEdge QFS shared file system, the order in which the Solaris OS is mounted or unmounted is important.

For failover purposes, the mount options should be the same on the metadata server and all potential metadata servers. For example, you can create a `samfs.cmd(4)` file containing mount options and copy it to all of the hosts.

For more information about mounting Sun StorEdge QFS shared file systems, see “Mount Options in a Sun StorEdge QFS Shared File System” on page 117 or see the `mount_samfs(1M)` man page. For more information about mounting and unmounting file systems, see “File System Operations” on page 57.

## ▼ To Mount a Sun StorEdge QFS Shared File System

The `mount(1M)` command mounts a Sun StorEdge QFS shared file system in a Solaris OS. For more information about the `mount(1M)` command, see the `mount(1M)` man page.

1. **Become superuser on the metadata server and on all the client hosts.**

2. **Use the `mount(1M)` command to mount the metadata server.**

Mount the file system on the metadata server before mounting it on any client hosts.

3. **Use the `mount(1M)` command to mount the client hosts.**

You can mount the file system on the client hosts in any order.

## ▼ To Unmount a Sun StorEdge QFS Shared File System

Follow the instructions in “To Unmount Sun StorEdge QFS and Sun SAM-QFS Shared File Systems” on page 70.

---

# Adding and Removing a Client Host

The following sections describe adding and removing client host systems:

- “To Add a Client Host” on page 100
- “To Remove a Client Host” on page 111

## ▼ To Add a Client Host

You can add a client host to a Sun StorEdge QFS shared file system after you have configured and mounted the file system on all participants. If you are adding a client host that is a node in a Sun Cluster environment, you must add the node to the cluster’s existing resource group. For more information, see the *Sun Cluster System Administration Guide for Solaris OS*.

Follow these steps for each client host.

1. **Become superuser on the metadata server.**
2. **Use the `samsharefs(1M)` command to retrieve the current Sun StorEdge QFS shared file system information and write it to an editable file.**
  - If the Sun StorEdge QFS shared file system is mounted, issue the `samsharefs(1M)` command on the current metadata server. For example:

```
# samsharefs sharefs1 > /etc/opt/SUNWsamfs/hosts.sharefs1
```

- If the Sun StorEdge QFS shared file system is unmounted, issue the `samsharefs(1M)` command with its `-R` option from the metadata server or from any of the potential metadata servers. For example:

```
# samsharefs -R sharefs1 > /etc/opt/SUNWsamfs/hosts.sharefs1
```

You can issue the `samsharefs(1M)` command only on the active metadata server or on client hosts configured as potential metadata servers. For more information, see the `samsharefs(1M)` man page.

---

**Note** – You can change the hosts information on any potential metadata server when the file system is unmounted. Sun Microsystems recommends that you always retrieve the hosts information to ensure that the hosts information is current.

---



3. Use **vi(1)** or another editor to open the Sun StorEdge QFS shared file system information file.

CODE EXAMPLE 5-9 shows this step.

**CODE EXAMPLE 5-9** hosts.sharefs1 Before Editing

# <b>vi /etc/opt/SUNWsamfs/hosts.sharefs1</b>				
# File /etc/opt/SUNWsamfs/hosts.sharefs1				
# Host	Host IP	Server	Not	Server
# Name	Addresses	Priority	Used	Host
# ----	-----	-----	----	----
titan	172.16.0.129,titan.xyzco.com	1	-	server
tethys	172.16.0.130,tethys.xyzco.com	2	-	
mimas	mimas.xyzco.com	-	-	
dione	dione.xyzco.com	-	-	

4. Use the editor to add a line for the new client host.

CODE EXAMPLE 5-10 shows the file after adding the line for helene as the last line.

**CODE EXAMPLE 5-10** hosts.sharefs1 After Editing

# File /etc/opt/SUNWsamfs/hosts.sharefs1				
# Host	Host IP	Server	Not	Server
# Name	Addresses	Priority	Used	Host
# ----	-----	-----	----	----
titan	172.16.0.129,titan.xyzco.com	1	-	server
tethys	172.16.0.130,tethys.xyzco.com	2	-	
mimas	mimas.xyzco.com	-	-	
dione	dione.xyzco.com	-	-	
helene	helene.xyzco.com	-	-	

5. Use the **samsharefs(1M)** command to update the current information in the binary file.

The options to use on this command, and the system from which it is issued, differ depending on whether or not the Sun StorEdge QFS shared file system is mounted, as follows:

- If the Sun StorEdge QFS shared file system is mounted, issue the **samsharefs(1M) -u** command from the current metadata server. For example:

```
# samsharefs -u sharefs1
```

- If the Sun StorEdge QFS shared file system is unmounted, issue the `samsharefs(1M) -R -u` command from the active metadata server or from any of the potential metadata servers. For example:

```
# samsharefs -R -u sharefs1
```

The client host `helene` is now recognized.

6. As superuser, log in to one of the client hosts.
7. Use the `format(1M)` command to verify the presence of client host disks.
8. Update the `mcf` file on the client host.

Before a host system can access or mount a shared file system, it must have that file system defined in its `mcf` file.

Use `vi(1)` or another editor to edit the `mcf` file on one of the client host systems. The `mcf` file must be updated on all client hosts to be included in the Sun StorEdge QFS shared file system. The file system and disk declaration information must have the same data for the Family Set Name, Equipment Ordinal, and Equipment Type as the configuration on the metadata server. The `mcf` files on the client hosts must also include the shared keyword. The device names, however, can change as controller assignments can change from host to host.

The `samfsconfig(1M)` command generates configuration information that can help you to identify the devices included in the Sun StorEdge QFS shared file system. Enter a separate `samfsconfig(1M)` command on each client host. Note that the controller number might not be the same controller number as on the metadata server because the controller numbers are assigned by each client host.

**Example 1.** CODE EXAMPLE 5-11 shows how the `samfsconfig(1M)` command is used to retrieve device information for family set `sharefs1` on client `tethys`. Note that

tethys is a potential metadata server, so it is connected to the same metadata disks as titan.

**CODE EXAMPLE 5-11** samfsconfig(1M) Command Example on tethys

```
tethys# samfsconfig /dev/dsk/*
#
# Family Set 'sharefs1' Created Wed Jun 27 19:33:50 2003
#
sharefs1                      10 ma sharefs1 on shared
/dev/dsk/c2t50020F23000065EE0s6 11 mm sharefs1 on
/dev/dsk/c7t50020F2300005D22d0s6 12 mr sharefs1 on
/dev/dsk/c7t50020F2300006099d0s6 13 mr sharefs1 on
/dev/dsk/c7t50020F230000651Cd0s6 14 mr sharefs1 on
```

Edit the mcf file on client host tethys by copying the last five lines of output from the samfsconfig(1M) command into the mcf file on client host tethys. Verify the following:

- Each Device State field is set to on.
- The shared keyword appears in the Additional Parameters field for the file system name.

CODE EXAMPLE 5-12 shows the resulting mcf file.

**CODE EXAMPLE 5-12** mcf File for sharefs1 Client Host tethys

# Equipment	Eq	Eq	Family	Dev	Add
# Identifier	Ord	Type	Set	State	Params
# -----	---	----	-----	-----	-----
sharefs1	10	ma	sharefs1	on	shared
/dev/dsk/c2t50020F23000065EE0s6	11	mm	sharefs1	on	
/dev/dsk/c7t50020F2300005D22d0s6	12	mr	sharefs1	on	
/dev/dsk/c7t50020F2300006099d0s6	13	mr	sharefs1	on	
/dev/dsk/c7t50020F230000651Cd0s6	14	mr	sharefs1	on	

In CODE EXAMPLE 5-12, note that the Equipment Ordinal numbers match those of the example mcf file for metadata server titan. These Equipment Ordinal numbers must not already be in use on client host tethys or any other client host.

**Example 2.** CODE EXAMPLE 5-13 shows how the samfsconfig(1M) command is used to retrieve device information for family set sharefs1 on client host mimas. Note

that mimas can never become a metadata server, and it is not connected to the metadata disks.

**CODE EXAMPLE 5-13** samfsconfig(1M) Command Example on mimas

```
mimas# samfsconfig /dev/dsk/*
#
# Family Set 'sharefs1' Created Wed Jun 27 19:33:50 2001
#
# Missing slices
# Ordinal 0
# /dev/dsk/c1t50020F2300005D22d0s6    12    mr    sharefs1    on
# /dev/dsk/c1t50020F2300006099d0s6    13    mr    sharefs1    on
# /dev/dsk/c1t50020F230000651Cd0s6    14    mr    sharefs1    on
```

In the output from the `samfsconfig(1M)` command on mimas, note that Ordinal 0, which is the metadata disk, is not present. Because devices are missing, the `samfsconfig(1M)` command comments out the elements of the file system and omits the file system Family Set declaration line. Make the following types of edits to the `mcf` file:

- Create a file system Family Set declaration line, beginning with `sharefs1`, in the `mcf` file for client host mimas. Enter the `shared` keyword in the Additional Parameters field of the file system Family Set declaration line.
- Create one or more `nodev` lines for each missing Equipment Ordinal. For these lines, the keyword `nodev` must appear in the Equipment Identifier field for each inaccessible device. In this example, you create a device entry in the `mcf` file named `nodev` to represent the missing metadata disk.
- Ensure that each Device State field is set to `on`.
- Uncomment the device lines.

CODE EXAMPLE 5-14 shows the resulting `mcf` file for mimas.

**CODE EXAMPLE 5-14** mcf File for Client Host mimas

```
# The mcf File For mimas
# Equipment
# Identifier
-----
sharefs1                      10    ma    sharefs1    on        shared
nodev                        11    mm    sharefs1    on
/dev/dsk/c1t50020F2300005D22d0s6 12    mr    sharefs1    on
/dev/dsk/c1t50020F2300006099d0s6 13    mr    sharefs1    on
/dev/dsk/c1t50020F230000651Cd0s6 14    mr    sharefs1    on
```

---

**Note** – If you update a metadata server’s `mcf` file after the Sun SAM-QFS shared file system is mounted, be sure to update the `mcf` files on all hosts that can access that shared file system.

---

**9. Issue the `samd(1M) config` command on the metadata server host.**

This informs the `sam-fsd` daemon of the configuration changes. For example:

```
# samd config
```

**10. Create the local hosts configuration file on the client host. (Optional)**

You might want to perform this step if your Sun StorEdge QFS shared host systems have multiple host interfaces. The local hosts configuration file defines the host interfaces that the metadata server and the client hosts can use when accessing the

file system. You use this file to specify how file system traffic should flow over public and private networks in your environment.

The local hosts configuration file must reside in the following location:

```
/etc/opt/SUNWsamfs/hosts.fsname.local
```

For *fsname*, specify the Family Set Name of the Sun StorEdge QFS shared file system.

Comments are permitted in the local hosts configuration file. Comment lines must begin with a pound character (#). Characters to the right of the pound character are ignored.

TABLE 5-1 shows the fields in the local hosts configuration file.

**TABLE 5-1** Local Hosts Configuration File Fields

Field Number	Content
1	The Host Name field. This field must contain the alphanumeric name of a metadata server or potential metadata server that is part of the Sun StorEdge QFS shared file system.
2	<p>The Host Interfaces field. This field must contain a comma-separated list of host interface addresses. This field can be created by using the output received from the <code>ifconfig(1M) -a</code> command. The individual interfaces can be specified in one of the following ways:</p> <ul style="list-style-type: none"><li>• Dotted-decimal IP address form</li><li>• IP version 6 hexadecimal address form</li><li>• As a symbolic name that the local domain name service (DNS) can resolve to a particular host interface</li></ul> <p>Each host uses this field to determine whether a host will try to connect to the specified host interface. The system evaluates the addresses from left to right, and the connection is made using the first responding address in the list that is also included in the shared hosts file.</p>

In a Sun StorEdge QFS shared file system, each client host obtains the list of metadata server IP addresses from the metadata server host.

The metadata server and the client hosts use both the `/etc/opt/SUNWsamfs/hosts.fs_name` file on the metadata server and the `hosts.fsname.local` file on each client host (if it exists) to determine the host interface to use when accessing the file system. This process is as follows (note that *client*, as in *network client*, is used to refer to both client hosts and the metadata server host in the following process):

1. The client obtains the list of metadata server host IP interfaces from the file system's on-disk host file. To examine this file, issue the `samsharefs(1M)` command from the metadata server or from a potential metadata server.

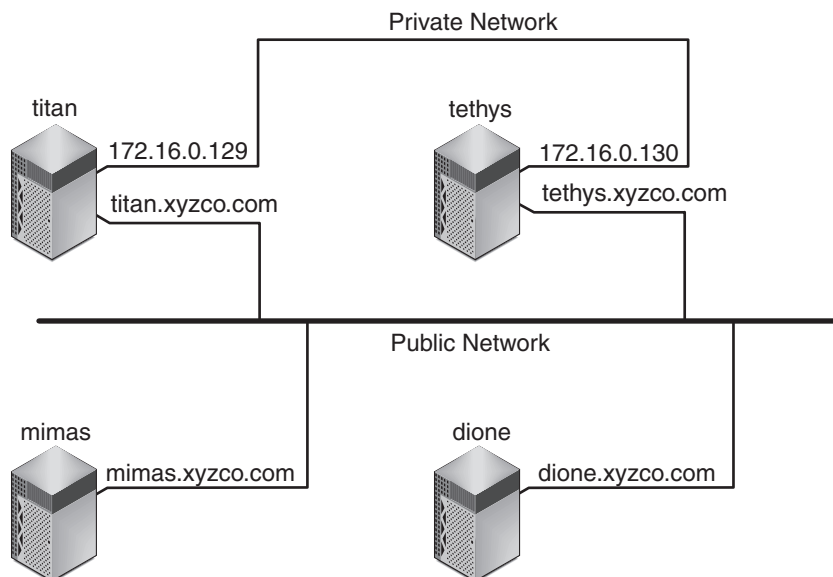
2. The client searches its files for a `hosts.fsname.local` file. Depending on the outcome of the search, one of the following courses of action is taken:
  - If a `hosts.fsname.local` file does not exist, the client attempts to connect, in turn, to each address in the system hosts configuration file until it succeeds in connecting.
  - If the `hosts.fsname.local` file exists, the client performs the following tasks:
    - i. It compares the list of addresses for the metadata server from both the `/etc/opt/SUNWsamfs/hosts.fsname` file on the metadata server and the `hosts.fsname.local` file.
    - ii. It builds a list of addresses that are present in both places, and then it attempts to connect to each of these addresses, in turn, until it succeeds in connecting to the server. If the order of the addresses differs in these files, the client uses the ordering in the `hosts.fsname.local` file.

**Example.** This example expands on the example that was introduced in the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*. CODE EXAMPLE 5-15 is an example hosts file that shows four hosts.

**CODE EXAMPLE 5-15** Sun StorEdge QFS Shared File System Hosts File Example

# File /etc/opt/SUNWsamfs/hosts.sharefs1				
# Host	Host IP	Server	Not	Server
# Name	Addresses	Priority	Used	Host
# ----	-----	-----	----	-----
titan	172.16.0.129,titan.xyzco.com	1	-	server
tethys	172.16.0.130,tethys.xyzco.com	2	-	
mimas	mimas.xyzco.com	-	-	
dione	dione.xyzco.com	-	-	

FIGURE 5-1 shows the interfaces to these systems.



**FIGURE 5-1** Network Interfaces

Systems `titan` and `tethys` share a private network connection with interfaces `172.16.0.129` and `172.16.0.130`. To guarantee that `titan` and `tethys` always communicate over their private network connection, the system administrator has created identical copies of `/etc/opt/SUNWsamfs/hosts.sharefs1.local` on each system. CODE EXAMPLE 5-16 shows the information in these files.

**CODE EXAMPLE 5-16** File `hosts.sharefs1.local` on Both `titan` and `tethys`

```
# This is file /etc/opt/SUNWsamfs/hosts.sharefs1.local
# Host Name      Host Interfaces
# -----
titan            172.16.0.129
tethys           172.16.0.130
```

Systems `mimas` and `dione` are not on the private network. To guarantee that they connect to `titan` and `tethys` through `titan`'s and `tethys`'s public interfaces, and never attempt to connect to `titan`'s or `tethys`'s unreachable private interfaces, the system administrator has created identical copies of



/etc/opt/SUNWsamfs/hosts.sharefs1.local on mimas and dione.  
CODE EXAMPLE 5-17 shows the information in these files.

**CODE EXAMPLE 5-17** File hosts.sharefs1.local on Both mimas and dione

```
# This is file /etc/opt/SUNWsamfs/hosts.sharefs1.local
# Host Name      Host Interfaces
# -----      -
titan           titan.xyzco.com
tethys          tethys.xyzco.com
```

**11. Issue the `samd(1M)` config command on the client host.**

This informs the `sam-fsd` daemon of the configuration changes. For example:

```
# samd config
```

**12. Verify that the `sam-sharefsd` daemon is running for this file system.**

To accomplish this, use the `ps(1)` and `grep(1)` commands as shown in CODE EXAMPLE 5-18.

**CODE EXAMPLE 5-18** Output from the `ps(1)` Command

```
# ps -ef | grep sam-sharefsd
root 26167 26158  0 18:35:20 ?          0:00 sam-sharefsd sharefs1
root 27808 27018  0 10:48:46 pts/21    0:00 grep sam-sharefsd
```

CODE EXAMPLE 5-18 shows that the `sam-sharefsd` daemon is active for the `sharefs1` file system. If this is the case for your system, you can proceed to the next step in this procedure. If, however, the output returned on your system does not show that the `sam-sharefsd` daemon is active for your Sun StorEdge QFS shared file system, perform the diagnostic procedures described in “Recovering a Hung mount(1M) Command” on page 134.

**13. If your mount point does not exist, make the mount point for the new Sun StorEdge QFS shared file system.**

Use the `mkdir(1)` command to make the directory for the mount point. For example:

```
# mkdir /sharefs1
```

**14. Issue the `chmod(1M)` command to give the mount point the 755 set of permissions.**

For example:

```
# chmod 755 /sharefs1
```

The permissions must be the same on all participant hosts. 755 is suggested as the initial permission set because users must have execute permission on the mount point in order to be able to use the file system after it has been mounted. After you mount the file systems, the `root` directory's permissions override this setting.

**15. Modify the `/etc/vfstab` file.**

You must have an entry in the `/etc/vfstab` file for the Sun StorEdge QFS shared file system. Specify `shared` in the Mount Parameters field.

If you want the Sun StorEdge QFS shared file system to automatically mount at boot, make the following changes in the `/etc/vfstab` file:

- Type `yes` in the `Mt@boot` field.
- Add the `bg` mount option in the `Mt params` field. The `bg` mount option mounts the file system in the background if the metadata server is not responding.

If you do not want to mount this file system automatically at boot time, type `no` in the `Mt@boot` field. In either case, as CODE EXAMPLE 5-19 shows, `shared` is a required entry in the `Mt params` field.

**CODE EXAMPLE 5-19** `/etc/vfstab` File Example

```
# File /etc/vfstab
# FS name  FS to fsck  Mnt pt   FS type  fsck  Mt@boot  Mt params
#                                     pass
sharefs1  -              /sharefs1 samfs   -      yes      shared,bg
```

**16. Issue the `df(1M)` command on the metadata server to verify that the file system is mounted on the metadata server.**

For example:

```
# df -k
```

17. From the client host, issue the `mount(1M)` command to mount the Sun StorEdge QFS shared file system on the client host.

For failover purposes, the mount options should be the same on the metadata server and all potential metadata servers. For example, you can create a `samfs.cmd(4)` file containing mount options and copy it to all the hosts.

For more information about mounting Sun StorEdge QFS shared file systems, see “Mount Options in a Sun StorEdge QFS Shared File System” on page 117, or see the `mount_samfs(1M)` man page.

For example:

```
# mount /sharefs1
```

## ▼ To Remove a Client Host

1. Become superuser on the metadata server and on all the client hosts.

---

**Tip** – You can use the `samsharefs(1M)` command to verify that you are, indeed, logged into the metadata server or a client host.

---

2. Use the `umount(1M)` command to unmount the Sun StorEdge QFS shared file system on the first client host.

Repeat this step for all client hosts that have the Sun StorEdge QFS shared file system mounted.

For example:

```
client# umount sharefs1
```

3. Use the `umount(1M)` command to unmount the Sun StorEdge QFS shared file system on the metadata server.

For example:

```
metaserver# umount sharefs1
```

4. If you have not already done so, log in as superuser to the metadata server for the Sun StorEdge QFS shared file system.

5. Use the `samsharefs(1M)` command to obtain the current configuration information.

The following example command writes current configuration information to file `/etc/opt/SUNWsamfs/hosts.sharefs1`:

```
# samsharefs -R sharefs1 > /etc/opt/SUNWsamfs/hosts.sharefs1
```

6. Use `vi(1)` or another editor to open the Sun StorEdge QFS shared file system information file.

CODE EXAMPLE 5-20 shows the file before deleting the client host.

**CODE EXAMPLE 5-20** `hosts.sharefs1` Before Deleting a Client Host

```
# vi /etc/opt/SUNWsamfs/hosts.sharefs1
# File /etc/opt/SUNWsamfs/hosts.sharefs1
# Host      Host IP      Server  Not   Server
# Name      Addresses      Priority Used  Host
# ----      -
titan       172.16.0.129,titan.xyzco.com    1      -    server
tethys      172.16.0.130,tethys.xyzco.com    2      -
mimas       mimas.xyzco.com                  -      -
dione       dione.xyzco.com                   -      -
helene      helene.xyzco.com                  -      -
```

7. Use the editor to delete the client host or hosts that are no longer to be supported.

CODE EXAMPLE 5-21 shows the file after the line for `helene` has been deleted.

**CODE EXAMPLE 5-21** `hosts.sharefs1` After Deleting a Client Host

```
# File /etc/opt/SUNWsamfs/hosts.sharefs1
# Host      Host IP      Server  Not   Server
# Name      Addresses      Priority Used  Host
# ----      -
titan       172.16.0.129,titan.xyzco.com    1      -    server
tethys      172.16.0.130,tethys.xyzco.com    2      -
mimas       mimas.xyzco.com                  -      -
dione       dione.xyzco.com                   -      -
```

8. Use the `samsharefs(1M) -R -u` command to update the current hosts information.

For example:

```
# samsharefs -R -u sharefs1
```

The host `helene` has been removed.

9. Use the `samsharefs(1M) -R` command to display the current configuration.

For example:

```
# samsharefs -R sharefs1
```

10. Use the `mount(1M)` command to mount the Sun StorEdge QFS shared file system on the metadata server.

For information about the `mount(1M)` command, see the `mount_samfs(1M)` man page.

11. Use the `mount(1M)` command to mount the Sun StorEdge QFS shared file system on the client hosts.

For information about the `mount(1M)` command, see the `mount_samfs(1M)` man page.

---

## Changing the Metadata Server in a Sun StorEdge QFS Environment

The procedures in the following sections describe how to change which host is acting as the metadata server in a Sun StorEdge QFS shared file system without using the automatic Membership Services feature of a software package such as Sun Cluster.

You can change the metadata server system manually under the following circumstances:

- If the metadata server becomes unavailable
- If you want to change the metadata server or the potential metadata servers

For changing the metadata server to succeed, the mount options of the existing metadata server and all potential metadata servers must be the same.

---

**Note** – Contact the Sun Microsystems Professional Services Group if you need assistance in changing the metadata server in a Sun SAM-QFS environment.

---

Choose one of the following procedures depending on whether the existing metadata server is available at the time the change is being performed:

- “To Change the Metadata Server When the Metadata Server Is Available” on page 114
- “To Change the Metadata Server When the Metadata Server Is Unavailable” on page 114

## ▼ To Change the Metadata Server When the Metadata Server Is Available

This procedure shows how to change the metadata server of a Sun StorEdge QFS shared file system in a Sun StorEdge QFS environment when the metadata server is available.

- **On the existing metadata server, issue the `samsharefs(1M) -s` command to declare the new metadata server.**

For example:

```
titan# samsharefs -s tethys sharefs1
```

## ▼ To Change the Metadata Server When the Metadata Server Is Unavailable

This procedure shows how to change the metadata server of a Sun StorEdge QFS shared file system in a Sun StorEdge QFS environment when the existing metadata server is unavailable.

1. **Ensure that the existing metadata server cannot restart without being rebooted.**

Specifically, ensure that the server is powered down, rebooted, halted, or disconnected from the metadata disks. Your goal is to bring down the old metadata

server and flush or destroy all buffers (or otherwise ensure that they cannot be rewritten).

CODE EXAMPLE 5-22 shows the key sequence to use from the `kadb` prompt.

**CODE EXAMPLE 5-22** Key Sequence for Ensuring that the Metadata Server Cannot Restart from the `kadb` Prompt

```
kadb[1]: :c      # Forces a dump
kadb[1]: $q      # Exits the debugger for prom
```

CODE EXAMPLE 5-23 shows the key sequence to use from the PROM prompt.

**CODE EXAMPLE 5-23** Key Sequence for Ensuring that the Metadata Server Cannot Restart from the PROM Prompt

```
{0} > sync      # Forces the buffers out
{0} > boot args  # Discards buffers
```

For *args*, specify arguments for the `boot(1M)` command, such as `-r` or `-v`. For information, see the `boot(1M)` man page.



---

**Caution** – If the metadata server of a shared file system crashes, it is safe to change the metadata server only *after* rebooting the metadata server or otherwise ensuring that the server cannot issue any I/O before being rebooted. Do not use any of the following methods to stop the server because these are likely to corrupt the file system:

- Issuing an L1-A key sequence
- Performing an involuntary failover to another host
- Issuing a `go` (continue), requesting a dump file, or issuing a `sync` command to the old, down metadata server

Similarly, if the metadata server panics and drops into kernel `adb(1)`, do not change the metadata server and then issue `:c` (continue) on the server. This action causes the old metadata server to push stale buffers out to the now active file system.

---

2. From the new (potential) metadata server, wait for at least the period of the maximum lease time, and then issue the `samsharefs(1M)` command.

The wait is necessary because you must ensure that all client leases expire before you issue the `samsharefs(1M)` command. From the new metadata server, issue a command such as the following:

```
# samsharefs -R -s tethys sharefs1
```

If you are uncertain as to whether or not the lease time has expired, bring up the `samu(1M) N` display. For information about `samu(1M)`, see “Using the `samu(1M)` Operator Utility” on page 145. For information about leases and their durations, see “Using Leases in a Sun StorEdge QFS Shared File System: the `rdlease=n`, `wrlease=n`, and `aplease=n` Options” on page 119.



---

**Caution** – If you use the `-R` option to the `samsharefs(1M)` command on a mounted file system to change the metadata server host, you must first stop, disable, and disconnect the active metadata server. Failure to do so can cause file system corruption.

---

3. Unmount the file system. (Optional)

Perform this step only if you want to perform a file system check.

Use the procedure in “To Unmount a Sun StorEdge QFS Shared File System” on page 99.

4. Issue the `samfsck(1M)` command to perform a file system check. (Optional)

Perform this step only if you want to perform a file system check at this time.

If the metadata server of a Sun StorEdge QFS or Sun SAM-QFS shared file system crashes, the server should be rebooted and the file system should be unmounted on all clients before a `samfsck(1M)` is run. The server and clients preallocate blocks before changing the length of files. The `samfsck(1M)` command cleans up files that have extra blocks allocated, and these extra blocks might contain data. If such a cleaned-up file is awaiting a size update from the client, the file will be missing those blocks when the client continues. As a result, the file will be missing data, and the missed data will read as zeroes.



---

# Daemons

In a Sun StorEdge QFS shared file system, a `sam-fsd` daemon is always active. In addition, one `sam-sharefsd` daemon is active for each mount point configured in the Sun StorEdge QFS shared file system.

When a `sam-fsd` daemon recognizes a Sun StorEdge QFS shared file system, it starts a shared file system daemon (`sam-sharefsd`). TCP sockets are used to communicate between the server and client hosts. All clients that connect to the metadata server are validated against the hosts file.

One Sun StorEdge QFS shared file system daemon is started for each Sun StorEdge QFS shared file system shared mount point on each client host. This daemon establishes a connection to the metadata server. The `sam-sharedfsd` daemon on the metadata server opens a listener socket on the port named `sam-qfs`. At Sun StorEdge QFS installation time, the `sam-qfs` entry is added to `/etc/services` automatically, and this entry should not be removed. The shared file system port is defined in the `/etc/inet/services` file. The port number installed in the `/etc/inet/services` file is 7105. Verify that this port does not conflict with another service.

---

**Note** – Before the Sun StorEdge QFS 4.2 release, one port per file system was required. You can remove these entries from your file.

---

All metadata operations, block allocation and deallocation, and record locking are performed on the metadata server. The `sam-sharefsd` daemon does not keep any information. Hence, it can be killed and restarted without causing any consistency problems for the file system.

---

## Mount Options in a Sun StorEdge QFS Shared File System

The Sun StorEdge QFS shared file system can be mounted with several mount options. This chapter describes many options within the context of their roles. Other options, however, are useful only in certain situations. This section describes the mount options that can be used for special purposes.

You can specify most mount options by using the `mount(1M)` command, by entering them in the `/etc/vfstab` file, or by entering them in the `samfs.cmd(4)` file. For example, the following `/etc/vfstab` file includes `mount(1M)` options for a Sun StorEdge QFS shared file system:

```
sharefs1 - /sfs samfs - no shared,mh_write
```

You can change some mount options dynamically by using the `samu(1M)` operator utility. For more information about these options, see “Using the `samu(1M)` Operator Utility” on page 145.

The following sections summarize the mount options available to you in a Sun StorEdge QFS shared file system. For more information about any of these mount options, see the `mount_samfs(1M)` man page or see the cross-references mentioned in their descriptions.

## Mounting in the Background: the `bg` Option

The `bg` mount option specifies that if the first mount operation fails, subsequent attempts at mounting should occur in the background. By default, `bg` is not in effect, and mount attempts continue in the foreground.

---

**Note** – Do *not* use this option if you are mounting a Sun StorEdge QFS shared file system on a Sun Cluster node.

---

## Reattempting a File System Mount: the `retry` Option

The `retry` mount option specifies the number of times that the system should attempt to mount a file system. The default is 10000.

## Declaring a Sun StorEdge QFS Shared File System: the `shared` Option

The `shared` mount option declares a file system to be a Sun StorEdge QFS shared file system. This option must be specified in the `/etc/vfstab` file in order for the file system to be mounted as a Sun StorEdge QFS shared file system. The presence of

this option in a `samfs.cmd(4)` file or on the `mount(1M)` command does not cause an error condition, but it does not mount the file system as a Sun StorEdge QFS shared file system.

## Tuning Allocation Sizes: the `minallocsz=n` and `maxallocsz=n` Options

The `-o minallocsz=n` and `-o maxallocsz=n` options to the `mount(1M)` command specify an amount of space, in kilobytes. This is the minimum block allocation size. If a file is growing, the metadata server allocates blocks when an append lease is granted. You can use the `-o minallocsz=n` option to specify the initial size of this allocation. The metadata server can increase the size of the block allocation depending on the application's access patterns up to, but not exceeding, the `-o maxallocsz=n` option's setting.

You can specify these `mount(1M)` options on the `mount(1M)` command line, in the `/etc/vfstab` file, or in the `samfs.cmd` file.

## Using Leases in a Sun StorEdge QFS Shared File System: the `rdlease=n`, `wrlease=n`, and `aplease=n` Options

A *lease* grants a shared host permission to perform an operation on a file for as long as the lease is valid. The metadata server issues leases to each shared host, including itself. The leases are renewed as necessary to permit continued file operations. The possible file operations are as follows:

- A *read lease* enables existing file data to be read.
- A *write lease* enables existing file data to be overwritten.
- An *append lease* enables a file's size to be extended and enables newly allocated blocks to be written.

A shared host can continue to update leases for as long as necessary. The lease is transparent to the end user. TABLE 5-2 shows the mount options that enable you to specify the duration of each lease type.

**TABLE 5-2** Lease-Related mount(1M) Options

Option	Action
-o rdlease= <i>n</i>	This option specifies the maximum amount of time, in seconds, for the read lease.
-o wrlease= <i>n</i>	This option specifies the maximum amount of time, in seconds, for the write lease.
-o aplease= <i>n</i>	This option specifies the maximum amount of time, in seconds, for the append lease.

All three leases enable you to specify an *n* such that  $15 \leq n \leq 600$ . The default time for each lease is 30 seconds. A file cannot be truncated if a lease is in effect. For more information about setting these leases, see the `mount_samfs(1M)` man page.

If you change the metadata server because the current metadata server is down, you must add the lease time to the change over time because all leases must expire before an alternate metadata server can assume control.

Setting a short lease time causes more traffic between the client hosts and the metadata server because the lease must be renewed after it has expired. For information on lease times in a Sun Cluster environment, see the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.

## Enabling Multiple Host Reads and Writes: the `mh_write` Option

By default, in a Sun StorEdge QFS shared file system, multiple hosts can read the same file at the same time, and if no host is writing to that file, I/O can be paged on all hosts. Only one host can append or write to a file at any one time.

The `mh_write` option controls write access to the same file from multiple hosts. If `mh_write` is specified as a mount option on the metadata server host, the Sun StorEdge QFS shared file system enables simultaneous reads and writes to the same file from multiple hosts. If `mh_write` is not specified on the metadata server host, only one host can write to a file at any one time.

By default, `mh_write` is disabled, and only one host has write access to a file at any one time. The length of that time period is determined by the duration of the `wrlease` mount option. If the Sun StorEdge QFS shared file system is mounted on the metadata server with the `mh_write` option enabled, simultaneous reads and writes to the same file can occur from multiple hosts.

TABLE 5-3 describes how file access from multiple hosts is affected depending on whether the `mh_write` option is enabled on the metadata server.

**TABLE 5-3** File Access Based on the `mh_write` Option

<code>mh_write</code> Not Enabled on the Metadata Server	<code>mh_write</code> Enabled on the Metadata Server
Multiple reader hosts allowed. Can use paged I/O.	Multiple reader hosts allowed. Can use paged I/O.
Only one writer host is allowed. Can use paged I/O. All other hosts wait.	Multiple reader and/or writer hosts allowed. If any writer hosts exist, all I/O is direct.
Only one append host. All other hosts wait.	Only one append host is allowed. All other hosts can read and/or write. If any writer hosts exist, all I/O is direct.

The `mh_write` option does not change locking behavior. File locks behave the same whether `mh_write` is in effect or not. The `mh_write` option's effect is as follows:

- When `mh_write` is in effect, all hosts can read from and write to the same file simultaneously.
- When `mh_write` is not in effect, only one host can write to a given file during a given time interval, and no hosts can read from the file during that time interval.

Sun StorEdge QFS shared file system maintains consistency between hosts. The first time that a host executes a read or write system call, it gets a *lease*, which allows it to read or write the file for some period of time. The existence of that lease prevents other hosts without `mh_write` from accessing the file. In particular, the lease can last longer than the duration of the system call that caused its acquisition.

When `mh_write` is not in effect, the Sun StorEdge QFS shared file system should provide near-POSIX behavior for data reads and writes. For metadata, however, access time changes might not be seen immediately on other hosts. Changes to a file are pushed to disk at the end of a write lease, and when a read lease is acquired, the system invalidates any stale cache pages so that the newly written data can be seen.

When `mh_write` is in effect, behavior might be less consistent. When there are simultaneous readers and writers, the Sun StorEdge QFS shared file system switches all hosts accessing the file into direct I/O mode. This means that page-aligned I/O

should be visible immediately to other hosts. However, non-page-aligned I/O can result in stale data being visible, or even written to the file, because the normal lease mechanism that prevents this has been disabled.

You should specify the `mh_write` option only when multiple hosts need to write to the same file simultaneously and when applications perform page-aligned I/O. In other cases, there is some risk of data inconsistency because even using `flock()` (which works with `mh_write`) to coordinate between hosts does not guarantee consistency.

For more information about `mh_write`, see the `mount_samfs(1M)` man page.

## Setting the Number of Concurrent Threads: the `nstreams=n` Option

The `nstreams=n` mount option sets the number of concurrent threads for the Sun StorEdge QFS shared file system. By default, `nstreams=256`. This means, for example, that under default settings, up to 256 operations can be processed simultaneously, and the 257th operation commences only after an operation has finished. You can adjust the `nstreams=n` mount option based on the Sun StorEdge QFS shared file system's activity. For *n*, specify a value such that  $76 \leq n \leq 1024$ .

## Retaining Cached Attributes: the `meta_timeo=n` Option

The `meta_timeo=n` mount option determines how long the system waits between checks on the metadata information. By default, the system refreshes metadata information every 15 seconds. This means, for example, that an `ls(1)` command entered in a Sun StorEdge QFS shared file system with several newly created files might not return information about all the files until 15 seconds had passed. For *n*, specify a value such that  $0 \leq n \leq 60$ .

## Specifying Striped Allocation: the `stripe` Option

By default, data files in the Sun StorEdge QFS shared file system are allocated using the round-robin file allocation method. To specify that file data be striped across disks, you can specify the `stripe` mount option on the metadata host and all potential metadata hosts. Note that by default, unshared file systems allocate file data using the striped method.

In a round-robin allocation, files are created in a round-robin fashion on each slice or striped group. This causes the maximum performance for one file to be the speed of a slice or striped group. For more information about file allocation methods, see “File System Design” on page 7.

## Specifying the Frequency With Which Metadata is Written: the `sync_meta=n` Option

You can set the `sync_meta=n` option to `sync_meta=1` or `sync_meta=0`.

By default, `sync_meta=1` and a Sun StorEdge QFS shared file system writes file metadata to disk every time the metadata changes. This slows data performance, but it ensures data consistency. This is the setting that must be in effect if you want to change the metadata server.

If you set `sync_meta=0`, the Sun StorEdge QFS shared file system writes the metadata to a buffer before writing it to disk. This delayed write delivers higher performance, but it decreases data consistency after an unscheduled machine interruption.

## Enabling WORM Functionality: the `worm_capable` and `def_retention` Options

If you have purchased the optional WORM package, the `worm_capable` mount option enables the file system to support WORM files. The `def_retention` mount option sets the default retention time. The retention time is specified in minutes using the format `def_retention=x`.

See “WORM File Systems” on page 310 for more information about the WORM functionality.

---

# Mount Semantics in a Sun StorEdge QFS Shared File System

The behavior of the Sun StorEdge QFS shared file system is that of an interruptible hard connection. Each client tries repeatedly to communicate with the metadata server, even if the server is unavailable. If the metadata server is not responding, a user can terminate any pending, blocked I/O transmission by pressing Ctrl-C. If the I/O attempt is interrupted, the client persists until the I/O completes.

The system generates the following messages to describe status conditions:

```
SAM-FS: Shared server is not responding.
```

This message is also generated if the client `sam-sharefsd` daemon is not active or if the server `sam-sharefsd` daemon is not active. When the server responds, it generates the following message:

```
SAM-FS: Shared server is responding.
```

If the file system is not mounted on the metadata server, but it is mounted on the client, the system generates the following message:

```
SAM-FS: Shared server is not mounted.
```

When the Sun StorEdge QFS shared file system mounts on the server, it generates the following message:

```
SAM-FS: Shared server is mounted.
```



---

# File Locking in a Sun StorEdge QFS Shared File System

Mandatory locks are not supported. An EACCES error is returned if the mandatory lock is set. Advisory locks are supported. For more information about advisory locks, see the `fcntl(2)` system call.

---

## Performance Considerations

Because the metadata server looks up file names on behalf of all clients, performance can improve if you increase the size of the Solaris directory name lookup cache (DNLC) on the metadata server. This can increase performance when clients are frequently opening a large number of files. Doubling or tripling the size of this cache from its default can be appropriate.

This procedure is documented in the *Solaris Tunable Parameters Reference Manual*. The parameter that controls the size of the directory name lookup cache is `ncsize`.

---

## Troubleshooting a Failed or Hung `sammkfs(1M)` or `mount(1M)` Command

The following sections describe what to do when a `sammkfs(1M)` or `mount(1M)` command fails or when a `mount(1M)` command hangs.

The procedures in this section can be performed on client hosts and can also be performed on the server. Commands that can be executed only on the metadata server are preceded with a `server#` prompt.

## Recovering a Failed `sammkfs(1M)` Command

If the `sammkfs(1M)` command returns an error or messages indicating that an unexpected set of devices are to be initialized, you need to perform this procedure. It includes steps for verifying the `mcf(4)` file and for propagating `mcf(4)` file changes to the system.

### ▼ To Verify the `mcf(4)` File and Propagate `mcf(4)` File Changes to the System

1. Use the `sam-fsd(1M)` command to verify the `mcf(4)` file.

For example:

```
# sam-fsd
```

Examine the output from the `sam-fsd(1M)` command and determine if there are errors that you need to fix.

2. Edit the `mcf(4)` file to resolve any diagnostic issues. (Optional)

Perform this step if the output from the `sam-fsd(1M)` command indicates that there are errors in the `/etc/opt/SUNWsamfs/mcf` file.

3. Issue the `sam-fsd(1M)` command again to verify the `mcf(4)` file.

Repeat Step 1, Step 2, and Step 3 of this process until the output from the `sam-fsd(1M)` command indicates that the `mcf(4)` file is correct.

4. Issue the `samd(1M) config` command.

This is needed to propagate `mcf(4)` file changes by informing the `sam-fsd` daemon of the configuration change.

For example:

```
# samd config
```

## Recovering a Failed `mount(1M)` Command

A `mount(1M)` command can fail for several reasons. This section describes some actions you can take to remedy a mount problem. If the `mount(1M)` command hangs, rather than fails, see “Recovering a Hung `mount(1M)` Command” on page 134.

Some failed `mount(1M)` behaviors and their remedies are as follows:

- If the `mount(1M)` command fails with a `Shared server is not mounted` message generated on a client, determine the server host and mount the file system on the metadata server.
- If the `mount` command fails with a message indicating that there is a mismatch between the file system and the `mcf(4)` file, ensure the following:
  - That the `mcf(4)` file is syntactically valid. For more information, see “To Verify the `mcf(4)` File and Propagate `mcf(4)` File Changes to the System” on page 126.
  - That recent changes to the `mcf(4)` file are valid and have been enacted. For more information, see “To Verify the `mcf(4)` File and Propagate `mcf(4)` File Changes to the System” on page 126.
  - That the `mcf(4)` file matches the server’s `mcf(4)` file with device names or controller numbers adjusted for any differences on the client. You can use the `samfsconfig(1M)` command to diagnose some of these problems. For more information about using the `samfsconfig(1M)` command, see “To Use the `samfsconfig(1M)` Command” on page 132.
- If the `mount(1M)` command fails for other reasons, use the procedures described in the following sections to verify the system characteristics that must be in place in order for the `mount(1M)` command to be successful. These procedures are as follows:
  - “To Verify that the File System can be Mounted” on page 127
  - “To Use the `samfsinfo(1M)` and `samsharefs(1M)` Commands” on page 130
  - “To Use the `samfsconfig(1M)` Command” on page 132

## ▼ To Verify that the File System can be Mounted

If this procedure does not expose errors, perform “To Use the `samfsinfo(1M)` and `samsharefs(1M)` Commands” on page 130, which can help you verify that the file system has been created and that the shared hosts file is correctly initialized.

The following procedure shows you what to verify if the `mount(1M)` command fails.

## 1. Ensure that the mount point directory is present.

There are multiple ways to accomplish this. For example, you can issue the `ls(1)` command in the following format:

```
ls -ld mountpoint
```

For *mountpoint*, specify the name of the Sun StorEdge QFS shared file system's mount point.

When you examine the `ls(1)` command's output, make sure that the output shows a directory with access mode 755. In other words, the codes should read `drwxr-xr-x`. CODE EXAMPLE 5-24 shows example output.

### CODE EXAMPLE 5-24 Access Mode Values

```
# ls -ld /sharefs1  
drwxr-xr-x  2 root      sys          512 Mar 19 10:46 /sharefs1
```

If the access is not at this level, enter the following `chmod(1)` command:

```
# chmod 755 mountpoint
```

For *mountpoint*, specify the name of the Sun StorEdge QFS shared file system's mount point.

## 2. Ensure that there is an entry for the file system in the `/etc/vfstab` file.

CODE EXAMPLE 5-25 shows an entry for the shared file system named `sharefs1`.

### CODE EXAMPLE 5-25 Example `/etc/vfstab` File

```
# File /etc/vfstab  
# FS name  FS to fsck  Mnt pt FS type  fsck pass  Mt@boot  Mt params  
sharefs1   -           /sharefs1 samfs -         yes      shared,bg
```

Ensure that the `shared` flag is present in the Mount Parameters field of the shared file system's entry in the `/etc/vfstab` file.

**3. Ensure that the mount point directory is not shared out for NFS use.**

If the mount point is shared, use the `unshare(1M)` command to unshare it. For example:

```
# unshare mountpoint
```

For *mountpoint*, specify the name of the Sun SAM-QFS shared file system's mount point.

## ▼ To Use the `samfsinfo(1M)` and `samsharefs(1M)` Commands

This procedure shows how to analyze the output from these commands.

### 1. Enter the `samfsinfo(1M)` command on the server.

Use this command in the following format:

```
samfsinfo filesystem
```

For *filesystem*, specify the name of the Sun StorEdge QFS shared file system as specified in the `mcf(4)` file. CODE EXAMPLE 5-26 shows the `samfsinfo(1M)` command and output.

**CODE EXAMPLE 5-26** samfsinfo(1M) Command Example

```
titan-server# samfsinfo sharefs1
samfsinfo: filesystem sharefs1 is mounted.
name:      sharefs1      version:      2      shared
time:      Mon Apr 29 15:12:18 2002
count:     3
capacity:  10d84000      DAU:      64
space:     10180400
meta capacity: 009fe200      meta DAU: 16
meta space: 009f6c60
ord  eq  capacity      space  device
1    11  086c0000      080c39b0  /dev/dsk/c1t2100002037E9C296d0s6
2    12  086c4000      080bca50  /dev/dsk/c3t50020F2300005D22d0s6
3    13  086c4000      080a9650  /dev/dsk/c3t50020F2300006099d0s6
4    14  086c4000      08600000  /dev/dsk/c3t50020F230000651Cd0s6
```

The output from CODE EXAMPLE 5-26 shows a shared keyword in the following line:

```
name:      sharefs1      version:      2      shared
```

Note the list of file system devices, ordinals, and equipment numbers that appear after the following line:

```
ord  eq  capacity      space  device
```

Make sure that these numbers correspond to the devices in the file system’s `mcf(4)` entry.

## 2. Enter the `samsharefs(1M)` command on the server.

Use this command in the following format:

```
samsharefs -R filesystem
```

For *filesystem*, specify the name of the Sun StorEdge QFS shared file system as specified in the `mcf(4)` file. CODE EXAMPLE 5-27 shows the `samsharefs(1M)` command and output.

### CODE EXAMPLE 5-27 `samsharefs(1M)` Command Example

```
titan-server# samsharefs -R sharefs1
#
# Host file for family set 'sharefs1'
#
# Version: 3      Generation: 50      Count: 4
# Server = host 0/titan, length = 216
#
titan 173.26.2.129,titan.foo.com 1 - server
tethys 173.26.2.130,tethys.foo.com 2 -
dione dione.foo.com 0 -
mimas mimas.foo.com 0 -
```

The following information pertains to the diagnostic output from the `samfsinfo(1M)` or `samsharefs(1M)` commands.

- If either command issues diagnostics or error messages, resolve them. Ensure that the output from the `samfsinfo(1M)` command includes the `shared` keyword.
- You can execute these commands on alternate server hosts and on client hosts that have no `nodev` devices in the host's `mcf` entry for the file system.

If the `samfsinfo(1M)` and `samsharefs(1M)` commands do not expose irregularities, perform “To Use the `samfsconfig(1M)` Command” on page 132.

## ▼ To Use the `samfsconfig(1M)` Command

On clients with `nodev` device entries in the `mcf` file for the file system, the entire file system might not be accessible, and the shared hosts file might not be directly accessible. You can use the `samfsconfig(1M)` command to determine whether the shared file system's data partitions are accessible.



- **Issue the `samfsconfig(1M)` command.**

Use this command in the following format:

```
samfsconfig list_of_devices
```

For *list\_of\_devices*, specify the list of devices from the file system entry in the `mcf(4)` file. Use a space to separate multiple devices in the list.

**Example 1.** CODE EXAMPLE 5-28 shows the `mcf` file for the host `tethys`, a host that does not have a `nodev` entry in its `mcf` file. It then shows the `samfsconfig(1M)` command issued.

**CODE EXAMPLE 5-28** `samfsconfig(1M)` Command Example Without `nodev` Entries

```
tethys# cat /etc/opt/SUNWsamfs/mcf
sharefs1                      10  ma   sharefs1   on  shared
/dev/dsk/c1t2100002037E9C296d0s6 11  mm   sharefs1   -
/dev/dsk/c3t50020F2300005D22d0s6 12  mr   sharefs1   -
/dev/dsk/c3t50020F2300006099d0s6 13  mr   sharefs1   -
/dev/dsk/c3t50020F230000651Cd0s6 14  mr   sharefs1   -

tethys# samfsconfig /dev/dsk/c1t2100002037E9C296d0s6
/dev/dsk/c3t50020F2300005D22d0s6 /dev/dsk/c3t50020F2300006099d0s6
/dev/dsk/c3t50020F230000651Cd0s6
#
# Family Set 'sharefs1' Created Mon Apr 29 15:12:18 2002
#
sharefs1                      10  ma   sharefs1   -  shared
/dev/dsk/c1t2100002037E9C296d0s6 11  mm   sharefs1   -
/dev/dsk/c3t50020F2300005D22d0s6 12  mr   sharefs1   -
/dev/dsk/c3t50020F2300006099d0s6 13  mr   sharefs1   -
/dev/dsk/c3t50020F230000651Cd0s6 14  mr   sharefs1   -
```

**Example 2.** CODE EXAMPLE 5-29 shows the `samfsconfig(1M)` command being used on a host that has a `nodev` entry in its `mcf` file.

**CODE EXAMPLE 5-29** `samfsconfig(1M)` Command Example With `nodev` Entries

```
dione# cat /etc/opt/SUNWsamfs/mcf
sharefs1                      10  ma   sharefs1   on  shared
nodev                        11  mm   sharefs1   -
/dev/dsk/c4t50020F23000055A8d0s3 12  mr   sharefs1   -
/dev/dsk/c4t50020F23000055A8d0s4 13  mr   sharefs1   -
/dev/dsk/c4t50020F23000055A8d0s5 14  mr   sharefs1   -
```

**CODE EXAMPLE 5-29** `samfsconfig(1M)` Command Example With `nodev` Entries

```
dione# samfsconfig /dev/dsk/c4t50020F23000055A8d0s3
/dev/dsk/c4t50020F23000055A8d0s4 /dev/dsk/c4t50020F23000055A8d0s5
#
# Family Set 'sharefs1' Created Mon Apr 29 15:12:18 2002
#
# Missing slices
# Ordinal 1
# /dev/dsk/c4t50020F23000055A8d0s3      12      mr      sharefs1  -
# /dev/dsk/c4t50020F23000055A8d0s4      13      mr      sharefs1  -
# /dev/dsk/c4t50020F23000055A8d0s5      14      mr      sharefs1  -
```

For examples 1 and 2, verify that the output lists all slices from the file system, other than the metadata (`mm`) devices, as belonging to the file system. This is the case for example 2.

## Recovering a Hung `mount(1M)` Command

If the `mount(1M)` command hangs, follow the procedure in this section. You have a hung `mount(1M)` command if, for example, the `mount(1M)` command fails with a connection error or with a `Server not responding` message that does not resolve itself within 30 seconds.

The most typical remedy for a hung `mount(1M)` command is presented first. If that does not work, perform the subsequent procedures.

### ▼ To Verify Network Connections

The `netstat(1M)` command verifies that the `sam-sharefsd` daemon's network connections are correctly configured.

1. **Become superuser on the metadata server.**
2. **Type the `samu(1M)` command to invoke the `samu(1M)` operator utility.**

For example:

```
# samu
```

3. Press P to access the Active Services display.

CODE EXAMPLE 5-30 shows a P display.

**CODE EXAMPLE 5-30** P Display on the Metadata Server

```
Active Services                                samu   4.2 09:02:22 Sept 22 2004

Registered services for host 'titan':
    sharedfs.sharefs1
    1 service(s) registered.
```

Examine the output. In CODE EXAMPLE 5-30, look for a line that contains `sharedfs.filesystem-name`. In this example, the line must contain `sharedfs.sharefs1`.

If no such line appears, you need to verify that both the `sam-fsd` and `sam-sharefsd` daemons have started. Perform the following steps:

a. Enable daemon tracing in the `defaults.conf` file.

For information about how to enable tracing, see `defaults.conf(4)` or see Step 2 in “To Examine the `sam-sharefsd` Trace Log (Optional)” on page 140.

b. Examine your configuration files, especially `/etc/opt/SUNWsamfs/mcf`.

c. After you have checked your configuration files and verified that the daemons are active, begin this procedure again.

4. Enter the `samsharefs(1M)` command to check the hosts file.

CODE EXAMPLE 5-34 shows the `samsharefs(1M)` command and correct output.

**CODE EXAMPLE 5-31** `samsharefs(1M) -R` Command

```
titan-server# samsharefs -R sharefs1
#
# Host file for family set 'sharefs1'
#
# Version: 3      Generation: 50      Count: 4
# Server = host 0/titan, length = 216
#
titan 173.26.2.129,titan.foo.com 1 - server
tethys 173.26.2.130,tethys.foo.com 2 -
dione dione.foo.com 0 -
mimas mimas.foo.com 0 -
```

In the output on your system, verify the following:

- That the host name is present in column 1 of the output and that it is designated as the server.
- That the host IP address is present in column 2. If there are multiple IP addresses, make sure that they are all valid.

#### 5. Enter the `netstat(1M)` command on the server.

CODE EXAMPLE 5-32 shows the `netstat(1M)` command entered on server `titan`.

**CODE EXAMPLE 5-32** `netstat(1M)` Example on the Server

```
titan-server# netstat -a | grep sam-qfs
*.sam-qfs *.*                0      0 24576  0 LISTEN
*.sam-qfs *.*                0      0 24576  0 LISTEN
titan.32834 titan.sam-qfs 32768    0 32768  0 ESTABLISHED
titan.sam-qfs titan.32891 32768    0 32768  0 ESTABLISHED
titan.sam-qfs tethys.32884 24820    0 24820  0 ESTABLISHED
titan.sam-qfs dione.35299 24820    0 24820  0 ESTABLISHED
*.sam-qfs *.*                0      0 24576  0 LISTEN
```

Verify that the output from the `netstat(1M)` command on the server contains the following:

- Three `LISTEN` entries.
- Two `ESTABLISHED` entries for the host.
- One `ESTABLISHED` entry for each client that is configured and running the `sam-fsd` daemon. This example shows `ESTABLISHED` entries for `tethys` and `dione`. There should be one `ESTABLISHED` entry for each client that is configured and running whether or not it is mounted.

#### 6. Enter the `netstat(1M)` command on the client.

CODE EXAMPLE 5-33 shows the `netstat(1M)` command entered on client `dione`.

**CODE EXAMPLE 5-33** `netstat(1M)` Command on the Client

```
dione-client# netstat -a | grep sam-qfs
*.sam-qfs *.*                0      0 24576  0 LISTEN
*.sam-qfs *.*                0      0 24576  0 LISTEN
dione.32831 titan.sam-qfs 24820    0 24820  0 ESTABLISHED
*.sam-qfs *.*                0      0 24576  0 LISTEN
```

Verify that the output contains the following:

- Three `LISTEN` entries. All entries are for the `sam-fsd` daemon.

- One ESTABLISHED entry.

If these lines are present, then the network connection is established.

If an ESTABLISHED connection is not reported, go to Step 7.

## 7. Perform one or more of the following procedures:

- “To Verify That the Client Can Reach the Server (Optional)” on page 137
- “To Verify That the Server Can Reach the Client (Optional)” on page 139
- “To Examine the sam-sharefsd Trace Log (Optional)” on page 140

## ▼ To Verify That the Client Can Reach the Server (Optional)

Perform these steps if using the procedure described in “To Verify Network Connections” on page 134 did not show an ESTABLISHED connection.

### 1. Use the `samsharefs(1M)` command to verify the hosts file on the server.

You can issue the `samsharefs(1M)` command on alternate server hosts and client hosts that have no `nodev` devices listed in the host’s `mcf(4)` entry for the file system. For this step, use this command in the following format:

```
samsharefs -R filesystem
```

For *filesystem*, specify the name of the Sun StorEdge QFS shared file system as specified in the `mcf(4)` file. CODE EXAMPLE 5-34 shows the `samsharefs(1M) -R` command.

#### CODE EXAMPLE 5-34 `samsharefs(1M) -R` Command

```
titan-server# samsharefs -R sharefs1
#
# Host file for family set 'sharefs1'
#
# Version: 3      Generation: 50      Count: 4
# Server = host 0/titan, length = 216
#
titan 173.26.2.129,titan.xyzco.com 1 - server
tethys 173.26.2.130,tethys.xyzco.com 2 -
dione dione.foo.com 0 -
mimas mimas.foo.com 0 -
```

### 2. Save this output.

If the steps in this procedure fail, you need this output for use in subsequent procedures.

### 3. Verify that the output matches expectations.

If the command fails, verify that the file system was created. In this case it is likely that one of the following has occurred:

- The `mcf` file was not created properly. You can use the `samfsconfig(1M)` command to verify the correctness of the `mcf` file.
- The file system was never created.
- The initial hosts configuration files have not been created. For information about configuring these files, see the procedures earlier in this chapter. The configuration process involves editing the existing `mcf(4)` file, propagating the `mcf(4)` file changes to the rest of the system, and configuring the hosts files.

### 4. Find the row containing the server's name in the first column.

### 5. From the client, use the `ping(1M)` command on each entry from the second column of `samsharefs(1M)` output to verify that the server can be reached.

Use this command in the following format:

```
ping servername
```

For *servername*, specify the name of the server as shown in the second column of the `samsharefs(1M)` command's output.

CODE EXAMPLE 5-35 shows output from `ping(1M)`.

#### CODE EXAMPLE 5-35 Using `ping(1M)` on Systems Named in `samsharefs(1M)` Output

```
dione-client# ping 173.26.2.129
ICMP Host Unreachable from gateway dione (131.116.7.218)
for icmp from dione (131.116.7.218) to 173.26.2.129
dione-client# ping titan.xyzco.com
titan.foo.com is alive
```

### 6. From the client, examine the `hosts.filesystem.local` file. (Optional)

Perform this step if the `ping(1M)` command revealed unreachable hosts.

If there is more than one entry in the second column of `samsharefs(1M)` output, and if some of the entries are not reachable, ensure that only the reachable entries for the entries you want the shared file system to use are present. Also ensure that the necessary entries are present in the `/etc/opt/SUNWsamfs/hosts.filesystem.local` file entry on that host. Ensure that the unreachable hosts are not entered in these places.

If the `sam-sharefsd` daemon attempts to connect to unreachable server interfaces, there can be substantial delays in its connecting to the server after installation,

rebooting, or file system host reconfiguration. This affects metadata server failover operations substantially.

CODE EXAMPLE 5-36 shows the `hosts.sharefs1.local` file.

**CODE EXAMPLE 5-36** Examining the `hosts.filesystem.local` File

```
dione-client# cat /etc/opt/SUNWsamfs/hosts.sharefs1.local
titan          titan.xyzco.com                # no route to 173.26.2.129
tethys         tethys.xyzco.com             # no route to 173.26.2.130
```

**7. Enable the correct server interfaces. (Optional)**

If the `ping(1M)` command revealed that there were no reachable server interfaces, then you need to either configure or initialize the server network interfaces for typical operations, or you must use the `samsharefs(1M)` command to update the interface names in the hosts file so they match the actual names.

▼ **To Verify That the Server Can Reach the Client (Optional)**

Perform these steps if the procedure in “To Verify Network Connections” on page 134 did not show an `ESTABLISHED` connection.

**1. Obtain `samsharefs(1M)` output.**

This can be the output generated in “To Verify That the Client Can Reach the Server (Optional)” on page 137, or you can generate it again using the initial steps in that procedure.

**2. Find the row containing the client’s name in the first column.**

**3. On the client, run the `hostname(1M)` command and ensure that the output matches the name in the first column of `samsharefs(1M)` output.**

CODE EXAMPLE 5-37 shows the `hostname(1M)` command and its output.

**CODE EXAMPLE 5-37** `hostname(1M)` Output

```
dione-client# hostname
dione
```

#### 4. Use the `ping(1M)` command on the server on each entry from the second column to verify that the client can be reached. (Optional)

Perform this step if the `hostname(1M)` command output matched the name in the second column of `samsharefs(1M)` output. CODE EXAMPLE 5-38 shows the `ping(1M)` command and its output.

##### CODE EXAMPLE 5-38 `ping(1M)` Output

```
titan-server# ping dione.xyzco.com
dione.xyzco.com is alive
```

It is not necessary that every entry in column two of CODE EXAMPLE 5-36 be reachable, but all interfaces that you wish any potential server to accept connections from must be present in the column. The server rejects connections from interfaces that are not declared in the shared hosts file.

#### 5. Enable the correct client interfaces. (Optional)

If the `ping(1M)` command revealed that there were no reachable client interfaces, then either you need to configure or initialize the client network interfaces for typical operations, or you must use the `samsharefs(1M)` command to update the interface names in the hosts file so they match the actual names.

### ▼ To Examine the `sam-sharefsd` Trace Log (Optional)

The trace log files keep information generated by the `sam-sharefsd(1M)` daemons during their operation. The trace log files include information about connections attempted, received, denied, refused, and so on, as well as other operations such as host file changes and metadata server changes.

Tracking problems in log files often involves reconciling the order of operations on different hosts by using the log files. If the hosts' clocks are synchronized, log file interpretation is greatly simplified. One of the installation steps directs you to enable the network time daemon, `xntpd(1M)`. This synchronizes the clocks of the metadata server and all client hosts during Sun StorEdge QFS shared file system operations.

The trace logs are particularly useful when setting up an initial configuration. The client logs show outgoing connection attempts. The corresponding messages in the server log files are some of the most useful tools for diagnosing network and configuration problems with the Sun StorEdge QFS shared file system. The log files contain diagnostic information for resolving most common problems.

The following procedures can resolve `mount(1M)` problems:

- "To Verify Network Connections" on page 134
- "To Verify That the Client Can Reach the Server (Optional)" on page 137
- "To Verify That the Server Can Reach the Client (Optional)" on page 139



If none of the preceding procedures resolved the problem, perform the steps in this section. You can perform these steps on both the server and the client hosts.

**1. Verify the presence of file** `/var/opt/SUNWsamfs/trace/sam-sharefsd`.

If this file is not present, or if it shows no recent modifications, proceed to the next step.

If the file is present, use `tail(1)` or another command to examine the last few lines in the file. If it shows suspicious conditions, use one or more of the other procedures in this section to investigate the problem.

**2. Edit file** `/etc/opt/SUNWsamfs/defaults.conf` **and add lines to enable** `sam-sharefsd` **tracing. (Optional)**

Perform this step if Step 1 indicates that file `/var/opt/SUNWsamfs/trace/sam-sharefsd` does not exist or if the file shows no recent modifications.

**a. Copy the example** `defaults.conf` **file from**

`/opt/SUNWsamfs/examples/defaults.conf` **to** `/etc/opt/SUNWsamfs`.

**(Optional)**

Perform this step if a `defaults.conf` file does not reside in `/etc/opt/SUNWsamfs` at this time. CODE EXAMPLE 5-39 shows this.

**CODE EXAMPLE 5-39** Copying the `defaults.conf` File

```
# cd /etc/opt/SUNWsamfs
# cp /opt/SUNWsamfs/examples/defaults.conf .
```

**b. Use** `vi(1)` **or another editor to edit file**

`/opt/SUNWsamfs/examples/defaults.conf` **and add lines to enable tracing.**

CODE EXAMPLE 5-40 shows the lines to add to the `defaults.conf` file.

**CODE EXAMPLE 5-40** Lines to Enable Tracing in `defaults.conf`

```
trace
sam-sharefsd = on
sam-sharefsd.options = all
endtrace
```

**c. Issue the** `samd(1M)` **config command to reconfigure the** `sam-fsd(1M)` **daemon and cause it to recognize the new** `defaults.conf(4)` **file.**

For example:

```
# samd config
```

**d. Issue the `sam-fsd(1M)` command to check the configuration files.**

CODE EXAMPLE 5-41 shows the output from the `sam-fsd(1M)` command.

**CODE EXAMPLE 5-41** Output From the `sam-fsd(1M)` Command

```
# sam-fsd
Trace file controls:
sam-archiverd off
sam-catserverd off
sam-fsd      off
sam-rftd     off
sam-recycler off
sam-sharefsd /var/opt/SUNWsamfs/trace/sam-sharefsd
              cust err fatal misc proc date
              size    0    age 0
sam-stagerd  off

Would stop sam-archiverd()
Would stop sam-rftd()
Would stop sam-stagealld()
Would stop sam-stagerd()
Would stop sam-initd()
```

**e. Examine the log file in `/var/opt/SUNWsamfs/trace/sam-sharefsd` to check for errors.**

```
# more /var/opt/SUNWsamfs/trace/sam-sharefsd
```

**3. Examine the last few dozen lines of the trace file for diagnostic information.**

CODE EXAMPLE 5-42 shows a typical `sam-sharefsd` client log file. In this example, the server is `titan`, and the client is `dione`. This file contains normal log entries generated after a package installation, and it finishes with the daemon operating normally on a mounted file system.

**CODE EXAMPLE 5-42** Client Trace File

```
dione# tail -18 /var/opt/SUNWsamfs/trace/sam-sharefsd
2004-03-23 16:13:11 shf-shsam2[13835:1]: FS shsam2: Shared file system daemon
started - config only
2004-03-23 16:13:11 shf-shsam2[13835:1]: FS shsam2: Host dione
2004-03-23 16:13:11 shf-shsam2[13835:1]: FS shsam2: Filesystem isn't mounted
2004-03-23 16:13:11 shf-shsam2[13837:1]: FS shsam2: Shared file system daemon
started
2004-03-23 16:13:11 shf-shsam2[13837:1]: FS shsam2: Host dione
2004-03-23 16:13:11 shf-shsam2[13837:1]: FS shsam2: Filesystem isn't mounted
```

**CODE EXAMPLE 5-42** Client Trace File *(Continued)*

```
2004-03-23 16:13:11 shf-shsam2[13837:1]: FS shsam2: Kill sam-sharefsd pid 13835
2004-03-23 16:13:12 shf-shsam2[13837:1]: FS shsam2: Killed sam-sharefsd pid
13835
2004-03-23 16:13:12 shf-shsam2[13837:1]: FS shsam2: Host dione; server = titan
2004-03-23 16:13:12 shf-shsam2[13837:1]: FS shsam2: Wakened from AWAIT_WAKEUP
2004-03-23 16:13:14 shf-shsam2[13837:5]: FS shsam2: Set Client (Server titan/3).
2004-03-23 16:13:14 shf-shsam2[13837:5]: FS shsam2: SetClientSocket dione
(flags=0)
2004-03-23 16:13:14 shf-shsam2[13837:5]: FS shsam2: rdsock dione/0 (buf=6c000).
2004-03-23 16:13:15 shf-shsam2[13837:1]: FS shsam2: Signal 1 received: Hangup
2004-03-23 16:13:15 shf-shsam2[13837:1]: FS shsam2: Wakened from AWAIT_WAKEUP
2004-03-23 16:13:15 shf-shsam2[13837:1]: FS shsam2: mount; flags=18889
2004-03-23 16:18:55 shf-shsam2[13837:1]: FS shsam2: Signal 1 received: Hangup
2004-03-23 16:18:55 shf-shsam2[13837:1]: FS shsam2: Wakened from AWAIT_WAKEUP
```



## Using the samu(1M) Operator Utility

---

This chapter shows how to use `samu(1M)` to control the devices configured within your Sun StorEdge QFS or Sun StorEdge SAM-FS environment. Many `samu(1M)` displays are useful only for sites using the storage and archive management mechanism. If you are using `samu(1M)` in a Sun StorEdge QFS environment, some displays do not apply to you.

This chapter contains the following sections:

- “Overview” on page 145
- “Operator Displays” on page 148
- “Operator Display Status Codes” on page 201
- “Operator Display Device States” on page 203
- “Operator Commands” on page 205

The operations that you can perform from within `samu(1M)` can also be performed by using the `samcmd(1M)` command. For more information about `samcmd(1M)`, see the `samcmd(1M)` man page.

---

## Overview

The `samu(1M)` operator utility requires a display terminal that displays a minimum of 24 lines by 80 characters wide. The utility includes the following features:

- Displays that enable you to monitor Sun StorEdge QFS and Sun StorEdge SAM-FS devices and file system activity.
- Commands that enable you to select displays, set display options, control access to and the activity of devices, and take snapshots of display windows.

- Commands that enable you to tune a running Sun StorEdge QFS or Sun StorEdge SAM-FS file system.

The display windows shown in this chapter are representative examples. The exact format and amount of information displayed on your terminal can be different depending on your terminal model and the devices configured in your Sun StorEdge QFS or Sun StorEdge SAM-FS environment.

The following sections describe how to start and stop `samu(1M)`, interact with the utility, access the help windows, and view operator displays.

## ▼ To Invoke `samu(1M)`

- **To start `samu(1M)`, type the `samu(1M)` command from the command line.**

For example:

```
# samu
```

The system starts `samu(1M)` and shows the help display. This is the default initial display. To view a different `samu(1M)` display, follow the steps in “To Display a `samu(1M)` Screen” on page 146.

The `samu(1M)` utility allows you to select its initial display. For more information about the `samu(1M)` command line options, see the `samu(1M)` man page.

---

**Note** – `samu(1M)`, like the `vi(1)` editor, is based on the `curses(3CURSES)` routine. If you have trouble invoking `samu(1M)`, make sure that your terminal type is defined correctly.

---

## ▼ To Display a `samu(1M)` Screen

The `samu(1M)` command accepts options on its command line for displaying different `samu(1M)` screens.

1. **Type a colon (:) to bring up the `samu(1M)` prompt.**

After you type in the colon, the following appears in the lower left:

```
Command:
```

---

**Note** – You access the help screen and all the display screens in `samu(1M)` through this same method. After you type a colon character, the Command prompt appears.

---

**2. Type the letter that corresponds to the display you want to view and press return.**

For example, to view the `v` display, type a `v` and press Return after the Command prompt.

For a complete list of letters to type and the displays to which they correspond, see “(h) - Help Display” on page 161.

## ▼ To Stop `samu(1M)`

- **To exit `samu(1M)`, type one of the following:**

- `q`
- `:q`

The `samu(1M)` operator utility exits and returns you to the command shell.

## Interacting With `samu(1M)`

Interacting with `samu(1M)` is similar to interacting with the UNIX `vi(1)` editor with respect to paging forward or backward, entering commands, refreshing the display, and quitting the utility.

Each display has its own section in this chapter, and each display section shows the control key sequences you can use to navigate in that display. The `samu(1M)` man page summarizes the control key navigation sequences.

The last line of the display window shows the command and display error messages. If a command error occurs, automatic display refreshing halts until the next operator action.

## Entering a Device

Each device included in the Sun StorEdge QFS or Sun StorEdge SAM-FS environment is assigned an Equipment Ordinal (for example, 10) in the `mcf` file. Many `samu(1M)` commands reference a specific device using that Equipment Ordinal.

**Example.** The syntax for the `:off` command is as follows:

```
:off eq
```

For *eq*, type the Equipment Ordinal for the device you are trying to address.

## Getting Online Help

When you start `samu(1M)`, the system automatically displays the first help screen. This help screen differs depending on whether you have a Sun StorEdge QFS or Sun StorEdge SAM-FS file system.

For more information about the help (h) display, see “(h) - Help Display” on page 161.

### ▼ To Access Online Help From a Display Screen

- **Type** `:h`

To move forward or backward from one screen to the next, type the following key sequence:

- Press Ctrl-f to page the display forward.
- Press Ctrl-b to page the display backward to previous pages.

You can return to the help display at any time by pressing the h key.

---

## Operator Displays

You can view the `samu(1M)` operator displays by pressing the key corresponding to each display. The lowercase keys a through w display operational information.

---

**Note** – The uppercase `samu(1M)` displays (A, C, F, I, J, L, M, N, P, R, S, T, and U) are designed to be used at a customer site only with the assistance of a member of the technical support staff.

This chapter does not describe these uppercase displays as thoroughly as the lowercase displays.

---

For displays that overflow the screen area, the word `more` appears on the bottom of the screen display, indicating that the display contains additional information.



CODE EXAMPLE 6-1 contains the word `more`, indicating that more information appears on subsequent screens.

**CODE EXAMPLE 6-1**    `samu(1M)` Screen That Indicates More Text Can Be Obtained

xb54	54	exb8505	pt03	0	yes	2	0	on	
lt55	55	dlt2000	pt02	1	yes	4	0	on	ml65
hp56	56	hpc1716	pt01	1	yes	3	0	on	hp70
hp57	57	hpc1716	pt01	1	yes	4	0	on	hp70
more									

If `samu(1M)` prompts you to enter a device, enter its associated Equipment Ordinal. The configuration display (c) shows Equipment Ordinals for all removable media devices. To control all displays, use the control keys listed for the display.

The following sections describe the operator displays in alphabetical order. Examples are provided, and when necessary, displays are followed by a table describing the fields displayed.

## (a) - Archiver Status Display

The `a` display shows the archiver status.

You can invoke this display differently, depending on what you need to view, as follows:

- To display an archiver status summary, which shows the status of the archiver on a per-file-system basis, type the command with the following format:

Command:**a**

- To display archiving details for a specific file system, type the command with the following format:

Command:**a** *filesystem*

For *filesystem*, specify the name of a file system

## Navigation

TABLE 6-1 shows the control keys you can use in the `a` display.

**TABLE 6-1** Control Keys for the `a` Display

Key	Function
Ctrl-b	Previous file system
Ctrl-f	Next file system
Ctrl-d	Page <i>arcopies</i> forward (bottom portion)
Ctrl-u	Page <i>arcopies</i> backward (bottom portion)

TABLE 6-2 shows the control keys you can use in the `:a filesystem` display.

**TABLE 6-2** Control Keys for the `:a filesystem` Display

Key	Function
Ctrl-b	Previous file system
Ctrl-f	Next file system

## Sample Display

CODE EXAMPLE 6-2 shows activity and statistics for a single file system in the summary display.

**CODE EXAMPLE 6-2** `samu(1M) a` Display

```
Archiver status          samu 4.2 07:44:02 Sept 8 2004
License: License never expires.

sam-archiverd:  Waiting for resources


sam-arfind:  samfs1 mounted at /sam1
Waiting until 2004-05-08 07:54:02 to scan .inodes

sam-arfind:  samfs2 mounted at /sam2
Waiting until 2004-05-08 07:52:57 to scan .inodes

sam-arfind:  qfs1 mounted at /qfs1
Waiting until 2004-05-08 07:44:33 to scan .inodes

sam-arfind:  qfs2 mounted at /qfs2
```

**CODE EXAMPLE 6-2** samu(1M) a Display (Continued)

```
Waiting until 2004-05-08 07:53:21 to scan .inodes

sam-arfind: qfs3 mounted at /qfs3
Waiting until 2004-05-08 07:44:11 to scan .inodes

sam-arfind: qfs4 mounted at /qfs4
Waiting until 2004-05-08 07:53:35 to scan .inodes

sam-arfind: shareqfs1 mounted at /shareqfs1
Shared file system client. Cannot archive.

sam-arfind: shareqfs2 mounted at /shareqfs2
Shared file system client. Cannot archive.

sam-arcopy: qfs4.arset5.1.83 dt.DAT001
Waiting for volume dt.DAT001
```

## Field Descriptions

TABLE 6-3 shows the fields in the detail display.

**TABLE 6-3** samu(1M) a Display Field Descriptions

Field	Description
samfs1 mounted at	Mount point.
regular files	Number of regular files and their total size.
offline files	Number of offline files and their total size.
archdone files	Number of archdone files and size. Indicates that the archiver has completed processing and can perform no further processing for archdone files. Files marked as archdone have been processed for archiving but have not necessarily been archived.
copy1	Number of files and total size for archive copy 1.
copy2	Number of files and total size for archive copy 2.
copy3	Number of files and total size for archive copy 3.
copy4	Number of files and total size for archive copy 4.
Directories	Number of directories and total size.
sleeping until	Indicates when archiver runs again.

## (c) - Device Configuration Display

The `c` display shows your configuration's connectivity. It lists all device names and Equipment Ordinals.

To invoke the device configuration display, type the command with the following format:

```
Command: c
```

## Navigation

TABLE 6-4 shows the control keys you can use in this display.

**TABLE 6-4** Control Keys for the `c` Display

Key	Function
Ctrl-b	Page backward
Ctrl-d	Half-page forward
Ctrl-f	Page forward
Ctrl-u	Half-page backward

## Sample Display

CODE EXAMPLE 6-3 shows the device configuration display.

**CODE EXAMPLE 6-3** samu(1M) `c` Display

Device configuration:				samu	4.2 07:48:11 Sept 8 2004
License: License never expires.					
ty	eq	state	device_name	fs	family_set
sk	100	on	/etc/opt/SUNWsamfs/dcstkconf	100	dcL700
tp	120	off	/dev/rmt/1cbn	100	dcL700
sg	130	on	/dev/rmt/4cbn	100	dcL700
sg	140	on	/dev/rmt/5cbn	100	dcL700
tp	150	off	/dev/rmt/3cbn	100	dcL700
hy	151	on	historian	151	

## Field Descriptions

TABLE 6-5 shows the field descriptions for this display.

**TABLE 6-5** samu(1M) c Display Field Descriptions

Field	Description
ty	Device type.
eq	Equipment Ordinal of the device.
state	Current operating state of the device. Valid device states are as follows: <ul style="list-style-type: none"><li>• on—The device is available for access.</li><li>• ro—The device is available for read-only access.</li><li>• off—The device is not available for access.</li><li>• down—The device is available only for maintenance access.</li><li>• idle—The device is not available for new connections. Operations in progress continue until completion.</li></ul>
device_name	Path to the device.
fs	Family Set Equipment Ordinal.
family_set	Name of the storage Family Set or library to which the device belongs.

## (C) - Memory Display

The C display shows the content of a specified memory address. To show the content at an address, enter the address in hexadecimal.

To invoke this display, type the following command:

```
Command: C hex_address
```

For *hex\_address*, specify the address of a memory location in hexadecimal. For example:

```
Command: C 0x1044a998
```

This display is designed for debugging. It is intended to be used only with the assistance of a Sun Microsystems support staff person.

## Sample Display

CODE EXAMPLE 6-4 shows the memory display. The output has been truncated for inclusion in this manual.

### CODE EXAMPLE 6-4 samu(1M) C Display

```
Memory   base: 0x1234567                      samu 4.2 07:52:25 Sept 8 2004
License:  License never expires.
00000000  80921000 137ff801 edd05e21 40853420  ....x.mP^!@.4
00000010  00a00420 018528b0 01a604e0 02840640  . . . .(0.&.'...@
00000020  02d030a1 a0853420 0080a0a0 100a6fff  .P0! .4 . . .o.
00000030  f6921000 13c65e23 582d0000 0ba01020  v....F^#X-... .
00000040  00c45e20 48c608e0 2fd05e21 40920080  .D^ HF.'/P^!@...
00000050  037ff801 fa941000 16c45e20 48a600a0  ..x.z....D^ H&.
00000060  80921000 137ff801 d5d05e21 40853420  ....x.UP^!@.4
00000070  00a00420 018528b0 01a604e0 02840640  . . . .(0.&.'...@

00000080  02d030a1 c0853420 0080a0a0 100a6fff  .P0!@.4 . . .o.
00000090  f6921000 13c65e23 58a01020 00c45e20  v....F^#X . .D^
000000a0  48c608e0 2fd05e21 40920080 037ff801  HF.'/P^!@....x.
000000b0  e39405a2 00c45e20 48a600a0 80921000  c..".D^ H&. ....
000000c0  137ff801 bed05e21 40853420 00a00420  ..x.>P^!@.4 . .
000000d0  018528b0 01a604e0 02840640 02d030a1  ..(0.&.'...@.P0!
000000e0  e0853420 0080a0a0 100a6fff f6921000  '.4 . . .o.v...
000000f0  13c65e23 58a01020 00c45e20 48c608e0  .F^#X . .D^ HF.'
```

**CODE EXAMPLE 6-4** samu(1M) C Display (Continued)

00000100	02d05e21	40920080	037ff801	cc941020	.P^!@.....x.L..
00000110	10c45e20	48a600a0	80921000	137ff801	.D^ H&. ....x.
00000120	a7d05e21	40853420	00a00420	018528b0	'P^!@.4 . . . (0
00000130	01a604e0	02840640	02d030a2	00853420	.&.'...@.P0"...4
00000140	0080a0a0	400a6fff	f6921000	13c65e23	.. @.o.v....F^#
00000150	58a01020	00c45e20	48c608e0	02d05e21	X . .D^ HF.'..P^!
00000160	40920080	037ff801	b5941020	20c45e20	@.....x.5.. D^
00000170	48a600a0	80921000	137ff801	90d05e21	H&. ....x..P^!
00000180	40853420	00a00420	018528b0	01a604e0	@.4 . . . .(0.&.'
00000190	02840640	02d030a2	80853420	0080a0a0	...@.P0"...4 ..
000001a0	400a6fff	f6921000	13c65e23	58a01020	@.o.v....F^#X .
000001b0	00c45e20	48c608e0	02d05e21	40920080	.D^ HF.'..P^!@...
000001c0	037ff801	9e941020	30c45e20	48a600a0	..x.... 0D^ H&.
000001d0	80921000	137ff801	79d05e21	40853420	.....x.yP^!@.4
000001e0	00a00420	018528b0	01a604e0	02840640	. . . .(0.&.'...@
000001f0	02d030a3	00853420	0080a0a0	400a6fff	.P0#...4 .. @.o.

## (d) - Daemon Trace Controls Display

The `d` display shows the events being traced as specified in the `defaults.conf` file. For more information about enabling trace files, see the `defaults.conf(4)` man page.

To invoke this display, type the following command:

```
Command: d
```

### Sample Display

CODE EXAMPLE 6-5 shows trace file information. It includes information about the daemons being traced, the paths to the trace files, the events being traced, and information about the size and age of the trace files.

#### CODE EXAMPLE 6-5 `samu(1M)` `d` Display

```
Daemon trace controls                      samu 4.2 07:56:38 Sept 8 2004
License: License never expires.

sam-amld      /var/opt/SUNWsamfs/trace/sam-amld
              cust err fatal misc proc debug date
              size    0    age 0

sam-archiverd /var/opt/SUNWsamfs/trace/sam-archiverd
              cust err fatal misc proc debug date
              size    0    age 0

sam-catserverd /var/opt/SUNWsamfs/trace/sam-catserverd
              cust err fatal misc proc debug date
              size    0    age 0

sam-fsd       /var/opt/SUNWsamfs/trace/sam-fsd
              cust err fatal misc proc debug date
              size    0    age 0

sam-rftd      /var/opt/SUNWsamfs/trace/sam-rftd
              cust err fatal misc proc debug date
              size    0    age 0

sam-recycler  /var/opt/SUNWsamfs/trace/sam-recycler
              cust err fatal misc proc debug date
              size    0    age 0

sam-sharefsd  /var/opt/SUNWsamfs/trace/sam-sharefsd
```



**CODE EXAMPLE 6-5** samu(1M) d Display (Continued)

	cust err fatal misc proc debug date size 0 age 0
sam-stagerd	/var/opt/SUNWsamfs/trace/sam-stagerd cust err fatal misc proc debug date size 0 age 0
sam-serverd	/var/opt/SUNWsamfs/trace/sam-serverd cust err fatal misc proc debug date size 0 age 0
sam-clientd	/var/opt/SUNWsamfs/trace/sam-clientd cust err fatal misc proc debug date size 0 age 0
sam-mgmt	/var/opt/SUNWsamfs/trace/sam-mgmt cust err fatal misc proc debug date size 0 age 0

## (f) - File Systems Display

The `f` display shows the components of your Sun StorEdge QFS or Sun StorEdge SAM-FS file systems.

To invoke this display, type the following command:

```
Command: f
```

### Sample Display

CODE EXAMPLE 6-6 shows the file systems display.

#### CODE EXAMPLE 6-6 samu(1M) f Display

```
File systems                                     samu 4.2 08:11:24 Sept 8 2004
License: License never expires.

ty      eq state      device_name      status high low mountpoint server
ms      10      on          samfs1      m----2----d 90% 70% /sam1
md      11      on      /dev/dsk/c5t8d0s3
md      12      on      /dev/dsk/c5t8d0s4
md      13      on      /dev/dsk/c5t8d0s5
md      14      on      /dev/dsk/c5t8d0s6
md      15      on      /dev/dsk/c5t8d0s7
ms      20      on          samfs2      m----2----d 90% 70% /sam2
md      21      on      /dev/dsk/c5t9d0s3
md      22      on      /dev/dsk/c5t9d0s4
md      23      on      /dev/dsk/c5t9d0s5
md      24      on      /dev/dsk/c5t9d0s6
md      25      on      /dev/dsk/c5t9d0s7
ma      30      on          qfs1      m----2----d 90% 70% /qfs1
mm      31      on      /dev/dsk/c5t10d0s0
md      32      on      /dev/dsk/c5t10d0s1
ma      40      on          qfs2      m----2----d 90% 70% /qfs2
mm      41      on      /dev/dsk/c5t11d0s0
md      42      on      /dev/dsk/c5t11d0s1
ma      50      on          qfs3      m----2---r- 90% 70% /qfs3
mm      51      on      /dev/dsk/c5t12d0s0
mr      52      on      /dev/dsk/c5t12d0s1
ma      60      on          qfs4      m----2---r- 90% 70% /qfs4
mm      61      on      /dev/dsk/c5t13d0s0
mr      62      on      /dev/dsk/c5t13d0s1
ma     100      on      shareqfs1      m----2c--r- 80% 70% /shareqfs1 spade
mm     101      on      /dev/dsk/c6t50020F2300004655d0s0
mr     102      on      /dev/dsk/c6t50020F2300004655d0s1
```

**CODE EXAMPLE 6-6**    samu(1M) f Display (Continued)

ma	110	on	shareqfs2	m---2c--r-	80% 70%	/shareqfs2 spade
mm	111	on	/dev/dsk/c6t50020F2300004655d0s6			
mr	112	on	/dev/dsk/c6t50020F2300004655d0s7			

Field Descriptions

TABLE 6-6 shows the field descriptions for this display.

**TABLE 6-6**    samu(1M) f Display Field Descriptions

Field	Description
ty	Device type.
eq	Equipment Ordinal of the device.
state	Current operating state of the device. Valid device states are as follows: <ul style="list-style-type: none"><li>• on—The device is available for access.</li><li>• ro—The device is available for read-only access.</li><li>• off—The device is not available for access.</li><li>• down—The device is available only for maintenance access.</li><li>• idle—The device is not available for new operations. Operations in progress continue until completion.</li></ul>
device_name	File system name or path to the device.
status	Device status. For a description of status codes, see “Operator Display Status Codes” on page 201.
high	High disk usage threshold percentage.
low	Low disk usage threshold percentage.
mountpoint	Mount point of the file system.
server	Name of the host system upon which the file system is mounted.

## (F) - Optical Disk Label Display

The F display shows the label on an optical disk.

To invoke this display, type the following command:

Command: **F**

This display is designed for debugging. It is intended to be used only with the assistance of a Sun Microsystems support staff person.

## (h) - Help Display

The `h` display shows a summary of the `samu(1M)` displays available. By default, this is the first display that the system presents when you enter the `samu(1M)` command at the command line.

To invoke this display, type the following command:

```
Command:h
```

## Navigation

TABLE 6-7 shows the control keys you can use in this display.

**TABLE 6-7** Control Keys for the `h` Display

Key	Function
Ctrl-b	Page backward
Ctrl-d	Page forward (top portion)
Ctrl-f	Page forward
Ctrl-u	Page backward (top portion)
Ctrl-k	Toggle path display

## Sample Display

There are several pages of help screens, but this manual shows only the first. Subsequent help screens show `samu(1M)` commands.

CODE EXAMPLE 6-7 shows the initial help screen for the Sun StorEdge SAM-FS file system. On a Sun StorEdge QFS file system, not all of the displays appear in the initial help screen. For example, the removable media displays are not available if you are running a Sun StorEdge QFS system. If you are using Sun SAM-QFS software, the help screen appears as shown in CODE EXAMPLE 6-7.

**CODE EXAMPLE 6-7** `samu(1M)` Initial Help Screen for a Sun StorEdge SAM-FS System

Help information	page 1/15	samu 4.2	08:18:13 Sept 8 2004
License: License never expires.			
Displays:			
a	Archiver status	w	Pending stage queue

**CODE EXAMPLE 6-7** samu(1M) Initial Help Screen for a Sun StorEdge SAM-FS System *(Continued)*

c	Device configuration	C	Memory
d	Daemon trace controls	F	Optical disk label
f	File systems	I	Inode
h	Help information	J	Preview shared memory
l	License information	K	Kernel statistics
m	Mass storage status	L	Shared memory tables
n	Staging status	M	Shared memory
o	Optical disk status	N	File system parameters
p	Removable media load requests	P	Active Services
r	Removable media	R	SAM-Remote
s	Device status	S	Sector data
t	Tape drive status	T	SCSI sense data
u	Staging queue	U	Device table
v	Robot catalog		
more (ctrl-f)			

## (I) - Inode Display

The I display shows the content of inodes.

You can invoke this display differently, depending on what you need to view, as follows:

- To display inodes for an entire file system, type the command with the following format:

Command: **I** *filesystem*

For *filesystem*, specify the name of a file system

- To display a specific inode, type the command with the following format:

Command: **I** *inode\_number*

For *inode\_number*, specify the inode number in either hexadecimal or decimal.

## Navigation

TABLE 6-8 shows the control keys you can use in this display.

**TABLE 6-8** Control Keys for the I Display

Key	Function
Ctrl-b	Previous inode
Ctrl-f	Next inode
Ctrl-k	Advance display format

This display is designed for debugging. It is intended to be used only with the assistance of a Sun Microsystems support staff person.

## Sample Display

CODE EXAMPLE 6-8 shows the inode display.

### CODE EXAMPLE 6-8 samu(1M) I Display

Inode	0x1 (1) format: file	samu 4.2	08:27:14 Sept 8 2004
License:	License never expires.	incore:	y
00008100	mode -r-----	409cdf57	access_time
00000001	ino (1)	1d32ea20	
00000001	gen (1)	4096b499	modify_time
00000002	parent.ino (2)	02588660	
00000002	parent.gen (2)	4096b499	change_time
00000000	size_u	02588660	
000c0000	size_l (786432)	4096b443	creation_time
01000000	rm:media/flags	409a8a7c	attribute_time
00000000	rm:file_offset	409c0ce6	residence_time
00000000	rm:mau	00000000	unit/cs/arch/flg
00000000	rm:position	00000000	ar_flags
00000000	ext_attrs -----	00000000	stripe/stride/sg
00000000	ext.ino (0)	00000000	media -- --
00000000	ext.gen (0)	00000000	media -- --
00000000	uid root	00000000	psize (0)
00000000	gid root	000000c0	blocks (192)
00000001	nlink (1)	00000600	free_ino (1536)
00011840	status -n-----		
Extents (4k displayed as 1k):			
00_	000000d0.00	000000e0.00	000000f0.00 00000100.00 00000110.00 00000120.00
06_	00000130.00	00000140.00	00000150.00 00000160.00 00000170.00 00000180.00
12_	00000190.00	000001a0.00	000001b0.00 000001c0.00 00000630.00 00000000.00
18_	00000000.00		



## (J) - Preview Shared Memory Display

The J display shows the shared memory segment for the preview queue.

To invoke this display, type the following command:

Command: J

### Navigation

TABLE 6-9 shows the control keys you can use in this display.

**TABLE 6-9** Control Keys for the J Display

Key	Function
Ctrl-b	Page backward
Ctrl-d	Half-page forward
Ctrl-f	Page forward
Ctrl-u	Half-page backward

This display is designed for debugging. It is intended to be used only with the assistance of a Sun Microsystems support staff person.

### Sample Display

CODE EXAMPLE 6-9 shows the preview shared memory display. This output has been truncated for inclusion in this manual.

**CODE EXAMPLE 6-9** samu(1M) J Display

```
Preview shared memory size: 155648 samu 4.2 08:30:05 Sept 8 2004
License: License never expires.
00000000 00040000 00014d58 00000000 00000000 .....MX.....
00000010 00000000 00000000 73616d66 73202d20 .....samfs -
00000020 70726576 69657720 6d656d6f 72792073 preview memory s
00000030 65676d65 6e740000 00026000 00000000 egment....`....
00000040 00025fff 00000000 00040000 00014d58 .._.....MX
00000050 00000000 00000000 00000000 00000000 .....
00000060 0000d9e0 00000064 00000000 000001b8 ..Y'...d.....8
00000070 3f800000 447a0000 0000d820 00000008 ?...Dz....X ....
```

## (K) - Kernel Statistics Display

The K display shows kernel statistics, such as the number of inodes currently in memory.

To invoke this display, type the following command:

```
Command:K
```

## Navigation

TABLE 6-10 shows the control keys you can use in this display.

**TABLE 6-10** Control Keys for the K Display

Key	Function
Ctrl-b	Page backward
Ctrl-f	Page forward

This display is designed for debugging. It is intended to be used only with the assistance of a Sun Microsystems support staff person.

## Sample Display

CODE EXAMPLE 6-10 shows the kernel statistics display.

**CODE EXAMPLE 6-10** samu(1M) K Display

Kernel statistics	samu 4.2	08:33:19 Sept 8 2004
License: License never expires.		
module: sam-qfs name: general instance: 0 class: fs		
version	4.2.sam-qfs, gumball 2004-05-07 12:12:04	
configured file systems	8	
mounted file systems	8	
nhino	16384	
ninodes	129526	
inocount	129527	
inofree	128577	

## (1) - Usage Display

The 1 display shows the usage information for the file system, including the capacity and space used for each library and file system.

To invoke this display, type the following command:

```
Command:1
```

### Sample Display

CODE EXAMPLE 6-11 shows an example of a license display.

#### CODE EXAMPLE 6-11 samu(1M) 1 Display

```
Usage information                      samu      4.3 08:36:27 Sept 8 2004

hostid = 80e69e6e OS name: SunOS Architecture: sparc CPUs: 2 (2 online)

library      40: capacity 389.3G bytes space 291.1G bytes, usage 25%
library      51: capacity  9.5G bytes space  9.5G bytes, usage  0%
library      55: capacity   0 bytes space   0 bytes, usage  0%
library      56: capacity 10.7G bytes space 10.7G bytes, usage  0%
library totals: capacity 409.5G bytes space 311.3G bytes, usage 24%

filesystem samfs3: capacity 54.5M bytes space 13.4M bytes, usage 75%
filesystem samfs4: capacity 319.5M bytes space 298.0M bytes, usage  7%
filesystem samfs7: capacity 96.6M bytes space 69.6M bytes, usage 28%
filesystem samfs6: capacity  5.0G bytes space  4.9G bytes, usage  3%
filesystem samfs8: capacity  5.0G bytes space  4.9G bytes, usage  2%
filesystem totals: capacity 10.5G bytes space 10.2G bytes, usage  3%
```

---

**Note** – In versions of the software before 4.3, this display showed license information for the file system.

---

## (L) - Shared Memory Tables

The L display shows the location of the shared memory tables. It also shows some system defaults that are kept in shared memory.

To invoke this display, type the following command:

```
Command: L
```

This display is designed for debugging. It is intended to be used only with the assistance of a Sun Microsystems support staff person.

### Sample Display

CODE EXAMPLE 6-12 shows the shared memory tables.

**CODE EXAMPLE 6-12** samu(1M) L Display

Shared memory tables				samu 4.2 08:38:31 May 8 2004			
License: License never expires.							
shm ptr tbl:				defaults:			
size	12000	(73728)		optical	mo		
left	44c8	(17608)		tape	lt		
scanner pid	1861			timeout	600		
fifo path	01b0	/var/opt/SUNWsamfs/previews		100			
dev_table	01cc			stages	1000		
first_dev	0450			log_facility	184		
scan_mess	cf50			dio minfilesize	100		
preview_shmid	1			label barcode	FALSE		
flags	0x20000000			barcodes low	FALSE		
preview stages	55776			export unavail	FALSE		
preview avail	100			attended	TRUE		
preview count	0			start rpc	FALSE		
preview sequence	445						
age factor	1			vsn factor	1000		
fs tbl ptr	0xd820			fs count	8		
fseq 10	samfs1	state 0	0 0 0	0	0		
fseq 20	samfs2	state 0	0 0 0	0	0		
fseq 30	qfs1	state 0	0 0 0	0	0		
fseq 40	qfs2	state 0	0 0 0	0	0		
fseq 50	qfs3	state 0	0 0 0	0	0		
fseq 60	qfs4	state 0	0 0 0	0	0		
fseq 100	shareqfs1	state 0	0 0 0	0	0	0	
fseq 110	shareqfs2	state 0	0 0 0	0	0	0	

## (m) - Mass Storage Status Display

The `m` display shows the status of mass storage file systems and their member drives. This display shows only mounted file systems.

To invoke this display, type the following command:

```
Command: m
```

### Sample Display

CODE EXAMPLE 6-13 shows the `m` display. Member drives are indented one space and appear directly below the file system to which they belong.

**CODE EXAMPLE 6-13** `samu(1M) m` Display

Mass storage status				samu 4.2	08:41:11 Sept 8 2004			
License: License never expires.								
ty	eq	status	use state ord	capacity	free	ra	part	high low
ms	10	m----2----d	1% on	0	68.354G	68.343G	1M	16 90% 70%
md	11		1% on	0	13.669G	13.666G		
md	12		1% on	1	13.669G	13.667G		
md	13		1% on	2	13.669G	13.667G		
md	14		1% on	3	13.674G	13.672G		
md	15		1% on	4	13.674G	13.672G		
ms	20	m----2----d	1% on	0	68.354G	68.344G	1M	16 90% 70%
md	21		1% on	0	13.669G	13.667G		
md	22		1% on	1	13.669G	13.667G		
md	23		1% on	2	13.669G	13.667G		
md	24		1% on	3	13.674G	13.672G		
md	25		1% on	4	13.674G	13.672G		
ma	30	m----2----d	4% on	0	64.351G	61.917G	1M	16 90% 70%
mm	31		1% on	0	4.003G	3.988G	[8363840 inodes]	
md	32		4% on	1	64.351G	61.917G		
ma	40	m----2----d	1% on	0	64.351G	64.333G	1M	16 90% 70%
mm	41		1% on	0	4.003G	3.997G	[8382784 inodes]	
md	42		1% on	1	64.351G	64.333G		
ma	50	m----2---r-	1% on	0	64.351G	64.333G	1M	16 90% 70%
mm	51		1% on	0	4.003G	3.997G	[8382784 inodes]	
mr	52		1% on	1	64.351G	64.333G		
ma	60	m----2---r-	1% on	0	64.351G	64.331G	1M	16 90% 70%
mm	61		1% on	0	4.003G	3.997G	[8382784 inodes]	
mr	62		1% on	1	64.351G	64.331G		
ma	100	m----2c--r-	2% on	0	270.672G	265.105G	1M	16 80% 70%
mm	101		1% on	0	2.000G	1.988G	[4168992 inodes]	

**CODE EXAMPLE 6-13** samu(1M) m Display (Continued)

mr	102		2% on	1	270.672G	265.469G				
ma	110	m----2c--r-	3% on		270.656G	263.382G	1M	16	80%	70%
mm	111		1% on	0	2.000G	1.987G	[4167616 inodes]			
mr	112		2% on	1	270.656G	264.736G				

Field Descriptions

TABLE 6-11 shows the field descriptions for this display.

**TABLE 6-11** samu(1M) m Display Field Descriptions

Field	Description
ty	Device type.
eq	Equipment Ordinal of the mass storage device.
status	Device status. For a description of status codes, see “Operator Display Status Codes” on page 201.
use	Percentage of disk space in use.
state	Current operating state of the mass storage device.
ord	Ordinal number of the disk device within the storage Family Set.
capacity	Number of 1024-byte blocks of usable space on the disk.
free	Number of 1024-byte blocks of disk space available.
ra	Readahead size in kilobytes.
part	Partial stage size in kilobytes.
high	High disk usage threshold percentage.
low	Low disk usage threshold percentage.

## (M) - Shared Memory Display

The M display shows the raw shared memory segment in hexadecimal. This is a device table.

To invoke this display, type the following command:

Command:**M**

### Navigation

TABLE 6-12 shows the control keys you can use in this display.

**TABLE 6-12** Control Keys for the M Display

Key	Function
Ctrl-b	Page backward
Ctrl-d	Half-page forward
Ctrl-f	Page forward
Ctrl-u	Half-page backward

This display is designed for debugging. It is intended to be used only with the assistance of a Sun Microsystems support staff person.

### Sample Display

CODE EXAMPLE 6-14 shows the shared memory display. The output has been truncated for inclusion in this manual.

**CODE EXAMPLE 6-14** samu(1M) M Display

```
Shared memory      size: 73728          samu 4.2          08:43:20 May  8 2004
License: License never expires.
00000000  00040000 00014d58 00000000 00000000  .....MX.....
00000010  00000000 00000000 73616d66 73202d20  .....samfs -
00000020  73686172 6564206d 656d6f72 79207365  shared memory se
00000030  676d656e 74000000 00012000 000044c8  gment..... ..DH
00000040  0000dd20 00000000 00000742 00000745  ..] .....B...E
00000050  00000001 00000000 00000000 c0000000  .....@...
00000060  00000001 0001534d 00000000 00000000  .....SM.....
00000070  00000000 00000000 00000000 00000000  .....
```

**CODE EXAMPLE 6-14** samu(1M) M Display (Continued)

00000080	00000000	00000000	00000000	00000000	.....
00000090	20000000	000001b0	000001cc	00000450	.....0...L...P
000000a0	0000cf50	00000001	00000001	4c696365	..OP.....Lice
000000b0	6e73653a	204c6963	656e7365	206e6576	nse: License nev
000000c0	65722065	78706972	65732e00	00000000	er expires.....
000000d0	00000000	00000000	00000000	00000000	.....
000000e0	00000000	00000000	00000000	00000000	.....
000000f0	00000000	00000000	00000000	00000000	.....
00000100	00000000	00000000	00000000	00000000	.....
00000110	00000000	00000000	00000000	00000000	.....
00000120	00000000	00000000	00000000	00000000	.....
00000130	00000000	00000000	00000000	00000000	.....
00000140	00000000	00000000	00000000	00000000	.....
00000150	00000000	00000000	00000000	00000000	.....
00000160	00000000	00000000	00000000	00000000	.....
00000170	00000000	00000000	00000000	00000000	.....
00000180	00000000	00000000	00000000	00000000	.....
00000190	00000000	00000000	00000000	00000000	.....
000001a0	00000000	00000000	00000000	00000000	.....
000001b0	2f766172	2f6f7074	2f53554e	5773616d	/var/opt/SUNWsam
000001c0	66732f61	6d6c6400	00000000	00040000	fs/amld.....
000001d0	00014d58	00000000	00000000	00000000	..MX.....
000001e0	00000000	00000097	00000000	00000000	.....
000001f0	00000000	00000000	00000000	00000000	.....



## (n) - Staging Status Display

The `n` display shows the status of the stager for all media. It displays a list of outstanding stage requests.

You can invoke this display differently, depending on what you need to view, as follows:

- To display the staging status for all staging activity, type the command with the following format:

```
Command: n
```

- To display the staging status for a specific media type, type the command with the following format:

```
Command: n mt
```

For *mt*, specify one of the media types shown in the `mcf(4)` man page.

## Sample Display

CODE EXAMPLE 6-15 shows the staging status display.

### CODE EXAMPLE 6-15 samu(1M) n Display

```
Staging status                      samu 4.2                      08:47:16 May  8 2004
License: License never expires.

Log output to: /var/opt/SUNWsamfs/stager/log

Stage request: dt.DAT001
Loading VSN DAT001

Staging queues
ty pid    user      status    wait files vsn
dt 16097  root      active    0:00     12 DAT001
```

## (N) - File System Parameters Display

The N display shows all mount point parameters, the superblock version, and other file system information.

To invoke this display, type the following command:

```
Command: N
```

### Navigation

TABLE 6-13 shows the control keys you can use in this display.

**TABLE 6-13** Control Keys for the N Display

Key	Function
Ctrl-b	Previous file system
Ctrl-d	Page partitions forward
Ctrl-f	Next file system
Ctrl-i	Detailed status interpretations
Ctrl-u	Page partitions backward

This display is designed for debugging. It is intended to be used only with the assistance of a Sun Microsystems support staff person.

### Sample Display

CODE EXAMPLE 6-16 shows the file system parameters display.

**CODE EXAMPLE 6-16** samu(1M) N Display

File system parameters	samu 4.2	08:55:19 Sept 8 2004
License: License never expires.		
mount_point : /sam1	partial : 16k	
fs_type : 6	maxpartial : 16k	
server :	partial_stage : 16384	
filesystem name: samfs1	flush_behind : 0	
eq_type : 10 ms	stage_flush_beh: 0	
state version : 0 2	stage_n_window : 262144	
(fs,mm)_count : 5 0	stage_retries : 3	
sync_meta : 0	stage timeout : 0	
stripe : 0	dio_consec r,w : 0 0	

**CODE EXAMPLE 6-16** samu(1M) N Display (Continued)

mm_stripe	: 1	dio_frm_min r,w:	256 256
high low	: 90% 70%	dio_ill_min r,w:	0 0
readahead	: 1048576	ext_bsize	: 4096
writebehind	: 524288		
wr_throttle	: 16777216		
rd_ino_buf_size	: 16384		
wr_ino_buf_size	: 512		
config	: 0x08520530	mflag	: 0x00000044
status	: 0x00000001		
Device configuration:			
ty	eq state	device_name	fs family_set
md	11 on	/dev/dsk/c5t8d0s3	10 samfs1
md	12 on	/dev/dsk/c5t8d0s4	10 samfs1
md	13 on	/dev/dsk/c5t8d0s5	10 samfs1
md	14 on	/dev/dsk/c5t8d0s6	10 samfs1
md	15 on	/dev/dsk/c5t8d0s7	10 samfs1

## (o) - Optical Disk Status Display

The o display shows the status of all optical disk drives configured within the Sun StorEdge SAM-FS environment.

To invoke this display, type the following command:

```
Command: o
```

## Navigation

TABLE 6-14 shows the control keys you can use in this display.

**TABLE 6-14** Control Keys for the o Display

Key	Function
Ctrl-b	Page backward
Ctrl-f	Page forward
Ctrl-b	Page backward
Ctrl-d	Half-page forward
Ctrl-f	Page forward
Ctrl-k	Select (manual, automated library, both, priority)
Ctrl-u	Half-page backward

## Sample Display

CODE EXAMPLE 6-17 shows the optical disk status display.

**CODE EXAMPLE 6-17** samu(1M) o Display

Optical disk status				samu	4.2	Thu Oct 11 13:15:40	
ty	eq	status	act	use	state	vsn	
mo	35	--l---wo-r	1	29%	ready	oper2	

## Field Descriptions

TABLE 6-15 shows the field descriptions for this display.

**TABLE 6-15** samu(1M) o Display Field Descriptions

Field	Description
ty	Device type.
eq	Equipment Ordinal of the optical disk.
status	Device status. For a description of status codes, see “Operator Display Status Codes” on page 201.
act	Activity count.
use	Percentage of cartridge space used.
state	Current operating state of the optical disk. Valid device states are as follows: <ul style="list-style-type: none"><li>• <code>ready</code>—The device is on, and the disk is loaded in the transport; available for access.</li><li>• <code>notrdy</code>—The device is on, but no disk is present in the transport.</li><li>• <code>idle</code>—The device is not available for new connections. Operations in progress continue until completion.</li><li>• <code>off</code>—The device is not available for access.</li><li>• <code>down</code>—The device is available only for maintenance access.</li></ul>
vsn	Volume serial name assigned to the optical disk, or the keyword <code>nolabel</code> if the volume is not labeled.

## (p) - Removable Media Load Requests Display

The `p` display lists information about pending load requests for removable media. You can use the `mt` argument to select either a specific type of media, such as DLT tape, or a family of media, such as tape. The priority display lists the priority in the preview queue, rather than the user queue, and sorts the entries by priority.

It displays mount requests in the following formats:

- Both manual and automated library requests by user
- Both manual and automated library requests by priority
- Manual requests only
- Automated library requests only

You can invoke this display differently, depending on what you need to view, as follows:

- To display mount requests for all removable devices currently selected, type the command with the following format:

```
Command: p
```

- To display mount requests for devices of a given removable media type, type the command with the following format:

```
Command: p mt
```

For `mt`, specify one of the media types shown in the `mcf(4)` man page.

## Navigation

TABLE 6-16 shows the control keys you can use in this display.

**TABLE 6-16** Control Keys for the `p` Display

Key	Function
Ctrl-b	Page backward
Ctrl-d	Half-page forward
Ctrl-f	Page forward
Ctrl-k	Toggle between the different display formats
Ctrl-u	Half-page backward

# Sample Display

CODE EXAMPLE 6-18 shows the removable media load requests display.

**CODE EXAMPLE 6-18** samu(1M) p Display

Removable media load requests all both samu 4.2 09:14:19 Sept 8 2004							
License: License never expires.				count: 1			
index	type	pid	user	rb	flags	wait	count vsn
0	dt	15533	root	150	W--f---	0:00	DAT001

## Field Descriptions

TABLE 6-17 shows the field descriptions for this display.

**TABLE 6-17** samu(1M) p Display Field Descriptions

Field	Description
index	Index number in the preview table.
type	Device type code assigned to the removable media.
pid	UNIX process identifier. A process identifier of 1 indicates NFS access.
user	Name assigned to the user requesting the load.
priority	Priority of the request.
rb	Equipment Ordinal of the automated library in which the requested VSN resides.
flags	Flags for the device. See TABLE 6-18.
wait	The elapsed time since the mount request was received.
count	The number of requests for this VSN, if it is a stage.
vsn	Volume serial name of the volume.

## Flags

TABLE 6-18 shows the flags for the p display.

**TABLE 6-18** Flags Field for the samu(1M) p Display

Field	Description
W-----	Write access requested
-b-----	Entry is busy
--C----	Clear VSN requested
---f---	File system requested
----N--	Media is foreign to the Sun StorEdge SAM-FS file system
-----S-	Flip side already mounted
-----s	Stage request flag



## (P) - Active Services Display

The P display lists the services registered with the Sun StorEdge QFS and Sun StorEdge SAM-FS single port multiplexer.

To invoke this display, type the following command:

```
Command: P
```

## Navigation

TABLE 6-19 shows the control keys you can use in this display.

**TABLE 6-19** Control Keys for the P Display

Key	Function
Ctrl-b	Page backward
Ctrl-f	Page forward

This display is designed for debugging. It is intended to be used only with the assistance of a Sun Microsystems support staff person.

## Sample Display

CODE EXAMPLE 6-19 shows the active services display.

**CODE EXAMPLE 6-19** samu(1M) P Display

```
Active Services                      samu      4.2      09:08:33 Sept 8 2004
License: License never expires.

Registered services for host 'pup':
  sharedfs.qfs2
  sharedfs.qfs1
  2 service(s) registered.
```

## (r) - Removable Media Status Display

The `r` display enables you to monitor the activity on removable media devices such as tape drives. You can monitor either a specific type of device, such as video tape, or a family of devices such as all tape devices.

You can invoke this display differently, depending on what you need to view, as follows:

- To display the status for all removable media devices, type the command with the following format:

```
Command: r
```

- To display the status for a specific device, type the command with the following format:

```
Command: r eq
```

For *eq*, specify the Equipment Ordinal for the device.

### Sample Display

CODE EXAMPLE 6-20 shows the removable media status display.

#### CODE EXAMPLE 6-20 `samu(1M) r` Display

```
Removable media status: all                samu 4.2                09:11:27 Sept 8 2004
License: License never expires.

ty   eq   status      act   use   state   vsn
dt  150  --l-----r    0   63%  ready  DAT001
```

## Field Descriptions

TABLE 6-20 shows the field descriptions for this display.

**TABLE 6-20** samu(1M) r Display Field Descriptions

Field	Description
ty	Device type.
eq	Equipment Ordinal of the drive.
status	Device status. For a description of status codes, see “Operator Display Status Codes” on page 201.
act	Activity count.
use	Percentage of cartridge space used.
state	Current operating state of the removable media. Valid device states are as follows: <ul style="list-style-type: none"><li>• <code>ready</code>—The device is on, and the disk or tape is loaded in the transport; available for access.</li><li>• <code>notrdy</code>—The device is on, but no disk or tape is present in the transport.</li><li>• <code>idle</code>—The device is not available for new connections. Operations in progress continue until completion.</li><li>• <code>off</code>—The device is not available for access.</li><li>• <code>down</code>—The device is available only for maintenance access.</li></ul>
vsn	Volume serial name assigned to the volume, or the keyword <code>nolabel</code> if the volume is not labeled. Blank if no volume is present in the transport, or device is off.

## (R) - Sun SAM-Remote Information Display

The R display shows information and status on Sun SAM-Remote configurations.

To invoke this display, type the following command:

`Command: R`

This display is designed for debugging. It is intended to be used only with the assistance of a Sun Microsystems support staff person.

## (s) - Device Status Display

The `s` display shows the status for all devices configured within the Sun StorEdge SAM-FS environment.

To invoke this display, type the following command:

```
Command: s
```

## Navigation

TABLE 6-21 shows the control keys you can use in this display.

**TABLE 6-21** Control Keys for the `s` Display

Key	Function
Ctrl-b	Page backward
Ctrl-d	Half-page forward
Ctrl-f	Page forward
Ctrl-u	Half-page backward

## Sample Display

CODE EXAMPLE 6-21 shows the device status display.

**CODE EXAMPLE 6-21** `samu(1M) s` Display

Device status		samu	4.2	09:14:05	Sept 8 2004
License: License never expires.					
ty	eq state	device_name		fs status	pos
sk	100 on	/etc/opt/SUNWsamfs/dcstkconf		100 m-----r	
	stk_dismount(2275) 0, volser 700073				
sg	120 on	/dev/rmt/2cbn		100 -----p	
	empty				
sg	130 on	/dev/rmt/5cbn		100 --l----o-r	
	Ready for data transfer				
sg	140 on	/dev/rmt/6cbn		100 -----p	
	empty				
sg	150 on	/dev/rmt/4cbn		100 -----p	
	empty				
hy	151 on	historian		151 -----	

## Field Descriptions

TABLE 6-22 shows the field descriptions for this display.

**TABLE 6-22** samu(1M) s Display Field Descriptions

Field	Description
ty	Device type.
eq	Equipment ordinal of the device.
state	Current operating state of the device.
device_name	Path to the device. For file system devices, this is the file system name.
fs	Equipment Ordinal of the family, set to which the device belongs.
status	Device status. For a description of status codes, see “Operator Display Status Codes” on page 201.

## (S) - Sector Data Display

The S display shows raw device data.

To invoke this display, type the following command:

Command: **S**

## Navigation

TABLE 6-23 shows the control keys you can use in this display.

**TABLE 6-23** Control Keys for the S Display

Key	Function
Ctrl-b	Previous sector
Ctrl-d	Page forward (top portion)
Ctrl-f	Next sector
Ctrl-k	Advance display format
Ctrl-u	Page backward (top portion)

This display is designed for debugging. It is intended to be used only with the assistance of a Sun Microsystems support staff person.

## (t) - Tape Drive Status Display

The `t` display shows the status of all tape drives configured within the Sun StorEdge SAM-FS environment.

To invoke this display, type the following command:

```
Command: t
```

## Navigation

TABLE 6-24 shows the control keys you can use in this display.

**TABLE 6-24** Control Keys for the `t` Display

Key	Function
Ctrl-b	Page backward
Ctrl-f	Page forward

## Sample Display

CODE EXAMPLE 6-22 shows the tape drive status display.

**CODE EXAMPLE 6-22** samu(1M) `t` Display

Tape drive status						samu	4.2	09:21:07 Sept 8 2004
License: License never expires.								
ty	eq	status	act	use	state	vsu		
sg	120	-----p	0	0%	notrdy			
		empty						
sg	130	-----p	0	0%	notrdy			
		empty						
sg	140	-----p	0	0%	notrdy			
		empty						
sg	150	--l-----r	0	41%	ready	700088		
		idle						



## Field Descriptions

TABLE 6-25 shows the field descriptions for this display.

**TABLE 6-25** samu(1M) t Display Field Descriptions

Field	Description
ty	Device type.
eq	Equipment Ordinal of the drive.
status	Device status. For a description of status codes, see “Operator Display Status Codes” on page 201.
act	Activity count.
use	Percentage of cartridge space used.
state	Current operating state of the removable media. Valid device states are as follows: <ul style="list-style-type: none"><li>• <code>ready</code>—The device is on and the disk or tape is loaded in the transport; available for access.</li><li>• <code>notrdy</code>—The device is on but no disk or tape is present in the transport.</li><li>• <code>idle</code>—The device is not available for new connections. Operations in progress continue until completion.</li><li>• <code>off</code>—The device is not available for access.</li><li>• <code>down</code>—The device is available only for maintenance access.</li></ul>
vsn	Volume serial name assigned to the volume, or the keyword <code>noLabel</code> if volume is not labeled. Blank if no volume is present in the transport, or device is off.

## (T) - SCSI Sense Data Display

The T display shows the SCSI status of a SCSI device.

To invoke this display, type the following command:

Command: **T**

## Navigation

TABLE 6-26 shows the control keys you can use in this display.

**TABLE 6-26** Control Keys for the T Display

Key	Function
Ctrl-b	Previous equipment
Ctrl-f	Next equipment

This display is designed for debugging. It is intended to be used only with the assistance of a Sun Microsystems support staff person.

## (u) - Staging Queue Display

The u display lists all files in the staging queue.

To invoke this display, type the following command:

```
Command:u
```

## Navigation

TABLE 6-27 shows the control keys you can use in this display.

**TABLE 6-27** Control Keys for the u Display

Key	Function
Ctrl-b	Page backward
Ctrl-d	Half-page forward
Ctrl-f	Page forward
Ctrl-k	Display the path on the second line of each entry
Ctrl-u	Half-page backward

## Sample Display

CODE EXAMPLE 6-23 shows the staging queue display.

**CODE EXAMPLE 6-23** samu(1M) u Display

Staging queue by media type: all			samu 4.2		09:24:23 Sept 8 2004	
License: License never expires.					volumes 1 files 22	
ty	length	fseq	ino	position	offset	vsu
dt	451.611k	20	1030	207cc	473	DAT001
dt	341.676k	20	1031	207cc	7fc	DAT001
dt	419.861k	20	1032	207cc	aa9	DAT001
dt	384.760k	20	1033	207cc	df2	DAT001
dt	263.475k	20	1034	207cc	10f5	DAT001
dt	452.901k	20	1035	207cc	1305	DAT001
dt	404.598k	20	1036	207cc	1690	DAT001
dt	292.454k	20	1037	207cc	19bb	DAT001
dt	257.835k	20	1038	207cc	1c05	DAT001
dt	399.882k	20	1040	207cc	1e0b	DAT001

**CODE EXAMPLE 6-23** samu(1M) u Display (Continued)

dt	399.882k	40	1029	208d7	2	DAT001
dt	257.835k	40	1030	208d7	323	DAT001
dt	292.454k	40	1031	208d7	528	DAT001
dt	404.598k	40	1032	208d7	772	DAT001
dt	452.901k	40	1033	208d7	a9d	DAT001
dt	263.475k	40	1034	208d7	e28	DAT001
dt	384.760k	40	1035	208d7	1038	DAT001
dt	419.861k	40	1036	208d7	133b	DAT001
dt	341.676k	40	1037	208d7	1684	DAT001
dt	451.611k	40	1038	208d7	1931	DAT001
dt	161.326k	40	1039	208d7	1cba	DAT001
dt	406.400k	40	1040	208d7	1dfe	DAT001

## Field Descriptions

TABLE 6-28 shows the field descriptions for this display.

**TABLE 6-28** samu(1M) u Display Field Descriptions

Field	Description
ty	Device type.
length	File length.
fseq	File system equipment number.
ino	The inode number.
position	The position of the archive file on the specific medium.
offset	Offset of the archive file on the specific medium.
vsn	Volume serial name of the volume.

## (U) - Device Table Display

The U display shows the device table in a human-readable form.

You can invoke this display differently, depending on what you need to view, as follows:

- To display the device table for all devices, type the command with the following format:

```
Command:U
```

- To display the device table for a specific device, type the command with the following format:

```
Command:U eq
```

For *eq*, specify the Equipment Ordinal of the device.

## Navigation

TABLE 6-29 shows the control keys you can use in this display.

**TABLE 6-29** Control Keys for the U Display

Key	Function
Ctrl-b	Previous equipment
Ctrl-f	Next equipment

This display is designed for debugging. It is intended to be used only with the assistance of a Sun Microsystems support staff person.

## Sample Display

CODE EXAMPLE 6-24 shows the device table display.

**CODE EXAMPLE 6-24** samu(1M) U Display

```
Device table: eq: 10      addr: 00000450  samu 4.2      09:28:40 Sept 8 2004
License: License never expires.

message:
```

**CODE EXAMPLE 6-24** samu(1M) U Display (Continued)

```
0004000000014d58 0000000000000000      00000000 delay
0000000000000000 mutex                  00000000 unload_delay
00000aa8 next
73616d66 set:  samfs1
73310000
00000000
00000000
000a000a eq/fseq
08010801 type/equ_type
0000      state
00000000 st_rdev
00000000 ord/model
00000000 mode_sense
00000000 sense
00000000 space
00000000 capacity
00000000 active
00000000 open
00000000 sector_size
00000000 label_address
00000000 vsn:
00000000
00000000
00000000 status: -----
00000000 dt
73616d66 name: samfs1
```

## (v) - Automated Library Catalog Display

The `v` display shows the location and VSN of all disks or tapes currently cataloged in the automated library.

You can invoke this display differently, depending on what you need to view, as follows:

- To display the catalog for all devices, type the command with the following format:

```
Command: v
```

- To display catalog information for a specific device, type the command with the following format:

```
Command: v eq
```

For *eq*, specify the Equipment Ordinal of the device. Type the keyword `historian` to view the historian catalog.

At certain times, `samu(1M)` prompts for a device to be entered, as follows:

```
Enter robot: eq
```

For *eq*, specify the Equipment Ordinal of the device or press return. Pressing return displays information for the previous device specified.

For a list of all device names and Equipment Ordinals, see “(c) - Device Configuration Display” on page 152.

## Navigation

TABLE 6-30 shows the control keys you can use in this display.

**TABLE 6-30** Control Keys for the `v` Display

Key	Function
Ctrl-b	Page backward.
Ctrl-d	Next library catalog.
Ctrl-f	Page forward.

**TABLE 6-30** Control Keys for the v Display *(Continued)*

Key	Function
Ctrl-i	Detailed, 2-line display format. When you enter Ctrl-i once, it shows times and barcodes. When you enter Ctrl-i a second time, it shows volume reservations on the second line.
Ctrl-k	Advance sort key. After you enter Ctrl-k, you can enter one of the following to select a sort key: 1 - sort by slot. 2 - sort by count. 3 - sort by usage. 4 - sort by VSN. 5 - sort by access time. 6 - sort by barcode. 7 - sort by label time.
Ctrl-u	Previous automated library catalog.
/	Search for VSN
%	Search for barcode
\$	Search for slot

## Sample Display

CODE EXAMPLE 6-25 shows the automated library catalog display.

**CODE EXAMPLE 6-25** samu(1M) v Display

Robot VSN catalog by slot				: eq 100samu	4.2	09:30:25 Sept 8 2004
License: License never expires.						count 32
slot	access time	count	use flags	ty	vsn	
0	2004/05/08 08:35	64	0% -il-o-b-----	sg	700071	
1	2004/05/08 09:08	27	12% -il-o-b-----	sg	700073	
2	2004/05/08 09:12	26	12% -il-o-b-----	sg	700077	
3	2004/05/08 08:39	37	40% -il-o-b-----	sg	700079	
4	2004/05/08 09:16	24	6% -il-o-b-----	sg	700084	
5	2004/05/08 09:18	24	41% -il-o-b-----	sg	700088	
6	none	0	0% -il-o-b-----	sg	700090	
7	none	0	0% -il-o-b-----	sg	700092	
8	none	0	0% -il-o-b-----	sg	000155	
9	none	0	0% -il-o-b-----	sg	000156	
10	none	0	0% -il-o-b-----	sg	000157	



**CODE EXAMPLE 6-25** samu(1M) v Display (Continued)

11	none	0	0%	-il-o-b-----	sg 000158
12	none	0	0%	-il-o-b-----	sg 000154
13	none	0	0%	-il-o-b-----	sg 000153
14	none	0	0%	-il-o-b-----	sg 000152

## Field Descriptions

TABLE 6-31 shows the field descriptions for this display.

**TABLE 6-31** samu(1M) v Display Field Descriptions

Field	Description
Robot VSN catalog	Name of the specified automated library and time the display refreshed.
count	Number of slots allocated in this library's catalog.
slot	Slot number within the specified library.
access time	Time the volume was last accessed.
count	Number of accesses to this volume since the last audit operation.
use	Percentage of space used for the volume.
flags	Flags for the device. See TABLE 6-32 for information about the flags.
ty	Device type.
vsn	Volume serial name of the volume.

## Flags

TABLE 6-32 shows the flags from the flags field in TABLE 6-31. In some cases, more than one flag can occur in a field, and one flag overrides the other.

**TABLE 6-32** Flags Field for samu(1M) v Display

Flags	Description
A-----	Volume needs audit.
-i-----	Slot in use.
--l-----	Labeled. Overrides N.
--N-----	Unlabeled. This volume is foreign to the Sun StorEdge SAM-FS environment.

**TABLE 6-32** Flags Field for `samu(1M)` v Display (Continued)

Flags	Description
---E-----	Media error. Set when the Sun StorEdge SAM-FS software detects a write error on a cartridge.
----o-----	Slot occupied.
----C-----	Volume is a cleaning tape. Overrides <code>p</code> .
----p-----	Priority VSN.
-----b-----	Barcode detected.
-----W----	Write protect. Set when the physical write protection mechanism is enabled on a cartridge.
-----R----	Read only.
-----c--	Recycle.
-----d-	Duplicate VSN. Overrides <code>U</code> .
-----U-	Volume unavailable.
-----f	Archiver found volume full.
-----X	Export slot.

## (w) - Pending Stage Queue

The `w` display shows queued stage requests for which the volumes have not yet been loaded.

You can invoke this display differently, depending on what you need to view, as follows:

- To display the pending stage queue for all media, type the command with the following format:

```
Command: w
```

- To display the pending stage queue for a specific media type, type the command with the following format:

```
Command: w mt
```

For *mt*, specify one of the media types shown in the `mcf(4)` man page.

## Navigation

TABLE 6-33 shows the control keys you can use in this display.

**TABLE 6-33** Control Keys for the `w` Display

Key	Function
Ctrl-b	Page backward
Ctrl-d	Half-page forward
Ctrl-f	Page forward
Ctrl-k	Display the path on the second line of each entry
Ctrl-u	Half-page backward

# Sample Display

CODE EXAMPLE 6-26 shows the pending stage queue.

**CODE EXAMPLE 6-26** samu(1M) w Display

Pending stage queue by media type: all							samu	4.2	Thu Oct 11 13:20:27
License: License never expires.								volumes 1 files 13	
ty	length	fseq	ino	position	offset	vsn			
at	1.383M	1	42	3a786	271b	000002			
at	1.479M	1	56	3a786	5139	000002			
at	1018.406k	1	60	3a786	6550	000002			
at	1.000M	1	65	3a786	7475	000002			
at	1.528M	1	80	3a786	99be	000002			
at	1.763M	1	92	3a786	ce57	000002			
at	1.749M	1	123	3a786	11ece	000002			
at	556.559k	1	157	3a786	1532f	000002			
at	658.970k	1	186	3a786	17705	000002			
at	863.380k	1	251	3a786	1dd58	000002			
at	1.268M	1	281	3a786	1f2b7	000002			
at	1.797M	1	324	3a786	23dfa	000002			
at	1.144M	1	401	3a786	2bb6d	000002			

## Field Descriptions

TABLE 6-34 shows the field descriptions for this display.

**TABLE 6-34** samu(1M) w Display Field Descriptions

Field	Description
ty	Device type.
length	File length.
fseq	File system Equipment Ordinal.
ino	The inode number.
position	The position (in decimal format) of the archive file on the specific medium.
offset	Offset of the archive file on the specific medium.
vsn	Volume serial name of the volume.

# Operator Display Status Codes

The operator displays have different status codes for the removable media device displays and the file system displays. The following sections describe these displays.

## Removable Media Device Display Status Codes

The `o`, `r`, `s`, and `t` operator displays show status codes for removable media devices. Status codes are displayed in a 10-position format, reading from left (position 1) to right (position 10).

The status codes in this section do not apply to the `samu(1M)` `f`, `m`, and `v` displays. For information about the status codes for the `f` and `m` displays, see “File System Display Status Codes” on page 202. For information about the status codes for the `v` display, see “(v) - Automated Library Catalog Display” on page 195.

TABLE 6-35 defines the valid status codes for each position.

**TABLE 6-35** Removable Media Device Display Status Codes

Status Bit	Meaning for a Device
s-----	Media is being scanned.
m-----	The automated library is operational.
M-----	Maintenance mode.
-E-----	Device received an unrecoverable error in scanning.
-a-----	Device is in audit mode.
--l-----	Media has a label.
--N-----	Foreign media.
--L-----	Media is being labeled.
---I-----	Waiting for device to idle.
---A-----	Needs operator attention.
----C-----	Needs cleaning.
----U-----	Unload has been requested.
-----R----	Device is reserved.
-----w---	A process is writing on the media.
-----o--	Device is open.
-----P-	Device is positioning (tape only).

**TABLE 6-35** Removable Media Device Display Status Codes (*Continued*)

Status Bit	Meaning for a Device
-----F-	For automated libraries, all storage slots occupied. For tape and magneto-optical drives, media is full.
-----R	Device is ready and the media is read-only.
-----r	Device is spun up and ready.
-----p	Device is present.
-----W	Device is write protected.

## File System Display Status Codes

The `f` and `m` operator displays show status codes for file systems. Status codes are displayed in an 11-position format, reading from left (position 1) to right (position 11).

The status codes in this section do not apply to the `samu(1M)` `c`, `o`, `r`, `s`, `t`, or `v` displays. For information about the status codes for the `c`, `o`, `r`, `s`, and `t` displays, see “Removable Media Device Display Status Codes” on page 201. For information about the status codes for the `v` display, see “(v) - Automated Library Catalog Display” on page 195.

TABLE 6-36 defines the valid status codes for each position.

**TABLE 6-36** File System Display Status Codes

Status Bit	Meaning for a File System
m-----	File system is currently mounted.
M-----	File system is being mounted.
-u-----	File system is being unmounted.
--A-----	File system data is being archived.
---R-----	File system data is being released.
----S-----	File system data is being staged.
-----1----	Sun StorEdge SAM-FS file system version 1.
-----2----	Sun StorEdge SAM-FS file system version 2.
-----c----	Sun StorEdge QFS shared file system.
-----W---	Single writer.

**TABLE 6-36** File System Display Status Codes

Status Bit	Meaning for a File System
-----R--	Multireader.
-----r-	mr devices.
-----d	md devices.

## Operator Display Device States

The `c`, `m`, `o`, `r`, `s`, and `t` operator displays show device state codes. These codes represent the current access state for the device. TABLE 6-37 defines the valid state codes.

**TABLE 6-37** Operator Display Device States

Device State	Description
<code>on</code>	The device is available for access. For certain displays, this state might be superseded by the states <code>ready</code> or <code>notrdy</code> .
<code>ro</code>	The device is available for read-only access. For certain displays, this state might be superseded by the states <code>ready</code> or <code>notrdy</code> .
<code>off</code>	<p>The device is not available for access. For tape and optical disk drives, possible reasons for the device to be in the <code>off</code> state include the following:</p> <ul style="list-style-type: none"> <li>• Cleaning was requested, but no cleaning cartridge was found in the automated library.</li> <li>• The cleaning cartridge cannot be loaded or unloaded from the drive.</li> <li>• Initialization found the drive status to be full, and attempts to clear the drive failed.</li> <li>• The system was unable to clear a cartridge from a drive.</li> <li>• Opening the drive for I/O failed during spin-up.</li> <li>• An error other than NOT READY was received when spinning down the drive for unloading.</li> <li>• Opening the standard tape driver on the drive failed during spin-up.</li> </ul>
<code>down</code>	The device is available for maintenance access only.
<code>idle</code>	The device is not available for new connections. Operations in progress continue until completion.

**TABLE 6-37** Operator Display Device States (*Continued*)

Device State	Description
ready	The device is on and the disk or tape loaded in the transport is available for access.
notrdy	The device is on, but no disk or tape is present in the transport.
unavail	The device is unavailable for access and cannot be used for automatic Sun StorEdge SAM-FS operations. You can continue to use the load(1M) and unload(1M) commands for moving media while the device is in the unavail state.

You can use the `samu(1M)` `down`, `off`, and `on` device state commands to change device states to `down`, `off`, or `on`. You can enter these commands from any `samu(1M)` display, but if you enter them from the `c`, `m`, `o`, `r`, `s`, or `t` display, you can see the device state change in the display. For example, you could set a device state to `off` from within the `P` display, but you would not be able to see the new device state reflected in the display.

The following procedures show what to type to change a device's state from `down` to `on` and from `on` to `down`.

## ▼ To Change a Drive State from `down` to `on`

1. **Bring up a `samu(1M)` display that shows drive and automated library device states.**

The following `samu(1M)` displays all show device states: `c`, `m`, `o`, `r`, `s`, and `t`.

2. **Visually inspect the display to verify that the device is in the `down` state.**
3. **Type `:off`.**

Turning the device off halts all activity so the device can be started cleanly in the next step. For example:

```
Command:off eq
```

For `eq`, specify the Equipment Ordinal of the device.

4. **Type `:on`.**

For example:

```
Command:on eq
```

For `eq`, specify the Equipment Ordinal of the device.



## ▼ To Change a Drive State from on to down

1. **Bring up a samu(1M) display that shows drive and automated library device states.**

The following samu(1M) displays all show device states: c, m, o, r, s, and t.

2. **Visually inspect the display to verify that the device is in the on state.**

3. **Type :off.**

Turning the device off halts all activity so the device can be stopped cleanly in the next step. For example:

```
Command:off eq
```

For *eq*, specify the Equipment Ordinal of the device.

4. **Type :down.**

For example:

```
Command:down eq
```

For *eq*, specify the Equipment Ordinal of the device.

---

## Operator Commands

The following sections describe the operator commands that you can enter from the samu(1M) operator utility's command interface. You can enter the commands from any display.

The following types of operator commands are available:

- "Device Commands" on page 206
- "SAM Commands — Archiver Control" on page 207
- "SAM Commands — Stager Control" on page 210
- "SAM Commands — Releaser Control" on page 210
- "File System Commands — I/O Management" on page 212
- "File System Commands — Direct I/O Management" on page 214
- "File System Commands — Sun StorEdge QFS Shared File Systems" on page 216
- "File System Commands - Miscellaneous" on page 217

- “Automated Library Commands” on page 220
- “Miscellaneous Commands” on page 222

If you want to enter any operator commands from the Solaris operating system (OS) command line, you must use them as arguments to the `samcmd(1M)` command. For more information about the `samcmd(1M)` command, see the `samcmd(1M)` man page.

In the following subsections, each `samu(1M)` command is prefaced with a colon (:) when it is entered to designate that a command is being entered and not a series of hot keys.

## Device Commands

TABLE 6-38 shows the device commands and their actions.

**TABLE 6-38** Device Command Actions

Command	Action
<code>down</code>	Terminates operation on device <i>eq</i> .
<code>idle</code>	Restricts access to device <i>eq</i> by preventing new connections to the device. Existing operations continue until completion.
<code>off</code>	Logically turns off device <i>eq</i> .
<code>on</code>	Logically turns on device <i>eq</i> .
<code>unavail</code>	Selects device <i>eq</i> and makes it unavailable for use with the Sun StorEdge SAM-FS file system. You might set a drive state to <code>unavail</code> , for example, in a disaster recovery situation in which you are trying to load media to restore a file system and you do not want the Sun StorEdge SAM-FS software to attempt to use this drive.
<code>unload</code>	Unloads the mounted media for the specified removable media device <i>eq</i> . For magazine devices, the <code>unload</code> command unloads the mounted cartridge and ejects the magazine.

CODE EXAMPLE 6-27 shows the formats for the device control commands.

**CODE EXAMPLE 6-27** Formats for the Device Control Commands

```
:down eq
:idle eq
:off eq
:on eq
:unavail eq
:unload eq
```

For *eq*, specify the Equipment Ordinal of the device.

## SAM Commands — Archiver Control

TABLE 6-39 shows the archiver commands and their actions.

**TABLE 6-39** Archiver Command Actions

Command	Action
<code>aridle</code>	Stops all archiving at the next convenient point. For example, at the end of the current <code>tar(1)</code> file for <code>sam-arcopy</code> operations. You can also use this command to stop all archiving activity for all file systems before unmounting the file systems.
<code>arrerrun</code>	Performs a soft restart on the archiver. The archiver daemons are restarted, and all work in progress is recovered.
<code>arrestart</code>	Interrupts the archiver and restarts the archiver. This action occurs regardless of the state of the archiver. Therefore, use <code>arrestart</code> with caution. Some copy operations to archive media might not complete and must be repeated. This wastes space on the media.
<code>armarchreq</code>	Removes an archive request.
<code>arrun</code>	Causes the archiver to begin archiving. This command overrides any existing global <code>wait</code> command in the <code>archiver.cmd</code> file.
<code>arscan</code>	Scans the file system.
<code>arstop</code>	Stops all archiving immediately.
<code>artrace</code>	Performs archiver tracing.

CODE EXAMPLE 6-28 shows the formats for the archiver commands.

**CODE EXAMPLE 6-28** Formats for the Archiver Commands

```
:aridle [ dk | rm | fs.fsname ]
:arrerrun
:arrestart
:armarchreq fsname.[* | archreq]
:arrun [ dk | rm | fs.fsname ]
:arscan fsname[.dir | ..inodes][int]
:arstop [ dk | rm | fs.fsname ]
:artrace [fs.fsname]
```

The arguments to these commands are optional. If no arguments are specified, all file systems are affected. If arguments are specified, the command takes action based on the type of archive file specified (*dk* or *rm*) or the file system specified. TABLE 6-40 shows the archiver command arguments.

**TABLE 6-40** Archiver Command Arguments

Argument	Description
<i>dk</i>	Specifies that this command pertains to disk archive files.
<i>rm</i>	Specifies that this command pertains to removable media files.
<i>fsname</i>	Specifies that this command pertains to a specific file system. Enter a file system name for <i>fsname</i> .
<i>archreq</i>	<p>Specifies the name of a specific archive request file in the following format:  <i>arset.copy.seq_num</i></p> <p>This file name has three components. Use a period to separate each component. The first component is the name of the archive set. The second component is the copy number (1, 2, 3, or 4). The third component is a sequence number that the archiver assigns. More than one archive request can exist at one time.</p> <p>You can use the <code>showqueue(1M)</code> command to obtain the names of the archive request files in the system. CODE EXAMPLE 6-29 shows how to use this command. Alternatively, you can go to the following directory and list the files present:</p> <p><code>/var/opt/SUNWsamfs/archiver/<i>fsname</i>/ArchReq</code></p>
<i>*</i>	Signifies all files.
<i>dir</i>	Specifies a specific directory name. This is the directory to scan.
<i>.inodes</i>	Specifies that the inodes should be scanned.
<i>int</i>	An integer number of seconds to delay the scan.

CODE EXAMPLE 6-29 shows using the `showqueue(1M)` command to obtain an *archreq* file name that can be used as input to the `armarchreq samu(1M)` command.

**CODE EXAMPLE 6-29** Using `showqueue(1M)`

```
# showqueue samfs9
Filesystem samfs9:
Scan list: empty
Archive requests
arset1.2.0 schedule 2004-01-22 16:23:07
    files:697 space: 4.934G flags: offline
(min: 1.000k) priority: 0 0
    No volumes available
    Drive 1
```

**CODE EXAMPLE 6-29** Using showqueue(1M) (Continued)

```
Files: 695, bytes: 1.932G (min: 1.000k)
Stage volumes:
  lt.CFX600
  lt.CFX601

arset1.1.1 schedule 2004-01-22 16:23:07
  files:3 space: 6.236M flags:
(min: 826.000k) priority: 0 0
  No volumes available
  Drive 1
  Files: 3, bytes: 6.236M (min: 826.000k)
```

CODE EXAMPLE 6-29 shows that files arset1.2.0 and arset1.1.1 are archive request files.

## The :hwm\_archive *eq* and :nohwm\_archive *eq* Commands

The hwm\_archive command invokes the archiver when the amount of data in the file system increases to a level above the releaser's high-water mark. You can set the releaser's high-water mark by using the thresh command. For information about the thresh command, see "The :thresh *eq* high low Command" on page 209. The nohwm\_archive command disables this capability and is the default.

For *eq*, specify the Equipment Ordinal for the file system.

## The :thresh *eq* high low Command

The thresh command sets the high and low thresholds for a file system to control file archiving.

For *eq*, specify the Equipment Ordinal of the storage family set.

For *high*, specify the high threshold.

For *low*, specify the low threshold.

For example, the following command sets the high threshold to 50 percent and the low threshold to 40 percent for the storage Family Set whose file system Equipment Ordinal is 10:

```
:thresh 10 50 40
```

## SAM Commands — Releaser Control

The following commands allow you to control aspects of the partial release feature. For more information about the partial release feature, see the Releasing chapter in the *Sun StorEdge SAM-FS Storage and Archive Management Guide*.

### The `:maxpartial eq value` Command

The `maxpartial` command sets the maximum partial release size for the file system to *value* kilobytes. The partial release size cannot be set larger than this `maxpartial` setting.

For *eq*, specify the Equipment Ordinal for the file system.

For *value*, specify an integer such that  $0 \leq \text{value} \leq 2097152$ .

### The `:partial eq value` Command

The `partial` command sets the number of kilobytes to leave online after release of the file. For more information, see the Releasing chapter in the *Sun StorEdge SAM-FS Storage and Archive Management Guide*.

For *eq*, specify the Equipment Ordinal for the file system.

For *value*, specify the number of kilobytes to leave online. The default size is 16.

## SAM Commands — Stager Control

The following commands allow you to control staging activities.

### The `:partial_stage eq value` Command

The `partial_stage` command sets the partial stage size for the file system to *value* kilobytes. For a file with the partial release attribute, *value* specifies the file offset past which access results in the entire file being staged to disk.

For *eq*, specify the Equipment Ordinal for the file system.

For *value*, specify an integer that is greater than 0 but is less than the *value* specified for the `maxpartial` setting. For more information about the `maxpartial` setting, see “The `:maxpartial eq value` Command” on page 210. For more information about the partial release feature, see the Releasing chapter in the *Sun StorEdge SAM-FS Storage and Archive Management Guide*.

## The `:stage_flush_behind eq value` Command

The `stage_flush_behind` command sets the maximum stage flush-behind value. Pages being staged are written to disk asynchronously to help the Solaris VM layer keep the pages clean.

For *eq*, specify the Equipment Ordinal for the file system.

For *value*, specify an integer number of kilobytes such that  $0 \leq \text{value} \leq 8192$ . By default, *value*=0, which disables `stage_flush_behind`.

## The `:stage_n_window eq value` Command

The `stage_n_window` command works with the `stage(1)` command's `-n` option. This `samu(1M)` command sets the `stage(1)` command's `-n` option for the file system to *value*. This command is effective for files read directly from the archive media and for which `stage -n` has been specified. For a file with the `stage -n` attribute set, *value* is the amount of data that is staged to the application's buffer at any one time.

For *eq*, specify the Equipment Ordinal for the file system.

For *value*, specify an integer such that  $64 \leq \text{value} \leq 2097152$  kilobytes. The default is 256 for all for all file systems except for the Sun StorEdge QFS shared file system, which is set to the value of the `minallopsz` mount option.

## The `:stage_retries eq value` Command

The `stage_retries` command sets the number of stage retries attempted per archive copy when certain errors are encountered.

For *eq*, specify the Equipment Ordinal for the file system.

For *value*, specify a number such that  $0 \leq \text{value} \leq 20$ . When *value*=0, retries are not attempted. The default is 3.

## The `:stclear mt.vsn` Command

The `stclear` command clears a stage request.

For *mt*, specify the media type; for information about valid media types, see the `mcf(4)` man page.

For *vsu*, specify the volume to mount.

## The `:stidle` Command

The `stidle` command idles the stager. Use this command if you want the stager to finish its current tasks and not commence any additional staging.

## The `:strun` Command

The `strun` command restarts staging activity. You can use this command to restart the stager after you have issued the `stidle` command.

# File System Commands — I/O Management

The following commands allow you to manage I/O characteristics dynamically.

## The `:flush_behind eq value` Command

The `flush_behind` command sets the maximum `flush_behind value`. When set to a value greater than 0, modified pages that are being written sequentially are written to disk asynchronously to help the Solaris kernel layer keep the pages clean. This option sets the maximum `flush_behind` value.

For *value*, specify an integer number of kilobytes such that  $0 \leq \textit{value} \leq 8192$ . By default, *value*=0, which disables `flush_behind`.

For *eq*, specify the Equipment Ordinal for the file system.

## The `:force_nfs_async eq` and `:noforce_nfs_async eq` Commands

These commands allow you to control whether the file system caches NFS data written to the server even if NFS has requested that the data be written synchronously through to disk. The `force_nfs_async` command caches NFS data. The `noforce_nfs_async` command, which is the default, synchronously writes data through to disk.

The `force_nfs_async` command is effective only if the file system is mounted as an NFS server and only if the clients are mounted with the `noac` NFS mount option. For more information about mounting an NFS file system, see the `mount_nfs(1M)` man page.

For *eq*, specify the Equipment Ordinal for the file system.





---

**Caution** – The `force_nfs_async` option violates NFS protocols. Use this command with caution. In the event of a server interruption, data can be lost. Data is cached on the NFS server and cannot be seen immediately by all the clients if there are multiple NFS servers. Multiple NFS servers can be enabled within the Sun StorEdge QFS shared file system. For more information about the Sun StorEdge QFS shared file system, see “Sun StorEdge QFS Shared File System” on page 91.

---

## The `:readahead eq contig` Command

The `readahead` command specifies the maximum number of bytes that can be read ahead by the file system.

For *eq*, specify the Equipment Ordinal for the file system.

For *contig*, specify units of 1-kilobyte blocks. This must be an integer such that  $1 < contig < 8192$ . The *contig* specified is truncated to a multiple of 8 kilobytes. The default *contig* is 8 (131072 bytes).

For example, the following command sets the maximum contiguous block size to 262,144 bytes for the file system defined as Equipment Ordinal 3:

```
:readahead 3 256
```

This value can also be configured in the `samfs.cmd` file by specifying the `readahead` directive. For more information, see the `samfs.cmd(4)` man page.

## The `:sw_raid eq` and `:nosw_raid eq` Commands

These options specify whether or not the file system aligns the writebehind buffer. Specify `sw_raid` if the software RAID feature of a package such as Solstice DiskSuite is also used on this file system. The default setting is `nosw_raid`.

For *eq*, specify the Equipment Ordinal for a file system.

## The `:writebehind eq contig` Command

The `writebehind` command specifies the maximum number of bytes that can be written behind by a file system.

For *eq*, specify the Equipment Ordinal for a file system.

For *contig*, specify units of 1-kilobyte blocks. This must be an integer such that  $1 < contig < 8192$ . The default *contig* is 8 (131072 bytes).

For example, the following command sets the maximum contiguous block size to 262,144 bytes for the file system defined as Equipment Ordinal 50:

```
:writebehind 50 256
```

This value can also be configured in the `samfs.cmd` file by specifying the `writebehind` directive. For more information, see the `samfs.cmd(4)` man page.

## The `:wr_throttle eq value` Command

The `wr_throttle` command sets the number of outstanding write bytes for one file to *value* kilobytes.

For *eq*, specify the Equipment Ordinal for a file system.

For *value*, specify an integer number of kilobytes. If *value*=0, there is no limit. The default is 16384.

## File System Commands — Direct I/O Management

The commands in this section control I/O on Sun StorEdge QFS and Sun StorEdge SAM-FS file systems. They allow you to change the type of I/O for an individual file based on I/O size and history. If direct I/O is specified for a file, for example, through the `setfa(1)` command, these options are ignored and all I/O to regular files is direct, if possible.

These commands refer to both well-aligned and misaligned I/O. *Well-aligned* I/O occurs when the file offset falls on a 512-byte boundary and when the length of the I/O transfer is at least 512 bytes. *Misaligned* I/O occurs when the file offset does not fall on a 512-byte boundary and the length of the transfer is less than 512 bytes.

For more information about I/O and I/O management, see “Advanced Topics” on page 303.

## The `:dio_rd_form_min eq value` and `:dio_wr_form_min eq value` Commands

These commands set the lower limits for well-aligned I/O to *value* 1024-byte blocks. Use the `dio_rd_form_min` command to set the *value* for reads, and use the `dio_wr_form_min` command to set the *value* for writes.

For *eq*, specify the Equipment Ordinal for the file system.

For *value*, specify an integer number of 1024-byte blocks to use for the lower limit. By default, *value*=256. If *value*=0, automatic I/O switching is disabled.

## The `:dio_rd_ill_min eq value` and `:dio_wr_ill_min eq value` Commands

These commands set the lower limit for misaligned I/O to *value* 1024-byte blocks. Use the `dio_rd_ill_min` command to set the *value* for reads, and use the `dio_wr_ill_min` command to set the *value* for writes.

For *eq*, specify the Equipment Ordinal for the file system.

For *value*, specify an integer number of 1024-byte blocks to use for the lower limit. By default, *value*=256. If *value*=0, automatic I/O switching is disabled.

## The `:dio_rd_consec eq value` and `:dio_wr_consec eq value` Commands

These commands set the number of consecutive I/O transfers that can occur, with a buffer size greater than the specified lower limits, to *value* operations.

For *eq*, specify the Equipment Ordinal for the file system.

For *value*, specify the number of consecutive I/O transfers with a buffer size greater than the specified lower limit. The specified lower limit is the *value* of `dio_rd_form_min` for aligned reads or `dio_rd_ill_min` for misaligned reads. By default, *value*=0, which means that no default direct reads occur based on I/O sizes.

For more information, see one or more of the following commands or mount parameters:

- “The `:dio_rd_form_min eq value` and `:dio_wr_form_min eq value` Commands” on page 215
- “The `:dio_rd_ill_min eq value` and `:dio_wr_ill_min eq value` Commands” on page 215

## The `:forcedirectio eq` and `:noforcedirectio eq` Commands

These commands allow you to control whether direct I/O be used as the default I/O mode. By default, the I/O mode is buffered and uses the page cache. The `forcedirectio` command enables direct I/O for all transfers. The `noforcedirectio` command enables the default, which is buffered I/O.

For *eq*, specify the Equipment Ordinal for the file system.

When direct I/O is specified, the system transfers data directly between the user's buffer and disk. Use direct I/O only if the file system is used for large, block-aligned, sequential I/O.

For more information about I/O, see "Advanced Topics" on page 303.

## File System Commands — Sun StorEdge QFS Shared File Systems

The following file system commands are supported on Sun StorEdge QFS shared file systems only.

### The `:meta_timeo eq interval` Command

The `metatimeo` command sets the Sun StorEdge QFS shared file system metadata cache time out value. For more information about using this feature, see "Retaining Cached Attributes: the `meta_timeo=n` Option" on page 122.

For *eq*, specify the Equipment Ordinal of the file system.

For *interval*, specify an interval in seconds. The default *interval* is 15. After this interval expires, the client host systems obtain a new copy of the metadata information from the metadata server host.

### The `:mhwrite eq` and `:nomh_write eq` Commands

These commands enable or disable multihost reads and writes. For information about this feature, see "Enabling Multiple Host Reads and Writes: the `mh_write` Option" on page 120.

For *eq*, specify the Equipment Ordinal of the file system.

## The `:minallopsz eq value` and `:maxallopsz eq value` Commands

These commands set the minimum and maximum block allocation size.

For *eq*, specify the Equipment Ordinal of the file system.

For *value*, and for more information about this feature, see “Tuning Allocation Sizes: the `minallopsz=n` and `maxallopsz=n` Options” on page 119.

## The `:rdlease eq interval`, `:wrlease eq interval`, and `:aplease eq interval` Commands

These commands tune the amount of time granted for read, write, and append leases. For information about this feature, see “Using Leases in a Sun StorEdge QFS Shared File System: the `rdlease=n`, `wrlease=n`, and `aplease=n` Options” on page 119.

For *eq*, specify the Equipment Ordinal of the file system.

For *interval*, specify an integer number of seconds. All three leases enable you to specify an *interval* such that  $15 \leq \textit{interval} \leq 600$ . The default *interval* is 30.

## File System Commands - Miscellaneous

The following commands allow you to control leases, allocation sizes, and various other file system characteristics.

### The `:invalid eq interval` Command

The `invalid` command specifies that the file system hold cached attributes for at least *interval* seconds after a file is modified. You can specify this command only if the file system was mounted originally with the `reader` mount option. For information about mount options, see the `mount_samfs(1M)` man page.

For *eq*, specify the Equipment Ordinal for the file system.

For *interval*, specify the number of seconds to hold the attributes after file modification. For example, assume that *interval*=30. In such a file system, if you issue an `ls(1)` command, you might not see a newly created file appear in its output for 30 seconds after it has been created on its writer host.

## The `:mm_stripe eq value` Command (Sun StorEdge QFS File Systems Only)

The `mm_stripe` command sets the metadata stripe width for the file system to *value* 16-kilobyte disk allocation units (DAUs).

For *eq*, specify the Equipment Ordinal of the file system.

For *value*, specify either 0 or 1. If *value*=1, which is the default, the file system writes one DAU of metadata to one LUN before switching to another LUN. If *value*=0, the metadata is round-robin across all available metadata LUNs.

## The `:qwrite eq` and `:noqwrite eq` Commands (Sun StorEdge QFS File Systems Only)

The `qwrite` and `noqwrite` commands control the ability to perform simultaneous reads and writes to the same file from different threads. Specify `qwrite` only if file system users handle multiple simultaneous transactions to the same file. For example, this is useful in database applications. The `qwrite` feature improves I/O performance by queuing multiple requests at the drive level. The `qwrite` specification is disabled for NFS reads or writes of the file system.

The default setting is `noqwrite`, so the file system disables simultaneous reads and writes to the same file. This is the mode defined by the UNIX `vnode` interface standard that gives exclusive access to only one writer and forces other writers and readers to wait.

For *eq*, specify the Equipment Ordinal of the file system.

## The `:refresh_at_eof eq` and `:norefresh_at_eof eq` Commands (Sun StorEdge QFS File Systems Only)

The `refresh_at_eof` and `norefresh_at_eof` commands can be used for fast updates to a Sun StorEdge QFS multireader file system on hosts that are mounted with the `reader` mount option in a multireader file system. This option ensures that the system refreshes the current file size when the read buffer exceeds the end of file. You can use this, for example, if the writer host system is appending to a file and the reader is issuing `tail(1)` commands with the `-f` option. The default is `norefresh_at_eof`.

For *eq*, specify the Equipment Ordinal of the file system.

## The `:setuid eq` and `:nosetuid eq` Commands

The `setuid` and `nosetuid` commands control whether `setuid` execution is allowed for this file system. These mount options control whether running programs are allowed to automatically change their owner IDs. For more information about the implications of using these mount options, see the `suid` and `nosuid` mount option descriptions on the `mount_ufs(1M)` man page and see the `setuid(2)` man page.

For *eq*, specify the Equipment Ordinal of the file system.

## The `:stripe eq value` Command

The `stripe` command sets the stripe width for the file system to *value* disk allocation units (DAUs). The stripe width specifies that *value* multiplied by the DAU bytes are written to one LUN before switching to the next LUN. You can use the `samkfs(1M) -a` command to set the DAU size on the file system when it is initialized.

For *eq*, specify the Equipment Ordinal of the file system.

For *value*, specify an integer such that  $0 < value < 255$ . If *value*=0, files are round-robin on each slice. The default *value* on file systems with an `ms` Equipment Type and on file systems with an `ma` Equipment Type with no striped group (`gXXX`) components is as follows:

- 128 kilobytes/DAU for DAUs < 128 kilobytes
- 1 for DAUs > 128 kilobytes

By default, *value*=0 on a Sun StorEdge QFS shared file system.

By default, *value*=0 on file systems with an `ma` Equipment Type with any striped group (`gXXX`) components.

The system sets *value*=0 if mismatched striped groups exist.

For more information about file system types, see “File System Design” on page 7 and see “Volume Management” on page 37.

## The `:sync_meta eq value` Command

The `sync_meta` command determines whether metadata is written to disk every time it changes. If you are using this command on Sun StorEdge QFS shared file system, also see “Specifying the Frequency With Which Metadata is Written: the `sync_meta=n` Option” on page 123.

For *eq*, specify the Equipment Ordinal of the file system.

For *value*, specify either 0 or 1, as follows:

- If *value* is 0, metadata is held in a buffer after it changes. For an unshared Sun StorEdge QFS or Sun StorEdge SAM-FS file system in which higher performance is desired, you can set *value* to 0. In this case, the system performs a delayed write in which metadata is held in a buffer before it is written to disk. This is the default for unshared file systems and for file systems that are not mounted as multireader file systems.
- If *value* is 1, metadata is written to disk every time it changes. This slows performance, but it increases data consistency. This is the default for Sun StorEdge QFS file systems mounted as multireader file systems or as shared file systems. For a Sun StorEdge QFS shared file system, *value* must be set to 1 if failover capability is required.

## The `:trace eq` and `:notrace eq` Commands

The `trace` command enables tracing for a file system. The `notrace` command disables tracing. These are global directives that affect all operations. For more information about file system tracing, see the `defaults.conf(4)` man page.

For *eq*, specify the Equipment Ordinal of a file system.

## Automated Library Commands

The following commands control media activities in an automated library.

### The `:audit [-e] eq [:slot [:side]]` Commands

The `audit` command causes the specified automated library device to mount each volume, read the VSN, and rebuild the library catalog.

If `-e` is specified, and the volume is on a tape cartridge, the tape skips to the end of data (EOD) and updates the space available. Note that the skip to EOD is not interruptible. Under certain conditions, it can take hours to complete.

For *eq*, specify the Equipment Ordinal of an automated library device.

For *slot*, specify the slot number containing the volume you want to load.

For *side*, specify the side of a magneto-optical disk. Must be 1 or 2. This argument is not applicable to tape cartridges.

This command is not supported for network-attached libraries.



## The `:export eq:slot` and `:export mt.vsn` Commands

The `export` command causes the specified automated library to export a volume to the mail slot. The volume is identified by its slot position within the automated library.

- If exporting by Equipment Ordinal and slot number, the specified automated library moves the volume to the mail slot. For *eq*, specify the Equipment Ordinal or device name. For *slot*, specify the slot number containing the volume you want to export.
- If exporting by logical identifier, the specified automated library moves the volume to the mail slot. For *mt*, specify the media type; for information about valid media types, see the `mcf(4)` man page. For *vsu*, specify the volume to export.

## The `:import eq` Command

The `import` command causes the specified automated library to allow you to add a cartridge. For *eq*, specify the Equipment Ordinal of the automated library.

## The `:load eq:slot [ :side ]` and `:load mt.vsu` Commands

The `load` command enables you to load by either a physical or a logical identifier, as follows:

- If loading by Equipment Ordinal and slot number, the specified automated library loads the volume into a drive.  
For *eq*, specify the Equipment Ordinal or device name.  
For *slot*, specify the slot number containing the volume you want to load.  
For *side*, specify the side of a magneto-optical disk. Must be 1 or 2. This argument is not applicable to tape cartridges.
- If loading by logical identifier, the specified automated library to load mounts a labeled volume into a drive.  
For *mt*, specify the media type; for information about valid media types, see the `mcf(4)` man page.  
For *vsu*, specify the volume to mount.

## The `:priority pid newpri` Command

The `priority` command sets the load priority for a process. You can specify this command from the removable media mount requests display. For more information, see “(p) - Removable Media Load Requests Display” on page 178.

For *pid*, specify the priority shown in the *p* display.

For *newpri*, specify the priority you want to give the request. This should be an integer number.

## Miscellaneous Commands

The following commands allow you to control tracing, open access to a disk device, and perform several other miscellaneous tasks.

### The `:clear vsn [ index ]` Command

The `clear` command clears the specified VSN from the removable media mount requests display. For more information, see “(p) - Removable Media Load Requests Display” on page 178.

For *vsn*, specify the volume to mount. Any process waiting for the VSN mount is aborted.

For *index*, specify the decimal ordinal of the VSN in the removable media display.

### The `:devlog eq [ option ]` Command

The `devlog` command sets one or more events to be logged.

For *eq*, specify the Equipment Ordinal of a device.

For *option*, specify one or more event types. Possible event types are as follows: `all`, `date`, `default`, `detail`, `err`, `event`, `label`, `mig`, `module`, `msg`, `none`, `retry`, `stage`, `syserr`, and `time`. For information about these options, see the `defaults.conf(4)` man page. If no *option* is specified, the system does not change the current events being logged for the *eq* specified.

### The `:dtrace` Commands

The `dtrace` commands are as follows:

- `:dtrace daemon_name on`
- `:dtrace daemon_name off`
- `:dtrace daemon_name.variable value`

The `dtrace` commands specify various tracing options. TABLE 6-41 shows the tracing control command arguments.

**TABLE 6-41** Tracing Command Arguments

Argument	Description
<i>daemon_name</i>	Specify the keyword <code>all</code> or a process name. If the keyword <code>all</code> is specified, the tracing command affects all daemons. If one of the following process names is specified, the tracing command affects that process only: <code>sam-archiverd</code> , <code>sam-catserverd</code> , <code>sam-fsd</code> , <code>sam-rftd</code> , <code>sam-recycler</code> , <code>sam-sharefsd</code> , and <code>sam-stagerd</code> . One of the keywords <code>on</code> or <code>off</code> can be specified after a process name. If <code>on</code> or <code>off</code> is specified, tracing is turned off or on for all processes specified.
<i>variable value</i>	Many different <i>variable</i> and <i>value</i> arguments can be specified. The <code>defaults.conf(4)</code> man page contains comprehensive information about these arguments. Specify one of the following <i>variable</i> and <i>value</i> combinations: <ul style="list-style-type: none"><li>• <i>file value</i>. For <i>value</i>, specify the name of a file to which trace files can be written. This can be a full path name.</li><li>• <i>options value</i>. For <i>value</i>, specify a space-separated list of trace options.</li><li>• <i>age value</i>. For <i>age</i>, specify the trace file rotation age.</li><li>• <i>size value</i>. For <i>value</i>, specify the size of the trace file at which rotation will begin.</li></ul>

## The `:fs fsname` Command

The `fs` command sets the file system to be displayed through the `N` display.

For `fsname`, specify the name of the file system to be examined.

## The `:mount mntpt` Command

The `mount` command selects a Sun StorEdge QFS or Sun StorEdge SAM-FS file system. For `mntpt`, specify the mount point of a file system.

## The `:open eq` Command

The `open` command enables access to the specified disk device. You must issue this command before you can use the `read` command, disk sector display (`S`), or file label display (`F`).

For `eq`, specify the Equipment Ordinal of a device.

## The `:read addr` Command

The `read` command reads the specified sector from the currently opened disk device. You must open the device before it can be read.

For *addr*, specify the hexadecimal sector address.

## The `:refresh i` Command

The `refresh` command determines the amount of time between `samu(1M)` screen refreshes.

For *i*, specify a time in seconds.

## The `:snap [ filename ]` Command

The `snap` command sends a snapshot of a display window to *filename*, which is the name of a file to receive the display information.

To aid in problem reporting, you can take a snapshot of all the `samu(1M)` utility's displays. Each new snapshot is appended to the snapshots file. The default file is `snapshots` in the current working directory. The file can be printed, examined using `vi(1)`, or faxed to Sun Microsystems customer support staff.

## The `:! shell_command` Command

The `!` command enables you to run a shell command without leaving the `samu(1M)` operator utility.

# File System Quotas

---

File system quotas control the amounts of online and total disk space that can be consumed by a specific user, a group of users, or an admin set in a file system. An *admin set* is a site-determined group of users.

Quotas help control the size of a file system by limiting the amount of space and the number of inodes each user can consume. Quotas can be especially useful on file systems that contain user home directories. After quotas are enabled, you can monitor usage and adjust the quotas as needs change.

This chapter contains the following sections:

- “Overview” on page 225
- “Enabling Quotas” on page 228
- “Checking Quotas” on page 240
- “Changing and Removing Quotas” on page 243

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## Overview

You can set file system quotas on a user, group, or a site-defined admin set basis. You, the system administrator, can set limits on the number of files, the number of blocks online, and the total number of blocks.

A file system provides a user with blocks for data and inodes for files. Each file uses one inode, and file data is stored in a disk allocation unit (DAU). DAU sizes are determined at the time the file system is created. Quotas account for disk usage in multiples of 512 bytes.

The following sections provide background information about using quotas:

- “Types of Quotas, Quota Files, and Quota Records” on page 226
- “Soft Limits and Hard Limits” on page 227

- “Quotas and Archive Media” on page 228
- “Disk Blocks and File Limits” on page 228

TABLE 7-1 shows the terms that are used extensively in this chapter’s quota documentation.

**TABLE 7-1** Quota Terminology

Term	Definition
<i>grace period</i>	The amount of time that can elapse during which a user is allowed to create files and/or allocate storage after users reach their soft limit.
<i>soft limit</i>	For disk quotas, a threshold limit on file system resources (blocks and inodes) that a user can temporarily exceed. Exceeding the soft limit starts a timer. When a user exceeds the soft limit for the specified time (the grace period), no further system resources can be allocated until the user reduces file system use below the soft limit.
<i>hard limit</i>	For disk quotas, a maximum limit on file system resources (blocks and inodes) that users cannot exceed.
<i>quota</i>	The amount of system resources that a user is allowed to consume.
<i>timer</i>	A facility for tracking the time elapsed after a user reaches a soft limit. When it reaches the grace period, a hard limit is imposed on the user.

## Types of Quotas, Quota Files, and Quota Records

You can set quotas according to user ID, group ID, or an administrator’s site-specific grouping. This site-specific grouping is called an *admin set ID*. You can use an admin set ID, for example, to identify a collection of users working on a project for which file system quotas are imposed.

Quotas are enabled when the system detects the presence of one or more quota files in the file system’s root directory *and* the `quota` mount option is in effect. Note that the `quota` mount option is enabled by default, so you must not have disabled quotas by specifying the `noquota` mount option. If you mount the file system with `noquota` in effect, quotas are disabled. For more information about mount options, see the `mount_samfs(1M)` man page.

Each quota file contains a sequence of records. Record zero is the record for the system administrator’s quotas. The system administrator’s resource usage is accumulated in record zero. System administrator quotas are never enforced, but you can use any record, including the system administrator’s record, as a template for subsequent records in the quota file. For more information about this practice, see “To Enable or Change Limits for Users, Groups, or Admin Sets Using an Existing Quota File” on page 238.

Record one is the record in the quota file for user one, group one, or admin set ID one, depending on the type of quota file. You can edit record one and all subsequent records in order to set different quotas for different users. TABLE 7-2 shows the quota file names and the quotas they enable in `/root`.

**TABLE 7-2** Quota File Names

Quota File Name in <code>/root</code> Directory	Quota Type
<code>.quota_u</code>	UID (system user ID)
<code>.quota_g</code>	GID (system group ID)
<code>.quota_a</code>	AID (system admin set ID)

You can set default quota limits for users by editing record zero in the quota file and allowing the values in record zero to be used as the initial quota settings for all other users. By default, if user quota limits have not been set specifically, the system uses the values in record zero.

## Soft Limits and Hard Limits

You can set both soft and hard limits. A *hard limit* specifies a fixed amount of system resources available for use, and the system never allows a user to exceed this limit. A *soft limit* specifies a level of system resource use that can be exceeded temporarily. The soft limits are never larger than the hard limits. If a new user attempts to allocate resources beyond his or her hard limit, the operation is aborted. In this case, the operation (typically a `write(2)` or `creat(2)`) fails and generates an `EDQUOT` error.

After a user exceeds a soft limit, a timer starts, and the user enters a grace period. While the timer is ticking, the user is allowed to operate above the soft limit but cannot exceed the hard limit. After the user goes below the soft limit, the timer is reset. If the grace period ends and the timer stops without the user having gone below the soft limit, the soft limit is then enforced as a hard limit.

For example, assume that a user has a soft limit of 10,000 blocks and a hard limit of 12,000 blocks. If the user's block usage exceeds 10,000 blocks and the timer exceeds the grace period, this user is no longer able to allocate more disk blocks on that file system until their usage drops below the 10,000-block soft limit.

You, the administrator, can use the `samquota(1M)` command to see the timer value. The `squota(1)` command is a user version of the `samquota(1M)` command. The `squota(1)` user command contains options that a user can specify to obtain information about quotas that pertain to them.

## Quotas and Archive Media

You can use quotas to limit the amount of data that a user is allowed to have on archive media in Sun StorEdge QFS and Sun StorEdge SAM-FS file systems.

**Example.** The `stage(1)` command brings data online from archive media. It is possible for a user quota to be exceeded when the `stage(1)` command is invoked at the system level in the following way:

```
# stage -r *
```

A user quota is observed when a user issues the `stage(1) -w` command, as follows:

```
# stage -w *
```

The system stages files until the user's quota is met. After that time, no more files are staged.

## Disk Blocks and File Limits

It is possible for a user to exceed an inode quota, without using any blocks, by creating all empty files. It is also possible for a user to use only one inode and still exceed the block quota by creating a file that is large enough to consume all data blocks in the user's quota.

File system quotas are expressed in terms of the number of 512-byte blocks that a user can allocate. However, disk space is allocated to user files in terms of DAUs. The DAU setting is specified by the `-a allocation_unit` option to the `sammkfs(1M)` command. It is preferable to set a block quota to a multiple of the file system DAU. If this is not done, users can allocate only up to the block count, rounded down to the nearest DAU.

---

## Enabling Quotas

You can enable quotas through a process that includes editing system files, creating quota files, and entering various quota commands.



TABLE 7-3 shows the commands used when manipulating quotas.

**TABLE 7-3** Quota Commands

Command	Description
<code>squota(1)</code>	Displays quota statistics for a user. This is a subset of the <code>samquota(1M)</code> command.
<code>samchaid(1M)</code>	Changes file admin set ID attributes.
<code>samquota(1M)</code>	Displays quota statistics for a user, group, or admin set. This command also enables an administrator to edit quota records.
<code>samquotastat(1M)</code>	Reports which, if any, quotas are active on a file system.

When it is run, the `samfsck(1M)` command checks the file system to make sure that usage values recorded in the quota files match the actual file system usage totals. If they do not match, the `samfsck(1M)` command issues notices, and it updates all existing, incorrect quota records if a file system repair is performed.

The following sections provide more details on how to configure a file system to use quotas and how to enable quotas.

## Guidelines for Setting Up Quotas

Before you enable quotas, you should determine how much disk space and how many inodes to allocate to each user. If you want to be sure that the total file system space is never exceeded, you can divide the total size of the file system between the number of users. For example, if three users share a 100-megabyte slice and have equal disk space needs, you could allocate 33 megabytes to each. In environments in which not all users are likely to push their limits, you might want to set individual quotas so that they add up to more than the total size of the file system. For example, if three users share a 100-megabyte slice, you could allocate 40 megabytes to each.

You can use the following quota commands, in the formats shown, for displaying quota information:

- The `squota(1)` command is for end users. It enables them to retrieve quota information for themselves on a user, group, or admin set basis.

- The `samquota(1M)` command is for system administrators. It enables you to retrieve quota information or to set quotas. The `-U`, `-G`, and `-A` options on the `samquota(1M)` command determine whether the command is being used for a user, a group, or an admin set. CODE EXAMPLE 7-1 shows this.

**CODE EXAMPLE 7-1** Using `samquota(1M)` to Retrieve Information

```
# samquota -U janet /mount_point    #Prints a user quota
# samquota -G pubs /mount_point    #Prints a group quota
# samquota -A 99 /mount_point      #Prints an admin set quota
```

## ▼ To Configure a New File System to Use Quotas

The following procedure shows how to configure a new file system to use quotas. This procedure applies if you are creating a new file system at this time and no files currently reside in the file system.

To configure an existing file system to use quotas, see “To Configure an Existing File System to Use Quotas” on page 232.

### 1. Become superuser.

### 2. Create the file system.

To create the file system, either follow the steps outlined in the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide* or use the examples in “Configuration Examples” on page 47 to guide you through creating the `mcf` file, creating the mount point, initializing the file system, and so on.

### 3. Use the `mount(1M)` command to mount the file system.

Mount the file system using the `mount(1M)` command, as follows:

```
# mount /qfs1
```

### 4. Use the `dd(1M)` command to create the quota file(s).

The arguments to this command differ depending on the type of quota you are creating, as follows:

- To create admin set quotas, use the following command:

```
# dd if=/dev/zero of=/qfs1/.quota_a bs=4096 count=1
```

- To create group quotas, use the following command:

```
# dd if=/dev/zero of=/qfs1/.quota_g bs=4096 count=1
```

- To create user quotas, use the following command:

```
# dd if=/dev/zero of=/qfs1/.quota_u bs=4096 count=1
```

For more information about the `dd(1M)` command, see the `dd(1M)` man page.

#### 5. Use the `umount(1M)` command to unmount the file system.

Unmount the file system in which the quota files have been created using the `umount(1M)` command. For example:

```
# umount /qfs1
```

The file system needs to be unmounted so it can be remounted and have its quota files read at mount time. For more information about the `umount(1M)` command, see the `umount(1M)` man page.

#### 6. Use the `samfsck(1M)` command to perform a file system check.

Run the `samfsck(1M)` command on the file system. For example, the following command performs a file system check. The `-F` option resets the in-use values in the quota files.

```
# samfsck -F qfs1
```

#### 7. Use the `mount(1M)` command to remount the file system.

Quotas are enabled when the system detects the presence of one or more quota files in the root directory of a file system.



---

**Caution** – You do not need to include the quota mount option in the `/etc/vfstab` or `samfs.cmd` file. The quota mount option is enabled by default on the `mount(1M)` command, and quotas are enabled automatically when the system detects the presence of quota files. Make sure that you do not have the `noquota` mount option specified in your `samfs.cmd` or `/etc/vfstab` files.

If quota files are present and if the file system is mounted without quotas enabled, when blocks or files are allocated or freed, the quota records become inconsistent

with actual usages. If a file system with quotas is mounted and run without the `quota mount` option, run `samfsck(1M)` with its `-F` option to update the quota file usage counts before again remounting the file system with quotas enabled.

---

For more information about the `mount(1M)` command, see the `mount_samfs(1M)` man page.

**8. Use the `samquota(1M)` command to set quotas for users, groups, or admin sets.**

Subsequent sections in this chapter provide procedures and show examples of this process. For more information about the `samquota(1M)` command, see the `samquota(1M)` man page.

## ▼ To Configure an Existing File System to Use Quotas

This procedure applies if you are creating quotas for a file system that is already populated with files.

If you are configuring a new file system to use quotas, see “To Configure a New File System to Use Quotas” on page 230.

**1. Use the `su(1)` command to become superuser.**

**2. Use the `mount(1M)` command to ensure that the file system is mounted.**

Examine the `/etc/mnttab` file using the `mount(1M)` command with no arguments, as follows:

```
# mount
```

**3. Use the `cd(1)` command to change to the root directory.**

Change to the root directory of the file system for which quotas are to be enabled. For example:

```
# cd /oldfs1
```

**4. Verify that quotas do not already exist on the file system.**

From the root directory, use the `ls(1) -a` command to retrieve the list of files in this directory. If at least one quota type (`u`, `g`, or `a`) is established for a file system, you

can establish any other quota type later. Be careful not to modify existing quota files when adding new ones later.

If any of the following files are present, quotas are, or previously have been, enabled for this file system: `.quota_u`, `.quota_g`, `.quota_a`.

#### 5. Use the `dd(1M)` command to create the quota file(s).

If the quota files do not exist, create the quota files for the type(s) of quota(s) you wish to enforce. Determine the highest existing ID numbers of the types of quotas you wish to enforce. Make the initial, zero quota files large enough to hold the record for those IDs; each quota file record requires 128 bytes.

**Example 1.** If you want to enable admin set quotas, and the highest admin set ID in use on the file system is 1024, the calculation is as follows:

- $(1024+1)*128 = 131200$

- $131200/4096 = 32.031...$

Use the following command:

```
# dd if=/dev/zero of=/oldfs1/.quota_a bs=4096 count=33
```

**Example 2.** If you want to enable group quotas, and group IDs up to 2000 are in use, the calculation is as follows:

- $(2000+1)*128 = 256128$

- $256128/4096 = 62.531...$

Use the following command:

```
# dd if=/dev/zero of=/oldfs1/.quota_g bs=4096 count=63
```

**Example 3.** If you want to enable user ID quotas, and user IDs up to 4799 are in use, the calculation is as follows:

- $(4799+1)*128 = 1228800$

- $1228800/4096 = 300.0$

Use the following command:

```
# dd if=/dev/zero of=/oldfs1/.quota_u bs=4096 count=300
```

For more information about the `dd(1M)` command, see the `dd(1M)` man page.

6. Use the `umount(1M)` command to unmount the file system in which the quota files have been created.

For example:

```
# umount /oldfs1
```

The file system needs to be unmounted so it can be remounted and have its quota files read at mount time. For more information about unmounting a file system, see “Unmounting a File System” on page 69.

7. Use the `samfsck(1M)` command to perform a file system check.

Use the `samfsck(1M) -F` command to perform a file system check. The `samfsck(1M)` command updates the quota files with correct, current usage information.

For example:

```
# samfsck -F /oldfs1
```

---

**Note** – The command in this step updates only the records already allocated in the quota files.

---

8. Use the `mount(1M)` command to remount the file system in which the quota files have been created.

The system enables quotas when it detects the presence of one or more quota files in the `/root` directory.



---

**Caution** – You do not need to include the `quota mount` option in the `/etc/vfstab` or `samfs.cmd` file. The `quota mount` option is enabled by default on the `mount(1M)` command, and quotas are enabled automatically when the system detects the presence of quota files. Make sure that you do not have the `noquota` mount option specified in your `samfs.cmd` or `/etc/vfstab` files.

If quota files are present and if the file system is mounted without quotas enabled, when blocks or files are allocated or freed, the quota records become inconsistent with actual usages. If a file system with quotas is mounted and run without the `quota mount` option, run the `samfsck(1M) -F` command to update the quota file usage counts before again remounting the file system with quotas enabled.

---

For more information about the `mount(1M)` command, see the `mount_samfs(1M)` man page.

9. Use the `samquota(1M)` command to set quotas for users, groups, or admin sets.  
Subsequent sections in this chapter provide procedures and show examples of this process. For more information about the `samquota(1M)` command, see the `samquota(1M)` man page.

## ▼ To Assign Admin Set IDs to Directories and Files

1. Use the `su(1)` command to become superuser.
2. Set the admin IDs.

Use the `samchaid(1M)` command to change the admin set IDs for the directory or file, as follows:

- To set IDs for a file or directory, specify the directory name or path. For example:

```
# samchaid 100 admin.dir
```

- To set IDs for a directory tree, use the `-R` and (if necessary) the `-h` options. The `-R` option specifies a recursive operation, and the `-h` option changes links, not targets. For example:

```
# samchaid -R -h 22 /qfs1/joe /qfs1/nancee
```

For more information about the `samchaid(1M)` command, see the `samchaid(1M)` man page.

## Setting Infinite Quotas

An *infinite quota* is a kind of special quota. Users with infinite quotas are never denied access to any available file system resource. You can set infinite quotas on a user, group, or admin set basis by setting both the hard block and hard file limits to zero. The file system treats an infinite quota as a special quota. You can set infinite quota values into record zero of the user, group, or admin set ID quota files, and from there they can become the default values for new users, groups, or admin set IDs.

## ▼ To Set an Infinite Quota

- Use the `samquota(1M)` command to set an infinite quota.

For example, the following command sets an infinite quota:

```
# samquota -U fred -b 0:h -f 0:h /qfs1
```

You can use the `samquota(1M)` command to set infinite quotas for particular users, groups, or admin set IDs by setting zero values for all hard and soft limits.

CODE EXAMPLE 7-2 shows how to set infinite quotas.

### CODE EXAMPLE 7-2 Setting Infinite Quotas

```
# samquota -G sam -b 0:s,h -f 0:s,h /sam6
# samquota -G sam /sam6
```

				Online Limits					Total Limits	
				Soft	Hard				Soft	Hard
/sam6	Type	ID	In Use			In Use				
Files	group	101	339	0	0	339			0	0
Blocks	group	101	248	0	0	2614			0	0
Grace period				0s					0s	
---> Infinite quotas in effect.										

## Enabling Default Quota Values

You can use the `samquota(1M)` command to enable a default quota for a user, group, or admin set. This is accomplished by setting default limits into user, group, or admin set zero (0).



## ▼ To Enable Default Quota Values for Users, Groups, or Admin Sets

- Use the `samquota(1M)` command to set an infinite quota.

For example, the following `samquota(1M)` command sets default quotas for all admin set IDs:

```
# samquota -A 0 -b 12000:s -b 15000:h -b 12G:s:t -b 15G:h:t \  
-f 1000:s -f 1200:h -t 1w /qfs1
```

On first reference, the preceding command sets any user's uninitialized admin set quota limits as follows:

- The soft online block limit is set to 12,000 blocks.
- The hard online block limit is set to 15,000 blocks.
- The total soft block limit is set to 12 gigablocks.
- The total hard block limit is set to 15 gigablocks.
- The soft file limit is set to 1000 files.
- The hard file limit is set to 1200 files.
- The grace period is set to one week.

Note that if a quota record already exists, the existing values remain in effect. This occurs, for example, if the admin group already has blocks assigned to it.

You can set similar default quotas for users or groups by specifying `-U 0` or `-G 0`, respectively, in place of `-A 0`.

For more information about the `samquota(1M)` command, see the `samquota(1M)` man page.

## Enabling Limits

You can use the `samquota(1M)` command to enable a set of limits for a particular user, group, or admin set.

## ▼ To Enable Limits for Users, Groups, or Admin Sets

- Use the `samquota(1M)` command to set limits for users, groups, or admin sets.

CODE EXAMPLE 7-3 shows commands that enable various limits.

CODE EXAMPLE 7-3 Quota Commands

```
# samquota -U joe -b 15000:s -b 20000:h -b 12G:s:t -b 15G:h:t \  
-f 500:s -f 750:h -t 3d /qfs1  
# samquota -G proj -b 15000:s -b 20000:h -b 12G:s:t -b 15G:h:t \  
-f 500:s -f 750:h -t 3d /qfs1  
# samquota -A 7 -b 15000:s -b 20000:h -b 12G:s:t -b 15G:h:t \  
-f 500:s -f 750:h -t 3d /qfs1
```

For more information about the `samquota(1M)` command, see the `samquota(1M)` man page.

## ▼ To Enable or Change Limits for Users, Groups, or Admin Sets Using an Existing Quota File

After quotas are established, you can use an existing quota file as a template when creating limits for another user, group, or admin set. The following procedure shows this. You can also use this procedure to change any of the quota settings.

1. Use the `samquota(1M)` command to retrieve a quota file.

Use the `-e` option with one or more of the following additional options: `-U userID`, `-G groupID`, or `-A adminsetID`. Direct the output to a temporary file.

```
# samquota -G sam -f 200:s:o -f 300:h:o -f 200:s:t -f 300:h:t \  
-b 40000:s:o -b 60000:h:o -b 40M:s:t -b 60M:h:t -t 0s:o -t 0s:t /sam6
```

You can use any temporary file. In Step 2, you use an editor to change one or more fields, so you can use a group quota entry as a template to create a user quota entry. CODE EXAMPLE 7-4 shows how to create and retrieve file `quota.group` to use as a template.

CODE EXAMPLE 7-4 File `quota.group`

```
# samquota -G sam -e /sam6 > /tmp/quota.group  
# cat /tmp/quota.group  
  
# Type ID  
# Online Limits Total Limits  
# soft hard soft hard  
# Files  
# Blocks
```

**CODE EXAMPLE 7-4** File quota.group (Continued)

```
# Grace Periods
#
samquota -G 101 \
    -f      200:s:o -f      300:h:o          -f      200:s:t -f      300:h:t \
    -b      40000:s:o -b      60000:h:o        -b 40000000:s:t -b 60000000:h:t \
    -t      0s:o                               -t 0s:t      /sam6
```

**2. Use an editor to edit the file from Step 1.**

For example, CODE EXAMPLE 7-5 shows the file that was generated in Step 1 opened in the vi(1) editor. This file also shows that group ID 101 is changed to 102. This has the effect of generating a command to copy the quotas set for group 101 to group 102.

**CODE EXAMPLE 7-5** File quota.group After Editing

```
# Type ID
#
#           Online Limits
#           soft          hard
# Files
# Blocks
# Grace Periods
#
samquota -G 102 \
    -f      200:s:o -f      300:h:o          -f      200:s:t -f      300:h:t \
    -b      40000:s:o -b      60000:h:o        -b 40000000:s:t -b 60000000:h:t \
    -t      1d:o                               -t 1d:t      /sam6
```

**3. Save the file and exit the editor.****4. Execute the file using the shell.**

This step applies the changes made in the editor. For example:

```
# sh -x /tmp/quota.group
```

In this example, the -x option directs the shell to echo the commands it executes. You can omit the -x option if desired.

In similar fashion, you can use this procedure to generate quota commands that copy quota limits between users, groups, admin IDs, file systems, and other entities.

# Checking Quotas

After you have enabled disk and inode quotas, you can check these quotas. The `samquota(1M)` command is an administrator command that generates a quota report on an individual user, group, or admin set. The `squota(1)` command is a user command that enables users to check their own individual quotas. TABLE 7-4 shows commands you can use to check quotas.

**TABLE 7-4** Commands for Checking Quotas

Command	Task
<code>squota(1)</code>	This is a user command. It displays user quotas and other information specific to a single user. For more information, see the <code>squota(1)</code> man page.
<code>samquota(1M)</code>	This is an administrator command. It displays user, group, and admin set quotas, and it displays current disk use. This command also displays information about users who are exceeding their quotas. For more information, see the <code>samquota(1M)</code> man page.

## ▼ To Check for Exceeded Quotas

The following procedure shows how to check quotas for excess usage.

1. **Become superuser.**
2. **Use the `samquota(1M)` command to display the quotas in effect.**

Use the `samquota(1M)` command in one of the following ways to display quotas for mounted file systems in which quotas are enabled:

- To display user quotas, specify the following command:

```
# samquota -U userID [ file ]
```

For *userID*, specify the numeric user ID or user name of the user whose quotas are being examined.

For *file*, specify a specific file system for the selected user, group, or admin set. The *file* argument can also be the name of any file in the file system. Typically, *file* is the name of the root directory of the file system.

**Example 1.** CODE EXAMPLE 7-6 retrieves user hm1259’s quota statistics in the sam6 file system on the server and displays output indicating that this user is not exceeding his quota.

**CODE EXAMPLE 7-6**    Checking for Exceeded Quotas for User hm1259

# samquota -U hm1259 /sam6								
			Online Limits			Total Limits		
	Type	ID	In Use	Soft	Hard	In Use	Soft	Hard
/sam6								
Files	user	130959	13	100	200	13	100	200
Blocks	user	130959	152	200	3000	272	1000	3000
Grace period			0s			0s		

**Example 2.** CODE EXAMPLE 7-7 retrieves user memil’s quota statistics in all mounted Sun StorEdge QFS and Sun StorEdge SAM-FS file systems and displays output indicating that this user is exceeding the quota. Note the plus sign (+) in the Blocks row of the output. The plus sign would appear in the Files row, too, if the soft quota limit were being exceeded for files.

**CODE EXAMPLE 7-7**    Checking for Exceeded Quotas for User memil

# samquota -U memil								
			Online Limits			Total Limits		
	Type	ID	In Use	Soft	Hard	In Use	Soft	Hard
/sam6								
Files	user	130967	4	500	750	4	500	750
Blocks	user	130967	41016+	40000	50000	41016	50000	50000
Grace period				1w		0s		
---> Warning: online soft limits to be enforced in 6d23h36m45s								
/sam7								
Files	user	130967	4	500	750	4	500	750
Blocks	user	130967	4106	40000	50000	4106	50000	50000
Grace period				1w		0s		

If a hard limit has been exceeded, or if the soft limit has been exceeded and the grace period has expired, the offending In Use field is marked with an asterisk character (\*). If a quota record’s limits are determined to be inconsistent, (for example if a soft

limit is larger than a hard limit), an exclamation point is used to mark the field, and all allocation operations are prevented.

TABLE 7-5 shows the fields in the `samquota(1M)` output.

**TABLE 7-5** `samquota(1M)` Output Fields

Field Name	Content
In Use	Current block usage.
Soft	Soft block limit
Hard	Hard block limit
Grace Period	Amount of time the user is allowed to exceed the soft limit

- To display group quotas, specify the following command:

```
# samquota -G groupID [ file ]
```

For *groupID*, specify the numeric group ID or the group name for the group of users whose quotas are being examined. For example, the following command retrieves user quota statistics for the group `turtles` in the `qfs3` file system:

```
# samquota -G turtles /qfs3
```

- To display admin set quotas, specify the following command:

```
# samquota -A adminsetID [ file ]
```

For *adminsetID*, specify the numeric admin set ID of the site-specific administrator set whose quotas are being examined. For example, the following command retrieves user quota statistics for the admin set 457 in all mounted Sun StorEdge QFS and Sun StorEdge SAM-FS file systems:

```
# samquota -A 457
```

---

# Changing and Removing Quotas

You can change quotas to adjust the amount of disk space or number of inodes allocated to users. You can also remove quotas from users or from an entire file system. The following sections describe how to change and remove quotas. The topics are as follows:

- “To Change the Grace Period” on page 243
- “Changing the Grace Period Expiration” on page 246
- “To Inhibit Additional File System Resource Allocations” on page 248
- “To Remove a File System’s Quotas” on page 251
- “To Correct Quotas” on page 252

## ▼ To Change the Grace Period

You can use the `samquota(1M)` command to change the soft time limit grace period.

### 1. Use the `samquota(1M)` command to retrieve quota statistics.

You can use the `samquota(1M)` command on a user, group, or admin set basis. CODE EXAMPLE 7-8 shows how to retrieve quota statistics.

**CODE EXAMPLE 7-8** Using `samquota(1M)` to Retrieve Quota Statistics

```
# samquota -U userID [ file ]  
# samquota -G groupID [ file ]  
# samquota -A adminsetID [ file ]
```

TABLE 7-6 shows the arguments to these commands.

**TABLE 7-6** `samquota(1M)` Command Arguments

Argument	Description
<i>userID</i>	Specify the numeric user ID or user name of the user whose quotas are being changed.

**TABLE 7-6** `samquota(1M)` Command Arguments *(Continued)*

Argument	Description
<i>groupID</i>	Specify the numeric group ID or the group name for the group of users whose quotas are being changed.
<i>adminsetID</i>	Specify the numeric admin set ID of the site-specific administrator set whose quotas are being changed.
<i>file</i>	Specify a specific file system for the selected user, group, or admin set. The <i>file</i> argument can also be the name of any file in the file system. Typically, <i>file</i> is the name of the root directory of the file system.

**2. Examine the output from the `samquota(1M)` command.**

Examine the output and determine what the new limits should be.



3. Use the `samquota(1M)` command to change the soft time limit grace period.

CODE EXAMPLE 7-9 shows using the `samquota(1M)` command options to use to change the soft time limit grace period.

CODE EXAMPLE 7-9 Using `samquota(1M)` to Change Soft Time Limit Grace Periods

```
# samquota -U userID -t interval file
# samquota -G groupID -t interval file
# samquota -A adminID -t interval file
```

TABLE 7-7 shows the arguments to these commands.

TABLE 7-7 `samquota(1M)` Command Arguments

Argument	Description
<i>userID</i>	Specify the numeric user ID or user name of the user whose quotas are being changed.
<i>groupID</i>	Specify the numeric group ID or the group name for the group of users whose quotas are being changed.
<i>adminsetID</i>	Specify the numeric admin set ID of the site-specific administrator set whose quotas are being changed.
<i>interval</i>	Specifies the interval to use for the grace period. Specify an integer number for <i>interval</i> to indicate the quantity, and then specify a unit multiplier, if desired. By default, the unit multiplier is <i>s</i> to indicate that the <i>interval</i> is being specified in seconds. You can also specify <i>w</i> (for weeks), <i>d</i> (for days), <i>h</i> (for hours), or <i>m</i> (for minutes).
<i>file</i>	Specify a specific file system for the selected user, group, or admin set. The <i>file</i> argument can also be the name of any file in the file system. Typically, <i>file</i> is the name of the root directory of the file system.

**Example.** Assume that you want to change the grace period for user `memil`. CODE EXAMPLE 7-10 shows the `samquota(1M)` command used to verify the quotas and its output.

CODE EXAMPLE 7-10 Changing the Grace Period

```
# samquota -U memil /sam6

              Online Limits
              Soft      Hard
Type  ID      In Use   Soft      Hard      In Use   Soft      Hard
/sam6
Files  user 130967      4        500      750        4        500      750
Blocks user 130967    41016+  40000    50000    41016    50000    50000
Grace period              3d                  0s
--> Warning:  online soft limits to be enforced in 2d23h59m7s
```

You enter the following command to shorten the grace period.

```
# samquota -U mem1 -t 1d /sam6
```

CODE EXAMPLE 7-11 shows the `samquota(1M)` command to use to verify the new quotas.

**CODE EXAMPLE 7-11** Verifying the New Quotas

# samquota -U memil /sam6								
			Online Limits			Total Limits		
	Type	ID	In Use	Soft	Hard	In Use	Soft	Hard
/sam6								
Files	user	130967	4	500	750	4	500	750
Blocks	user	130967	41016+	40000	50000	41016	50000	50000
Grace period			1d			0s		
---> Warning: online soft limits to be enforced in 23h58m31s								

## Changing the Grace Period Expiration

If a user has exceeded their soft quota limit, changing the grace period itself does not modify the expiration timer of any grace periods that have already started. If the grace period is already in effect, you can use the `samquota(1M)` command to modify the grace period in one of the following ways:

- **Clear the grace period.** The next time the user allocates a file or block (and is still over a soft limit), the grace period timer is reset to the grace period and starts counting down.
- **Reset the grace period.** When an expiration period is reset, the timer is reset to the present grace period, which starts counting down immediately.
- **Set the grace period to a value.** The timer is set to a value, and it starts counting down immediately from that value. There are no restrictions on this value. The value can be larger than the grace period.
- **Expire the grace period.** The timer is set to expire immediately.

**Example.** CODE EXAMPLE 7-12 retrieves information about group `sam` and shows that this group is over its soft limit.

**CODE EXAMPLE 7-12** Exceeding a Soft Limit

```
# samquota -G sam /sam6
```

				Online Limits				Total Limits	
	Type	ID	In Use	Soft	Hard	In Use	Soft	Hard	
/sam6									

**CODE EXAMPLE 7-12** Exceeding a Soft Limit *(Continued)*

Files	group	101	32	2000	2000	32	2000	2000
Blocks	group	101	41888*	40000	60000000	43208	60000000	60000000
Grace period				1w		1w		
---> Online soft limits under enforcement (since 30s ago)								

CODE EXAMPLE 7-13 clears the timer so it starts counting the next time a user in group sam attempts to allocate a block or file in /sam6.

**CODE EXAMPLE 7-13** Clearing the Timer

```
# samquota -G sam -x clear /sam6
Setting Grace Timer:  continue? y
# samquota -G sam /sam6
```

			Online Limits		Total Limits			
	Type	ID	In Use	Soft	Hard	In Use	Soft	Hard
/sam6								
Files	group	101	32	2000	2000	32	2000	2000
Blocks	group	101	41888+	40000	60000000	43208	60000000	60000000
Grace period			1w		1w			
---> Warning:  online soft limits to be enforced in 6d23h59m56s								

CODE EXAMPLE 7-14 resets the grace period.

**CODE EXAMPLE 7-14** Resetting the Grace Period

```
# samquota -G sam -x reset /sam6
Setting Grace Timer:  continue? y
# samquota -G sam /sam6
```

			Online Limits		Total Limits			
	Type	ID	In Use	Soft	Hard	In Use	Soft	Hard
/sam6								
Files	group	101	32	2000	2000	32	2000	2000
Blocks	group	101	41888	40000	60000000	43208	60000000	60000000
Grace period			1w		1w			
---> Warning:  online soft limits to be enforced in 6d23h59m52s								

CODE EXAMPLE 7-15 expires the grace period.

**CODE EXAMPLE 7-15** Expiring the Grace Period

```
# samquota -G sam -x expire /sam6
Setting Grace Timer:  continue? y
# samquota -G sam /sam6
```

			Online Limits		Total Limits			
	Type	ID	In Use	Soft	Hard	In Use	Soft	Hard
/sam6								

**CODE EXAMPLE 7-15**    Expiring the Grace Period *(Continued)*

Files	group	101	32	2000	2000	32	2000	2000
Blocks	group	101	41888	40000	60000000	43208	60000000	60000000
Grace period				1w		1w		
---> Online soft limits under enforcement (since 6s ago)								

CODE EXAMPLE 7-16 sets a very long expiration period.

**CODE EXAMPLE 7-16**    Setting a Very Long Grace Period

# samquota -G sam -x 52w /sam6								
Setting Grace Timer: continue? y								
# samquota -G sam /sam6								
			Online Limits			Total Limits		
	Type	ID	In Use	Soft	Hard	In Use	Soft	Hard
/sam6								
Files	group	101	32	2000	2000	32	2000	2000
Blocks	group	101	41888+	40000	60000000	43208	60000000	60000000
Grace period			1w		1w			
---> Warning: online soft limits to be enforced in 51w6d23h59m54s								

▼ **To Inhibit Additional File System Resource Allocations**

When the file system detects that quota values are not consistent for a user, group, or admin set, it prevents that user, group, or admin set from using any more system resources. You can inhibit file system resource allocations by creating inconsistent quota values. The `samquota(1M)` command detects these inconsistent values, and reports them in its output. For example, the software inhibits further allocation if the hard block or file limits are lower than the soft block or file limits, or if a user’s soft limit is larger than the user’s hard limit.

The file system treats an inconsistent quota setting as a special quota. You can set inconsistent quota values into record zero of the user, group, or admin set ID quota files, and from there they can become the default values for new users, groups, or admin set IDs.

The following procedure shows how to inhibit further system resource allocations for a user, group, or admin set.

**1. Become superuser.**

**2. Obtain, save, and examine current quota information.**

CODE EXAMPLE 7-17 shows how to use the `samquota(1M)` command to retrieve current group quota information for group `sam` and write it to a backup file.

**CODE EXAMPLE 7-17** Retrieving Group Quota Information

```
# samquota -G sam -e /sam6 | & tee restore.quota.sam

# Type ID
#
#           Online Limits
#           soft          hard
# Files
# Blocks
# Grace Periods
#
samquota -G 101 \
  -f 2000:s:o -f 2000:h:o          -f 2000:s:t -f 2000:h:t \
  -b 40000:s:o -b 60000000:h:o     -b 60000000:s:t -b 60000000:h:t \
  -t 1w:o                          -t 1w:t \
  -x 51w6d23h59m:o                -x clear /sam6
```

To obtain quota information about a user quota, specify the `-U userID` option in place of the `-G` option. To obtain quota information about an admin set quota, specify the `-A adminID` option in place of the `-G` option.

**3. Use the `samquota(1M)` command to set soft quotas to nonzero quotas and hard quotas to zero quotas.**

Use the `samquota(1M)` command to reset the quotas to invalid values. The following command sets the quotas for group `sam` to be inconsistent:

```
# samquota -G sam -f 1:s -f 0:h -b 1:s -b 0:h /sam6
```

To make the quotas for users or admin sets inconsistent, specify the `-U userID` or `-A adminID` options in place of the `-G` option.

#### 4. Use the `samquota(1M)` command to verify your changes.

Use the `samquota(1M)` command to verify that the quota has been correctly changed. The following example obtains quota information for a group quota of the group `sam`:

```
# samquota -G sam /qfs1
```

Enter the `samquota(1M)` command again to verify the changed quotas. CODE EXAMPLE 7-18 shows this.

#### CODE EXAMPLE 7-18 Verifying Changed Quotas

```
# samquota -G sam /sam6
```

	Type	ID	In Use	Online Soft	Limits Hard	In Use	Total Soft	Limits Hard
/sam6								
Files	group	101	32!	1	0	32!	1	0
Blocks	group	101	41888!	1	0	43208!	1	0
Grace period				1w			1w	

---> Quota values inconsistent; zero quotas in effect.

In the preceding output, a zero quota is in effect. Note the exclamation point characters (!) to indicate the over-quota condition in the output.

#### 5. Use the `sh(1)` and `samquota(1M)` commands to restore the group's quota.

CODE EXAMPLE 7-19 shows the commands to restore and verify the changed quotas.

#### CODE EXAMPLE 7-19 Restoring the Group Quota

```
# sh restore.quota.sam
Setting Grace Timer: continue? y
Setting Grace Timer: continue? y
# samquota -G sam /sam6
```

	Type	ID	In Use	Online Soft	Limits Hard	In Use	Total Soft	Limits Hard
/sam6								
Files	group	101	32	2000	2000	32	2000	2000
Blocks	group	101	41888+	40000	60000000	43208	60000000	60000000
Grace period				1w			1w	

---> Warning: online soft limits to be enforced in 6d23h59m54s

To perform this operation on a user quota, specify the `-U userID` option in place of the `-G` option. To perform this operation on an admin set quota, specify the `-A adminID` option in place of the `-G` option.

## ▼ To Remove a File System's Quotas

To remove or disable quotas for a file system, you need to remove quota specifications from the mount process. The following procedure shows how to disable quotas for a file system.

1. Use the `su(1)` command to become superuser.
2. Add the `noquota` mount option to the `/etc/vfstab` or `samfs.cmd` file.  
(Optional)

Perform this step only if you have the `quota` mount option in the `/etc/vfstab` or `samfs.cmd` file.

Use a viewer, such as `vi(1)` or `cat(1)` to examine the `/etc/vfstab` or `samfs.cmd` file for the presence of the `quota` mount option.

If this mount option is present, edit the file and remove the `quota` mount option.

---

**Note** – Beginning with the Sun StorEdge QFS and Sun StorEdge SAM-FS 4.1 releases, you do not need to use the `/etc/vfstab` and `samfs.cmd` files for enabling or disabling quotas.

---

3. Use the `umount(1M)` command to unmount the file system.

If the file system is mounted, use the `umount(1M)` command to unmount the file system.

For example:

```
# umount /myfs
```

If you have difficulty unmounting the file system, see “Unmounting a File System” on page 69.

4. Remount the file system using the `mount(1M)` command.

If you did not perform Step 2, include the `noquota` option on the `mount(1M)` command.

For example:

```
# mount -o noquota /myfs
```

5. Dispense with the quota files.

If you expect to reinstate the quota feature at a later date, do not destroy the quota files. To preserve the quota files and reinstate quotas at a later date, unmount the file system, run the `samfsck(1M)` command with its `-F` option on the file system, and

remount the file system again with the `quota mount` option. The `quota mount` option can be specified in either the `/etc/vfstab` file or in the `samfs.cmd` file as a mount option, or it can be specified on the `mount(1M)` command with the `-o quota` option.

If you do not expect to reinstate the quota feature at a later date, or if you want to reclaim the space consumed by the quota files, use the `rm(1)` command to remove the `.quota_u`, `.quota_g`, and `.quota_a` files. For example:

```
# rm /myfs/.quota_[agu]
```

## ▼ To Correct Quotas

### 1. Become superuser.

### 2. Use the `umount(1M)` command to unmount the file system.

If the file system is mounted, use the `umount(1M)` command to unmount the file system.

For example:

```
# umount /myfs
```

If you have difficulty unmounting the file system, see “Unmounting a File System” on page 69.

### 3. Use the `samfsck(1M) -F` command to perform a file system check.

The `samfsck(1M)` command updates the quota files with correct, current usage information. Note, however, that it updates only records already allocated in the quota files. For example:

```
# samfsck -F myfs
```

### 4. Use the `mount(1M)` command to remount the file system.

For example:

```
# mount /myfs
```



## Sun StorEdge QFS in a Sun Cluster Environment

---

This chapter describes how the Sun StorEdge QFS software works in a Sun Cluster environment. It also provides configuration examples for a Sun StorEdge QFS shared file system in a Sun Cluster environment and for an unshared Sun StorEdge QFS file system in a Sun Cluster environment.

This chapter contains the following sections:

- “Before You Begin” on page 254
- “Restrictions” on page 255
- “How the Sun Cluster and the Sun StorEdge QFS Software Interact” on page 256
- “About Configuration Examples” on page 257
- “Configuring a Sun StorEdge QFS Shared File System on a Sun Cluster” on page 258
- “Configuring an Unshared File System on a Sun Cluster” on page 267
- “Changing the Sun StorEdge QFS Configuration” on page 296

---

# Before You Begin

With version 4.2 of the Sun StorEdge QFS software, you can install a Sun StorEdge QFS file system in a Sun Cluster environment and can configure the file system for high availability. The configuration method you use varies, depending on whether your file system is shared or unshared.

This chapter assumes that you are an experienced user of both the Sun StorEdge QFS software and the Sun Cluster environment. It also assumes you have performed either or both of the following:

- You have configured file systems as highly available scalable or failover resources under Sun Cluster control.
- You have installed and configured both Sun StorEdge QFS and Sun StorEdge QFS shared file systems.

It is recommended that you read the following documentation before continuing with this chapter:

- The following chapters of the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*:
  - Chapter 1, which provides hardware and software prerequisite information for the Sun StorEdge QFS software in a Sun Cluster environment.
  - Chapter 3, which describes how to install a Sun StorEdge QFS file system on a Sun Cluster system for high availability.
- The following Sun Cluster documentation:
  - *Sun Cluster Concepts Guide for Solaris OS*, which introduces the Sun Cluster environment. In particular, please review the following sections in the guide:
    - Local Disks
    - Global Devices
    - Device ID (DID)
    - Disk Device Groups
    - Disk Device Group Failover
    - Local and Global Namespaces
    - Cluster File Systems
    - HASToragePlus Resource Type
    - Volume Managers
  - The *Sun Cluster Software Installation Guide for Solaris OS*, which describes the steps for installing the Sun Cluster software.

- The *Sun Cluster Data Services Planning and Administration Guide for Solaris OS*, which explains how to plan your Sun Cluster environment to include various data services.
- The *Sun Cluster Data Service for Oracle Real Application Clusters Guide for Solaris OS*, which describes how to use the Sun StorEdge QFS shared file system with the Sun Cluster data service for Oracle Real Application Clusters.

---

**Note** – All references in this document to “Oracle Real Application Clusters” apply also to “Oracle Parallel Server” unless otherwise specified.

---

## Restrictions

The following restrictions apply to the Sun StorEdge QFS software in a Sun Cluster environment:

- Sun StorEdge SAM-FS software, that is, use of storage and archive management software (SAM) configurations with Sun StorEdge QFS, is not supported.
- The following apply to shared file systems:
  - They can be configured only under the `SUNW.qfs` resource type. They cannot be configured under the `HASStoragePlus` resource type.
  - They can be configured as scalable file systems used only by the Sun Cluster data service for Oracle Real Application Clusters.
  - Shared file system data cannot be accessed from a node outside the Sun Cluster. This is true even if the node outside the Sun Cluster is configured only as a shared Sun StorEdge QFS reader. To access file system data, all nodes must be members of the same Sun Cluster.
- The following apply to unshared file systems:
  - They can be configured only under the `HASStoragePlus` resource type. They cannot be configured under the `SUNW.qfs` resource type.
  - Any failover application that is supported with Sun Cluster software is supported with unshared Sun StorEdge QFS software as a highly available local file system. Support is not limited to specific applications.
  - An unshared Sun StorEdge QFS file system cannot be the underlying native file system in a Sun Cluster.

---

# How the Sun Cluster and the Sun StorEdge QFS Software Interact

The shared file system uses Sun Cluster Disk ID (DID) support to enable data access by the Sun Cluster data service for Oracle Real Application Clusters. The unshared file system uses global device volume support and volume manager-controlled volume support to enable data access by failover applications supported by Sun Cluster.

## Data Access With a Shared File System

With DID support, each device that is under the control of the Sun Cluster system, whether it is multipathed or not, is assigned a unique disk ID. For every unique DID device, there is a corresponding global device. The Sun StorEdge QFS shared file system can be configured on redundant storage that consists only of DID devices (`/dev/did/*`), where DID devices are accessible only on nodes that have a direct connection to the device through a host bus adapter (HBA).

Configuring the Sun StorEdge QFS shared file system on DID devices and configuring the `SUNW.qfs` resource type for use with the file system makes the file system's shared metadata server highly available. The Sun Cluster data service for Oracle Real Application Clusters can then access data from within the file system. Additionally, the Sun StorEdge QFS Sun Cluster agent can then automatically relocate the metadata server for the file system as necessary.

## Data Access With an Unshared File System

A global device is Sun Cluster's mechanism for accessing an underlying DID device from any node within the Sun Cluster, assuming that the nodes hosting the DID device are available. Global devices and volume manager-controlled volumes can be made accessible from every node in the Sun Cluster. The unshared Sun StorEdge QFS file system can be configured on redundant storage that consists of either raw global devices (`/dev/global/*`) or volume manager-controlled volumes.

Configuring the unshared file system on these global devices or volume manager-controlled devices and configuring the `HASStoragePlus` resource type for use with the file system makes the file system highly available with the ability to fail over to other nodes.

---

# About Configuration Examples

This chapter provides configuration examples for the Sun StorEdge QFS shared file system on a Sun Cluster and for the unshared Sun StorEdge QFS file system on a Sun Cluster. All configuration examples are based on a platform consisting of the following:

- A two-node SunPlex™ system (scnode-A and scnode-B)
- DID devices that contain multi-host-accessible disk devices for both high availability and redundancy

All configurations in this chapter are also based on CODE EXAMPLE 8-1. In this code example, the `scdidadm(1M)` command displays the disk identifier (DID) devices, and the `-L` option lists the DID device paths, including those on all nodes in the Sun Cluster system.

**CODE EXAMPLE 8-1** Command That Lists the DID Devices and Their DID Device Paths

```
# scdidadm -L
1  scnode-A: /dev/dsk/c0t0d0      /dev/did/dsk/d1
2  scnode-A: /dev/dsk/c0t1d0      /dev/did/dsk/d2
3  scnode-A: /dev/dsk/c0t6d0      /dev/did/dsk/d3
4  scnode-A: /dev/dsk/c6t1d0      /dev/did/dsk/d4
4  scnode-B: /dev/dsk/c7t1d0      /dev/did/dsk/d4
5  scnode-A: /dev/dsk/c6t2d0      /dev/did/dsk/d5
5  scnode-B: /dev/dsk/c7t2d0      /dev/did/dsk/d5
6  scnode-A: /dev/dsk/c6t3d0      /dev/did/dsk/d6
6  scnode-B: /dev/dsk/c7t3d0      /dev/did/dsk/d6
7  scnode-A: /dev/dsk/c6t4d0      /dev/did/dsk/d7
7  scnode-B: /dev/dsk/c7t4d0      /dev/did/dsk/d7
8  scnode-A: /dev/dsk/c6t5d0      /dev/did/dsk/d8
8  scnode-B: /dev/dsk/c7t5d0      /dev/did/dsk/d8
9  scnode-B: /dev/dsk/c0t6d0      /dev/did/dsk/d9
10 scnode-B: /dev/dsk/c1t0d0      /dev/did/dsk/d10
11 scnode-B: /dev/dsk/c1t1d0      /dev/did/dsk/d11
```

CODE EXAMPLE 8-1 shows that DID devices d4 through d8 are accessible from both Sun Cluster systems (scnode-A and scnode-B). With the Sun StorEdge QFS file system sizing requirements and with knowledge of your intended application and configuration, you can decide on the most appropriate apportioning of devices to file systems. By using the Solaris `format(1M)` command, you can determine the sizing and partition layout of each DID device and resize the partitions on each DID device, if needed. Given the available DID devices, you can also configure multiple devices and their associated partitions to contain the file systems, according to your sizing requirements.

---

# Configuring a Sun StorEdge QFS Shared File System on a Sun Cluster

When you install a Sun StorEdge QFS shared file system on a Sun Cluster, you configure the file system's metadata server under the `SUNW.qfs` resource type. This makes the metadata server highly available and enables the Sun StorEdge QFS shared file system to be globally accessible on all configured nodes in the Sun Cluster.

A Sun StorEdge QFS shared file system is typically associated with a scalable application. The Sun StorEdge QFS shared file system is mounted on, and the scalable application is active on, one or more Sun Cluster nodes.

If a node in the Sun Cluster system fails, or if you switch over the resource group, the metadata server resource (Sun StorEdge QFS Sun Cluster agent) automatically relocates the file system's metadata server as necessary. This ensures that the other nodes' access to the shared file system is not affected.

---

**Note** – To manually relocate the metadata server for a Sun StorEdge QFS shared file system that is under Sun Cluster control, you must use the Sun Cluster administrative commands. For more information about these commands, see the Sun Cluster documentation.

---

## Metadata Server Resource Considerations

When the Sun Cluster boots, the metadata server resource ensures that the file system is mounted on all nodes that are part of the resource group. However, the file system mount on those nodes is not monitored. Therefore, in certain failure cases, the file system might be unavailable on certain nodes, even if the metadata server resource is in the online state.

If you use Sun Cluster administrative commands to bring the metadata server resource group offline, the file system under the metadata server resource remains mounted on the nodes. To unmount the file system (with the exception of a node that is shut down), you must bring the metadata server resource group into the unmanaged state by using the appropriate Sun Cluster administrative command.

To remount the file system at a later time, you must bring the resource group into a managed state and then into an online state.

## Example Configuration

This section shows an example of the Sun StorEdge QFS shared file system installed on raw DID devices with the Sun Cluster data service for Oracle Real Application Clusters. For detailed information on how to use the Sun StorEdge QFS shared file system with the Sun Cluster data service for Oracle Real Application Clusters, see the *Sun Cluster Data Service for Oracle Real Application Clusters Guide for Solaris OS*.

As shown in CODE EXAMPLE 8-1, DID devices d4 through d8 are highly available and are contained on controller-based storage. For you to configure a Sun StorEdge QFS shared file system on a Sun Cluster, the controller-based storage must support device redundancy by using RAID-1 or RAID-5.

For simplicity in this example, two file systems are created:

- `qfs1`—This file system is used for the Oracle Real Application Clusters shared installation, configuration, and log files.
- `qfs2`—This file system is used for the database files that are shared by the Oracle Real Application Clusters software.

Additionally, device d4 is used for Sun StorEdge QFS metadata. This device has two 50 GB slices. The remaining devices, d5 through d8, are used for Sun StorEdge QFS file data.

This configuration involves five main steps, as detailed in the following subsections:

1. Preparing to create Sun StorEdge QFS file systems.
2. Creating the file systems and configuring the Sun Cluster nodes.
3. Validating the configuration.
4. Configuring the network name service.
5. Configuring the Sun Cluster data service for Oracle Real Application Clusters.

### ▼ To Prepare to Create Sun StorEdge QFS Shared File Systems

Steps 1 through 3 in this procedure must be performed from one node in the Sun Cluster system. In this example, the steps are performed from node `scnode-A`.

1. **From one node in the Sun Cluster system, use the `format(1M)` utility to lay out partitions on `/dev/did/dsk/d4`.**

## CODE EXAMPLE 8-2 Laying Out Partitions on /dev/did/dsk/d4

```
# format /dev/did/rdisk/d4s2
# format> partition
[ output deleted ]
# partition> print
Current partition table (unnamed):
Total disk cylinders available: 12800 + 2 (reserved cylinders)
```

Part	Tag	Flag	Cylinders	Size	Blocks
0	usr	wm	1 - 6400	50.00GB	(6400/0/0) 104857600
1	usr	wm	6401 - 12800	50.00GB	(6400/0/0) 104857600
2	backup	wu	0 - 12800	100.00GB	(6400/0/0) 209715200
3	unassigned	wu	0	0	(0/0/0) 0
4	unassigned	wu	0	0	(0/0/0) 0
5	unassigned	wu	0	0	(0/0/0) 0
6	unassigned	wu	0	0	(0/0/0) 0
7	unassigned	wu	0	0	(0/0/0) 0

NOTE: Partition 2 (backup) will not be used and was created by format(1M) by default.

Partition (or slice) 0 skips over the volume's Volume Table of Contents (VTOC) and is then configured as a 50 GB partition. Partition 1 is configured to be the same size as partition 0.

**2. Use the format(1M) utility to lay out partitions on /dev/did/dsk/d5.**



**CODE EXAMPLE 8-3** Laying Out Partitions on /dev/did/dsk/d5

```
# format /dev/did/rdisk/d5s2
# format> partition
[ output deleted ]
# partition> print
Current partition table (unnamed):
Total disk cylinders available: 34530 + 2 (reserved cylinders)
```

Part	Tag	Flag	Cylinders	Size	Blocks
0	usr	wn	1 - 34529	269.77GB	(34529/0/0) 565723136
1	usr	wn	0 - 0	0	(0/0/0)
2	backup	wu	0 - 34529	269.77GB	(34530/0/0) 565739520
3	unassigned	wu	0	0	(0/0/0) 0
4	unassigned	wu	0	0	(0/0/0) 0
5	unassigned	wu	0	0	(0/0/0) 0
6	unassigned	wu	0	0	(0/0/0) 0
7	unassigned	wu	0	0	(0/0/0) 0

NOTE: Partition 2 (backup) will not be used and was created by format(1M) by default.

**3. Replicate the device d5 partitioning to devices d6 through d8.**

This example shows the command for device d6.

```
# prtvtoc /dev/did/rdisk/d5s2 | fmthard -s - /dev/did/rdisk/d6s2
```

**4. On all nodes that are potential hosts of the file systems, perform the following:**

- a. Configure the six partitions into two Sun StorEdge QFS shared file systems by adding two new configuration entries (qfs1 and qfs2) to the mcf file.**

**CODE EXAMPLE 8-4** Adding Configuration Entries to the mcf File

```
# cat >> /etc/opt/SUNWsamfs/mcf <<EOF
#
# Sun StorEdge QFS file system configurations
#
# Equipment      Equipment      Equipment      Family      Device      Additional
# Identifier      Ordinal      Type      Set      State      Parameters
# -----
qfs1              100          ma          qfs1        -          shared
/dev/did/dsk/d4s0  101          mm          qfs1        -
/dev/did/dsk/d5s0  102          mr          qfs1        -
/dev/did/dsk/d6s0  103          mr          qfs1        -
qfs2              200          ma          qfs2        -          shared
/dev/did/dsk/d4s1  201          mm          qfs2        -
/dev/did/dsk/d7s0  202          mr          qfs2        -
/dev/did/dsk/d8s0  203          mr          qfs2        -
EOF
```

For more information about the mcf file, see the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.

- b. Edit the /etc/opt/SUNWsamfs/samfs.cmd file to add the mount options that are required for the Sun Cluster data service for Oracle Real Application Clusters.**

**CODE EXAMPLE 8-5** Example samfs.cmd File

```
fs = qfs2
    stripe = 1
    sync_meta = 1
    mh_write
    qwrite
    forcedirectio
    nstreams = 1024
    rdlease = 600
```

For more information about the mount options that are required by the Sun Cluster data service for Oracle Real Application Clusters, see the *Sun Cluster Data Service for Oracle Real Application Clusters Guide for Solaris OS*.

c. **Validate that the configuration is correct.**

Be sure to perform this validation after you have configured the `mcf` file and the `samfs.cmd` file on each node.

```
# /opt/SUNWsamfs/sbin/sam-fsd
```

## ▼ To Create the Sun StorEdge QFS Shared File System and Configure Sun Cluster Nodes

Perform this procedure for each file system you are creating. This example describes how to create the `qfs1` file system.

1. **Obtain the Sun Cluster private interconnect names by using the following command.**

**CODE EXAMPLE 8-6** Obtaining the Sun Cluster Private Interconnect Names

```
# /usr/cluster/bin/scconf -p | egrep "Cluster node name:|Node private \
hostname:"
Cluster node name:                scnode-A
Node private hostname:           clusternode1-priv
Cluster node name:                scnode-B
Node private hostname:           clusternode2-priv
```

2. **On all nodes that are potential hosts of the file system, perform the following:**
  - a. **Use the `samd(1M) config` command, which signals to the Sun StorEdge QFS daemon that a new Sun StorEdge QFS configuration is available.**

```
# samd config
```

- b. **Create the Sun StorEdge QFS shared hosts file for the file system (`/etc/opt/SUNWsamfs/hosts.family-set-name`), based on the Sun Cluster's private interconnect names that you obtained in Step 1.**
3. **Edit the unique Sun StorEdge QFS shared file system's host configuration file with the Sun Cluster interconnect names.**

For Sun Cluster failover and fencing operations, the Sun StorEdge QFS shared file system must use the same interconnect names as the Sun Cluster system.

**CODE EXAMPLE 8-7**    Editing Each File System’s Host Configuration File

```
# cat > hosts.qfs1 <<EOF
# File /etc/opt/SUNWsamfs/hosts.qfs1
# Host      Host IP      Server  Not  Server
# Name      Addresses    Priority Used Host
# -----
scnode-A    clusternode1-priv      1      -    server
scnode-B    clusternode2-priv      2      -
EOF
```

- 4. From one node in the Sun Cluster, use the `sammkfs(1M) -S` command to create the Sun StorEdge QFS shared file system.

```
# sammkfs -S qfs1 < /dev/null
```

- 5. On all nodes that are potential hosts of the file system, perform the following:
  - a. Use the `mkdir(1M)` command to create a global mount point for the file system, use the `chmod(1M)` command to make `root` the owner of the mount point, and use the `chown(1M)` command to make the mount point usable by other with read/write (755) access.

**CODE EXAMPLE 8-8**    Creating a Global Mount Point for the qfs1 File System

```
# mkdir /global/qfs1
# chmod 755 /global/qfs1
# chown root:other /global/qfs1
```

- b. Add the Sun StorEdge QFS shared file system entry to the `/etc/vfstab` file.

**CODE EXAMPLE 8-9**    Adding the Shared File System Entry to the `/etc/vfstab` File

```
# cat >> /etc/vfstab <<EOF
# device      device      mount      FS      fsck      mount      mount
# to mount    to fsck      point      type     pass      at boot    options
#
qfs1          -          /global/qfs1  samfs    -         no         shared
EOF
```

▼ To Validate the Configuration

Perform this procedure for each file system you create. This example describes how to validate the configuration for file system `qfs1`.

1. If you do not know which node is acting as the metadata server for the file system, use the `samsharefs(1M) -R` command.

**CODE EXAMPLE 8-10** Determining Which Node is the Metadata Server

```
# samsharefs -R qfs1
#
# Host file for family set 'qfs1'
#
# Version: 4      Generation: 1      Count: 2
# Server = host 1/scnode-A, length = 165
#
scnode-A clusternode2-priv 1 - server
scnode-B clusternode2-priv 2 -
```

The example shows that the metadata server for `qfs1` is `scnode-A`.

2. Use the `mount(1M)` command to mount the file system first on the metadata server and then on each node in the Sun Cluster system.

It is very important that you mount the file system on the metadata server first.

**CODE EXAMPLE 8-11** Mounting File System, `qfs1`, on a Sun Cluster Node

```
# mount qfs1
# ls /global/qfs1
lost+found/
```

3. Validate voluntary failover by issuing the `samsharefs(1M) -s` command, which changes the Sun StorEdge QFS shared file system between nodes.

**CODE EXAMPLE 8-12** Switching Over File System `qfs1` to Validate Voluntary Failover

```
# samsharefs -s scnode-B qfs1
# ls /global/qfs1
lost+found/
# samsharefs -s scnode-A qfs1
# ls /global/qfs1
lost+found
```

4. Validate that the required Sun Cluster resource type is added to the resource configuration.

```
# scrgadm -p | egrep "SUNW.qfs"
```

5. If you cannot find the Sun Cluster resource type, use the `scrgadm(1M) -a -t` command to add it to the resource configuration.

```
# scrgadm -a -t SUNW.qfs
```

6. Register and configure the `SUNW.qfs` resource type.

**CODE EXAMPLE 8-13** Configuring the `SUNW.qfs` Resource

```
# scrgadm -a -g qfs-rg -h scnode-A,scnode-B
# scrgadm -a -g qfs-rg -t SUNW.qfs -j qfs-res \
    -x QFSFileSystem=/global/qfs1,/global/qfs2
```

7. Use the `scswitch(1M) -Z -g` command to bring the resource group online.

```
# scswitch -Z -g qfs-rg
```

8. Ensure that the resource group is functional on all configured nodes.

**CODE EXAMPLE 8-14** Testing the Resource Group on Configured Nodes

```
# scswitch -z -g qfs-rg -h scnode-B
# scswitch -z -g qfs-rg -h scnode-A
```

## ▼ To Configure the Sun Cluster Data Service for Oracle Real Application Clusters

This section provides an example of how to configure the data service for Oracle Real Application Clusters for use with Sun StorEdge QFS shared file systems. For more information, see the *Sun Cluster Data Service for Oracle Real Application Clusters Guide for Solaris OS*.

1. Install the data service as described in the *Sun Cluster Data Service for Oracle Real Application Clusters Guide for Solaris OS*.
2. Mount the Sun StorEdge QFS shared file systems.
3. Set the correct ownership and permissions on the file systems so that the Oracle database operations are successful.

**CODE EXAMPLE 8-15** Setting Ownership and Permissions on the File Systems `qfs1` and `qfs2`

```
# chown oracle:dba /global/qfs1 /global/qfs2
# chmod 755 /global/qfs1 /global/qfs2
```

4. As the `oracle` user, create the subdirectories that are required for the Oracle Real

## Application Clusters installation and database files.

**CODE EXAMPLE 8-16** Creating Subdirectories Within File Systems `qfs1` and `qfs2`

```
$ id
uid=120(oracle) gid=520(dba)
$ mkdir /global/qfs1/oracle_install
$ mkdir /global/qfs2/oracle_db
```

The Oracle Real Application Clusters installation uses the `/global/qfs1/oracle_install` directory path as the value for the `ORACLE_HOME` environment variable that is used in Oracle operations. The Oracle Real Application Clusters database files' path is prefixed with the `/global/qfs2/oracle_db` directory path.

### 5. Install the Oracle Real Application Clusters software.

During the installation, provide the path for the installation as defined in Step 4 (`/global/qfs1/oracle_install`).

### 6. Create the Oracle Real Application Clusters database.

During database creation, specify that you want the database files located in the `qfs2` shared file system.

### 7. If you are automating the startup and shutdown of Oracle Real Application Clusters database instances, ensure that the required dependencies for resource groups and resources are set.

For more information, see the *Sun Cluster Data Service for Oracle Real Application Clusters Guide for Solaris OS*.

---

**Note** – If you plan to automate the startup and shutdown of Oracle Real Application Clusters database instances, you must use Sun Cluster 3.1 9/04 or a compatible version.

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## Configuring an Unshared File System on a Sun Cluster

When you install the unshared Sun StorEdge QFS file system on a Sun Cluster system, you configure the file system for high availability (HA) under the Sun Cluster `HASStoragePlus` resource type. An unshared Sun StorEdge QFS file system on a Sun Cluster is typically associated with one or more failover applications, such

as HA-NFS, HA-ORACLE, and so on. Both the unshared Sun StorEdge QFS file system and the failover applications are active in a single resource group; the resource group is active on one Sun Cluster node at a time.

An unshared Sun StorEdge QFS file system is mounted on a single node at any given time. If the Sun Cluster fault monitor detects an error, or if you switch over the resource group, the unshared Sun StorEdge QFS file system and its associated HA applications fail over to another node, depending on how the resource group has been previously configured.

Any file system contained on a Sun Cluster global device group (`/dev/global/*`) can be used with the `HAStoragePlus` resource type. When a file system is configured with the `HAStoragePlus` resource type, it becomes part of a Sun Cluster resource group and the file system under Sun Cluster Resource Group Manager (RGM) control is mounted locally on the node where the resource group is active. When the RGM causes a resource group switchover or fails over to another configured Sun Cluster node, the unshared Sun StorEdge QFS file system is unmounted from the current node and remounted on the new node.

Each unshared Sun StorEdge QFS file system requires a minimum of two raw disk partitions or volume manager-controlled volumes (Solstice DiskSuite/Solaris Volume Manager or VERITAS Clustered Volume Manager), one for Sun StorEdge QFS metadata (inodes) and one for Sun StorEdge QFS file data. Configuring multiple partitions or volumes across multiple disks through multiple data paths increases unshared Sun StorEdge QFS file system performance. For information about sizing metadata and file data partitions, see “Design Basics” on page 7.

This section provides three examples of Sun Cluster configurations using the unshared Sun StorEdge QFS file system. In these examples, a file system is configured in combination with an HA-NFS file mount point on the following:

- Raw global devices in Example 1
- Solstice DiskSuite/Solaris Volume Manager-controlled volumes in Example 2
- VERITAS Clustered Volume Manager (VxVM)-controlled volumes in Example 3

For simplicity in all of these configurations, ten percent of each file system is used for Sun StorEdge QFS metadata and the remaining space is used for Sun StorEdge QFS file data. For information about sizing and disk layout considerations, see the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.

## Example 1

This example shows how to configure the unshared Sun StorEdge QFS file system with HA-NFS on raw global devices. For this configuration, the raw global devices must be contained on controller-based storage. This controller-based storage must support device redundancy by using RAID-1 or RAID-5.



As shown in CODE EXAMPLE 8-1, the DID devices used in this example, d4 through d7, are highly available and are contained on controller-based storage. (This example uses devices d4 through d7.) The HAStoragePlus resource type requires the use of global devices, so each DID device (/dev/did/dsk/dx) is accessible as a global device by using the following syntax: /dev/global/dsk/dx.

The main steps in this example are as follows:

1. Prepare to create an unshared file system.
2. Create the file system and configure the Sun Cluster nodes.
3. Configure the network name service and the IPMP validation testing.
4. Configure HA-NFS and configure the file system for high availability.

## ▼ To Prepare to Create an Unshared Sun StorEdge QFS File System

1. Use the **format(1M)** utility to lay out the partitions on /dev/global/dsk/d4.

**CODE EXAMPLE 8-17** Command that Lays Out Partitions on /dev/global/dsk/d4.

```
# format /dev/global/rdisk/d4s2
# format> partition
[ output deleted ]
# partition> print
Current partition table (original):
Total disk cylinders available: 34530 + 2 (reserved cylinders)
Part      Tag      Flag      Cylinders      Size      Blocks
0  unassigned  wm        1 - 3543      20.76GB    (3543/0/0)  43536384
1  unassigned  wm      3544 - 34529    181.56GB    (30986/0/0) 380755968
2  backup      wu        0 - 34529    202.32GB    (34530/0/0) 424304640
3  unassigned  wu         0           0          (0/0/0)      0
4  unassigned  wu         0           0          (0/0/0)      0
5  unassigned  wu         0           0          (0/0/0)      0
6  unassigned  wu         0           0          (0/0/0)      0
7  unassigned  wu         0           0          (0/0/0)      0
```

NOTE: Partition 2 (backup) will not be used and was created by format(1m) by default.

Partition (or slice) 0 skips over the volume's Volume Table of Contents (VTOC) and is then configured as a 20 GB partition. The remaining space is configured into partition 1.

**2. Replicate the global device d4 partitioning to global devices d5 through d7.**

This example shows the command for global device d5.

```
# prtvtoc /dev/global/rdisk/d4s2 | fmthard \
-s - /dev/global/rdisk/d5s2
```

**3. On all nodes that are potential hosts of the file system, perform the following:**

- a. Configure the eight partitions (four global devices, with two partitions each) into a Sun StorEdge QFS file system by adding a new file system entry to the `mcf` file.**

**CODE EXAMPLE 8-18** Adding the New File System to the `mcf` File

```
# cat >> /etc/opt/SUNWsamfs/mcf <<EOF
#
# Sun StorEdge QFS file system configurations
#
# Equipment      Equipment   Equipment   Family      Device      Additional
# Identifier      Ordinal     Type        Set         State       Parameters
# -----
qfsnfs1          100         ma          qfsnfs1     on
/dev/global/dsk/d4s0 101         mm          qfsnfs1
/dev/global/dsk/d5s0 102         mm          qfsnfs1
/dev/global/dsk/d6s0 103         mm          qfsnfs1
/dev/global/dsk/d7s0 104         mm          qfsnfs1
/dev/global/dsk/d4s1 105         mr          qfsnfs1
/dev/global/dsk/d5s1 106         mr          qfsnfs1
/dev/global/dsk/d6s1 107         mr          qfsnfs1
/dev/global/dsk/d7s1 108         mr          qfsnfs1
EOF
```

For information about the `mcf` file, see the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.

- b. Validate that the configuration information you added to the `mcf` file is correct.**

It is important to complete this step before you configure the Sun StorEdge QFS file system under the `HASStoragePlus` resource type.

```
# /opt/SUNWsamfs/sbin/sam-fsd
```

## ▼ Step 2: Create the Sun StorEdge QFS File System and Configure The Sun Cluster Nodes

1. On all nodes that are potential hosts of the file system, use the `samd(1M)` config command, which signals to the Sun StorEdge QFS daemon that a new Sun StorEdge QFS configuration is available.

```
# samd config
```

2. From one node in the Sun Cluster, use the `sammkfs(1M)` command to create the file system.

```
# sammkfs qfsnfs1 < /dev/null
```

3. On all nodes that are potential hosts of the file system, perform the following:
  - a. Use the `mkdir(1M)` command to create a global mount point for the file system, use the `chmod(1M)` command to make `root` the owner of the mount point, and use the `chown(1M)` command to make the mount point usable by `other` with read/write (755) access.

**CODE EXAMPLE 8-19** Creating a Global Mount Point for File System `qfsnfs1`

```
# mkdir /global/qfsnfs1
# chmod 755 /global/qfsnfs1
# chown root:other /global/qfsnfs1
```

- b. Add the Sun StorEdge QFS file system entry to the `/etc/vfstab` file.

Note that the mount options field contains the `sync_meta=1` value.

**CODE EXAMPLE 8-20** Adding the File System Entry to the `/etc/vfstab` File

```
# cat >> /etc/vfstab <<EOF

# device      device      mount      FS      fsck      mount      mount
# to mount    to fsck     point      type     pass      at boot    options
#
qfsnfs1      -          /global/qfsnfs1  samfs    2         no         sync_meta=1
EOF
```

- c. Validate the configuration by mounting and unmounting the file system.

**CODE EXAMPLE 8-21** Validating the Configuration

```
# mount qfsnfs1
# ls /global/qfsnfs1
lost+found/
# umount qfsnfs1
```

4. Use the `scrgadm(1M) -p | egrep` command to validate that the required Sun Cluster resource types have been added to the resource configuration.

**CODE EXAMPLE 8-22** Searching for the Required Sun Cluster Resource Types

```
# scrgadm -p | egrep "SUNW.HAStoragePlus|SUNW.LogicalHostname|SUNW.nfs"
```

5. If you cannot find a required Sun Cluster resource type, use the `scrgadm(1M) -a -t` command to add it to the configuration.

**CODE EXAMPLE 8-23** Adding the Required Sun Cluster Resource Types

```
# scrgadm -a -t SUNW.HAStoragePlus
# scrgadm -a -t SUNW.LogicalHostname
# scrgadm -a -t SUNW.nfs
```

## ▼ To Configure the Network Name Service and the IPMP Validation Testing

This section provides an example of how to configure the network name service and the IPMP Validation Testing for your Sun Cluster nodes. For more information, see the *Sun Cluster Software Installation Guide for Solaris OS*.

1. Use `vi` or another text editor to edit the `/etc/nsswitch.conf` file so that it looks in the Sun Cluster and files for node names.

Perform this step before you configure the NIS server.

**CODE EXAMPLE 8-24** Editing the /etc/nsswitch File to Look in the Sun Cluster and Files for Node Names

```
# cat /etc/nsswitch.conf
#
# /etc/nsswitch.nis:
#
# An example file that could be copied over to /etc/nsswitch.conf; it
# uses NIS (YP) in conjunction with files.
#
# the following two lines obviate the "+" entry in /etc/passwd and /etc/group.
passwd:    files nis
group:     files nis

# Cluster s/w and local /etc/hosts file take precedence over NIS
hosts:    cluster files nis [NOTFOUND=return]
ipnodes:  files
# Uncomment the following line and comment out the above to resolve
# both IPv4 and IPv6 addresses from the ipnodes databases. Note that
# IPv4 addresses are searched in all of the ipnodes databases before
# searching the hosts databases. Before turning this option on, consult
# the Network Administration Guide for more details on using IPv6.
# ipnodes: nis [NOTFOUND=return] files

networks: nis[NOTFOUND=return] files
protocols: nis [NOTFOUND=return] files
rpc: nis[NOTFOUND=return] files
ethers: nis[NOTFOUND=return] files
netmasks: nis[NOTFOUND=return] files
bootparams: nis[NOTFOUND=return] files
publickey: nis[NOTFOUND=return] files

netgroup: nis

automount: files nis
aliases: files nis
[remainder of file content not shown]
```

**2. Verify that the changes you made to the /etc/nsswitch.conf are correct.**

**CODE EXAMPLE 8-25** Verifying the /etc/nsswitch.conf File Changes

```
# grep '^hosts:' /etc/nsswitch.conf
hosts:    cluster files nis [NOTFOUND=return]
#
```

### 3. Set up IPMP validation testing by using available network adapters.

The adapters qfe2 and qfe3 are used as examples.

#### a. Statically configure the IPMP test address for each adapter.

**CODE EXAMPLE 8-26** Statically Configuring the IPMP Test Address for Adapters qfe2 and qfe3

```
#cat >> /etc/hosts << EOF
#
# Test addresses for scnode-A
#
192.168.2.2      `uname -n`-qfe2
192.168.2.3      `uname -n`-qfe2-test
192.168.3.2      `uname -n`-qfe3
192.168.3.3      `uname -n`-qfe3-test

#
# Test addresses for scnode-B
#
192.168.2.4      `uname -n`-qfe2
192.168.2.5      `uname -n`-qfe2-test
192.168.3.4      `uname -n`-qfe3
192.168.3.5      `uname -n`-qfe3-test
EOF
```

#### b. Dynamically configure the IPMP Adapters

**CODE EXAMPLE 8-27** Dynamically Configuring the IPMP Adapters, qfe2 and qfe3

```
# ifconfig qfe2 plumb `uname -n`-qfe2-test netmask + broadcast + deprecated \
    -failover -standby group ipmp0 up
# ifconfig qfe2 addif `uname -n`-qfe2 up
# ifconfig qfe3 plumb `uname -n`-qfe3-test netmask + broadcast + deprecated \
    -failover -standby group ipmp0 up
# ifconfig qfe3 addif `uname -n`-qfe3 up
```

#### c. Verify the configuration.

**CODE EXAMPLE 8-28** Verifying the Configuration of the IPMP Adapters, qfe2 and qfe3

```
# cat > /etc/hostname.qfe2 << EOF
`uname -n`-qfe2-test netmask + broadcast + deprecated -failover -standby \
group ipmp0 up addif `uname -n`-qfe2 up
EOF

# cat > /etc/hostname.qfe3 << EOF
`uname -n`-qfe3-test netmask + broadcast + deprecated -failover -standby \
group ipmp0 up addif `uname -n`-qfe3 up
EOF
```

## ▼ To Configure HA-NFS and the Sun StorEdge QFS File System for High Availability

This section provides an example of how to configure HA-NFS. For more information about HA-NFS, see the *Sun Cluster Data Service for Network File System (NFS) Guide for Solaris OS* and your NFS documentation.

### 1. Create the NFS share point for the Sun StorEdge QFS file system.

Note that the share point is contained within the `/global` file system, not within the Sun StorEdge QFS file system.

**CODE EXAMPLE 8-29** Creating the NFS Share Points for the Two File Systems

```
# mkdir -p /global/nfs/SUNW.nfs
# echo "share -F nfs -o rw /global/qfsnfs1" > \
/global/nfs/SUNW.nfs/dfstab.nfs1-res
```

### 2. Create the NFS resource group.

```
# scrgadm -a -g nfs-rg -y PathPrefix=/global/nfs
```

### 3. Add the NFS logical host to the `/etc/hosts` table, using the address for your site.

**CODE EXAMPLE 8-30** Adding the NFS Logical Host to the `/etc/hosts` Table

```
# cat >> /etc/hosts << EOF
#
# IP Addresses for LogicalHostnames
#
192.168.2.10      lh-qfs1
EOF
```

### 4. Use the `scrgadm(1M) -a -L -g` command to add the logical host to the NFS

resource group.

```
# scrgadm -a -L -g nfs-rg -l lh-nfs1
```

5. Use the `scrgadm(1M) -c -g` command to configure the `HASStoragePlus` resource type.

**CODE EXAMPLE 8-31** Configuring the `HASStoragePlus` Resource Type

```
# scrgadm -c -g nfs-rg -h scnode-A,scnode-B
# scrgadm -a -g nfs-rg -j qfsnfs1-res -t SUNW.HASStoragePlus \
    -x FilesystemMountPoints=/global/qfsnfs1 \
    -x FilesystemCheckCommand=/bin/true
```

6. Bring the resource group online.

```
# scswitch -Z -g nfs-rg
```

7. Configure the NFS resource type and set a dependency on the `HASStoragePlus` resource.

**CODE EXAMPLE 8-32** Configuring the NFS Resource Type to Depend on the `HASStoragePlus` Resource

```
# scrgadm -a -g nfs-rg -j nfs1-res -t SUNW.nfs -y \
    Resource_dependencies=qfsnfs1-res
```

8. Bring the NFS resource online.

```
# scswitch -e -j nfs1-res
```

The NFS resource `/net/lh-nfs1/global/qfsnfs1` is now fully configured and is also highly available.

9. Before announcing the availability of the highly available NFS file system on the Sun StorEdge QFS file system, ensure that the resource group can be switched between all configured nodes without errors and can be taken online and offline.

**CODE EXAMPLE 8-33** Testing the Resource Groups

```
# scswitch -z -g nfs-rg -h scnode-A
# scswitch -z -g nfs-rg -h scnode-B
# scswitch -F -g nfs-rg
# scswitch -Z -g nfs-rg
```



## Example 2

This example shows how to configure the unshared Sun StorEdge QFS file system with HA-NFS on volumes controlled by Solstice DiskSuite/Solaris Volume Manager software. With this configuration, you can choose whether the DID devices are contained on redundant controller-based storage using RAID-1 or RAID-5 volumes. Typically, Solaris Volume Manager is used only when the underlying controller-based storage is not redundant.

As shown in CODE EXAMPLE 8-1, the DID devices used in this example, d4 through d7, are highly available and are contained on controller-based storage. Solaris Volume Manager requires that DID devices be used to populate the raw devices from which Solaris Volume Manager can configure volumes. Solaris Volume Manager creates globally accessible disk groups, which can then be used by the HAStoragePlus resource type for creating Sun StorEdge QFS file systems.

This example follows these steps:

1. Prepare the Solstice DiskSuite/Solaris Volume Manager software.
2. Prepare to create an unshared file system.
3. Create the file system and configure the Sun Cluster nodes.
4. Configure the network name service and the IPMP validation testing.
5. Configure HA-NFS and configure the file system for high availability.

### ▼ To Prepare the Solstice DiskSuite/Solaris Volume Manager Software

1. **Determine whether a Solaris Volume Manager metadatabase (metadb) is already configured on each node that is a potential host of the Sun StorEdge QFS file system.**

**CODE EXAMPLE 8-34** Determining Whether a Solaris Volume Manager Metadatabase is Already Configured

# metadb					
flags		first blk	block count		
a	m p lu	16	8192	/dev/dsk/c0t0d0s7	
a	p lu	16	8192	/dev/dsk/c1t0d0s7	
a	p lu	16	8192	/dev/dsk/c2t0d0s7	

If the `metadb(1M)` command does not return a metadatabase configuration, then on each node, create three or more database replicas on one or more local disks. Each replica must be at least 16 MB in size. For more information about creating the metadatabase configuration, see the *Sun Cluster Software Installation Guide for Solaris OS*.

2. Create an HA-NFS disk group to contain all Solaris Volume Manager volumes for this Sun StorEdge QFS file system.

```
# metaset -s nfsdg -a -h scnode-A scnode-B
```

3. Add DID devices d4 through d7 to the pool of raw devices from which Solaris Volume Manager can create volumes.

**CODE EXAMPLE 8-35** Adding DID Devices d4 Through d7 to the Pool of Raw Devices

```
# metaset -s nfsdg -a /dev/did/dsk/d4 /dev/did/dsk/d5 \
/dev/did/dsk/d6 /dev/did/dsk/d7
```

## ▼ To Prepare to Create a Sun StorEdge QFS File System

1. Use the `format(1M)` utility to lay out partitions on `/dev/global/dsk/d4`.

**CODE EXAMPLE 8-36** Command that Lays Out Partitions on `/dev/global/dsk/d4`.

```
# format /dev/global/rdsk/d4s2
# format> partition
[ output deleted ]
# partition> print
Current partition table (original):
Total disk cylinders available: 34530 + 2 (reserved cylinders)
Part      Tag      Flag      Cylinders      Size      Blocks
0  unassigned  wm        1 - 3543      20.76GB   (3543/0/0)  43536384
1  unassigned  wm    3544 - 34529   181.56GB   (30986/0/0) 380755968
2  backup      wu        0 - 34529   202.32GB   (34530/0/0) 424304640
3  unassigned  wu         0           0         (0/0/0)         0
4  unassigned  wu         0           0         (0/0/0)         0
5  unassigned  wu         0           0         (0/0/0)         0
6  unassigned  wu         0           0         (0/0/0)         0
7  unassigned  wu         0           0         (0/0/0)         0
```

NOTE: Partition 2 (backup) will not be used and was created by `format(1m)` by default.

CODE EXAMPLE 8-36 shows that partition or slice 0 skips over the volume's Volume Table of Contents (VTOC) and is then configured as a 20 GB partition. The remaining space is configured into partition 1.

2. Replicate the partitioning of DID device d4 to DID devices d5 through d7.

This example shows the command for device d5.

```
# prtvtoc /dev/global/rdisk/d4s2 | fmthard \  
-s - /dev/global/rdisk/d5s2
```

3. Configure the eight partitions (four DID devices, two partitions each) into two RAID-1 (mirrored) Sun StorEdge QFS metadata volumes and two RAID-5 (parity-striped) Sun StorEdge QFS file data volumes.

Combine partition (slice) 0 of these four drives into two RAID-1 sets.

**CODE EXAMPLE 8-37** Configuring Partitions Into RAID-1 Metadata and Into RAID-5 Data Volumes, and Then Combining Partition Zero of the Four Drives into RAID-1 Sets

```
# metainit -s nfsdg -f d1 1 1 /dev/did/dsk/d4s0  
# metainit -s nfsdg -f d2 1 1 /dev/did/dsk/d5s0  
# metainit -s nfsdg d10 -m d1 d2  
# metainit -s nfsdg -f d3 1 1 /dev/did/dsk/d6s0  
# metainit -s nfsdg -f d4 1 1 /dev/did/dsk/d7s0  
# metainit -s nfsdg d11 -m d3 d4
```

4. Combine partition 1 of these four drives into two RAID-5 sets.

**CODE EXAMPLE 8-38** Combining Partition One of the Four Drives Into Two RAID-5 Sets

```
# metainit -s nfsdg d20 -p /dev/did/dsk/d4s1 205848574b  
# metainit -s nfsdg d21 -p /dev/did/dsk/d5s1 205848574b  
# metainit -s nfsdg d22 -p /dev/did/dsk/d6s1 205848574b  
# metainit -s nfsdg d23 -p /dev/did/dsk/d7s1 205848574b  
# metainit -s nfsdg d30 -r d20 d21 d22 d23
```

5. On each node that is a potential host of the file system, add the Sun StorEdge QFS file system entry to the `mcf` file.

**CODE EXAMPLE 8-39** Adding the Sun StorEdge QFS File System to the Metadata Server's mcf File

```
# cat >> /etc/opt/SUNWsamfs/mcf <<EOF

# Sun StorEdge QFS file system configurations
#
# Equipment      Equipment  Equipment  Family  Device  Additional
# Identifier      Ordinal    Type       Set     State   Parameters
# -----
qfsnfs1           100        ma         qfsnfs1  on
/dev/md/nfsdg/dsk/d10  101        mm         qfsnfs1
/dev/md/nfsdg/dsk/d11  102        mm         qfsnfs1
/dev/md/nfsdg/dsk/d30  103        mr         qfsnfs1
EOF
```

For more information about the mcf file, see the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.

**6. Validate that the mcf configuration is correct on each node.**

```
# /opt/SUNWsamfs/sbin/sam-fsd
```

▼ **To Create the Sun StorEdge QFS File System and Configure Sun Cluster Nodes**

**1. On each node that is a potential host of the file system, use the samd(1M) config command.**

This command signals to the Sun StorEdge QFS daemon that a new Sun StorEdge QFS configuration is available.

```
# samd config
```

**2. Enable Solaris Volume Manager mediation detection of disk groups, which assists the Sun Cluster system in the detection of drive errors.**

**CODE EXAMPLE 8-40** Enabling Solaris Volume Manager Mediation Detection of Disk Groups

```
# metaset -s nfsdg -a -m scnode-A
# metaset -s nfsdg -a -m scnode-B
```

**3. On each node that is a potential host of the file system, ensure that the NFS disk**

group exists.

```
# metaset -s nfsdg -t
```

4. From one node in the Sun Cluster system, use the `sammkfs(1M)` command to create the Sun StorEdge QFS file system.

```
# sammkfs qfsnfs1 < /dev/null
```

5. On each node that is a potential host of the file system, perform the following:
  - a. Use the `mkdir(1M)` command to create a global mount point for the file system, use the `chmod(1M)` command to make `root` the owner of the mount point, and use the `chown(1M)` command to make the mount point usable by `other` with read/write (755) access.

**CODE EXAMPLE 8-41** Creation of a Global Mount Point for the `qfsnfs1` File System

```
# mkdir /global/qfsnfs1
# chmod 755 /global/qfsnfs1
# chown root:other /global/qfsnfs1
```

- b. Add the Sun StorEdge QFS file system entry to the `/etc/vfstab` file.

Note that the mount options field contains the `sync_meta=1` value.

**CODE EXAMPLE 8-42** Editing the `/etc/vfstab` File to Add the File System Entry

```
# cat >> /etc/vfstab << EOF
# device      device      mount      FS      fsck      mount      mount
# to mount    to fsck     point      type     pass      at boot    options
#
qfsnfs1      -          /global/qfsnfs1  samfs    2         no         sync_meta=1
EOF
```

- c. Ensure that the nodes are configured correctly by mounting and unmounting the file system.

Perform this step one node at a time. In this example, the `qfsnfs1` file system is being mounted and unmounted on one node.

**CODE EXAMPLE 8-43** Validating the Configuration

```
# mount qfsnfs1
# ls /global/qfsnfs1
lost+found/
# umount qfsnfs1
```

---

**Note** – When testing the mount point, use the `metaset -r` (release) and `-t` (take) command to move the `nfsdg` disk group between Sun Cluster nodes. Then use the `samd(1M) config` command to alert the daemon of the configuration changes.

---

6. Use the `scrgadm(1M) -p | egrep` command to validate that the required Sun Cluster resource types have been added to the resource configuration.

```
# scrgadm -p | egrep "SUNW.HAStoragePlus|SUNW.LogicalHostname|SUNW.nfs"
```

If you cannot find a required Sun Cluster resource type, add it with one or more of the following commands.

**CODE EXAMPLE 8-44** Adding the Resource Types to the Resource Configuration

```
# scrgadm -a -t SUNW.HAStoragePlus
# scrgadm -a -t SUNW.LogicalHostname
# scrgadm -a -t SUNW.nfs
```

## ▼ To Configure the Network Name Service and the IPMP Validation Testing

This section provides an example of how to configure the network name service and IPMP validation testing for use with the Sun StorEdge QFS software. For more information, see the *System Administration Guide: IP Services* and the *System Administration Guide: Naming and Directory Services (DNS, NIS, and LDAP)*.

1. Use `vi` or another text editor to edit the `/etc/nsswitch.conf` file so that it looks in the Sun Cluster and files for node names.

Perform this step before you configure the NIS server.

**CODE EXAMPLE 8-45** Editing the /etc/nsswitch File to Look in the Sun Cluster and Files for Node Names

```
# cat /etc/nsswitch.conf
#
# /etc/nsswitch.nis:
#
# An example file that could be copied over to /etc/nsswitch.conf; it
# uses NIS (YP) in conjunction with files.
#
# the following two lines obviate the "+" entry in /etc/passwd and /etc/group.
passwd:    files nis
group:     files nis

# Cluster s/w and local /etc/hosts file take precedence over NIS
hosts:    cluster files nis [NOTFOUND=return]
ipnodes:  files
# Uncomment the following line and comment out the above to resolve
# both IPv4 and IPv6 addresses from the ipnodes databases. Note that
# IPv4 addresses are searched in all of the ipnodes databases before
# searching the hosts databases. Before turning this option on, consult
# the Network Administration Guide for more details on using IPv6.
# ipnodes: nis [NOTFOUND=return] files

networks: nis[NOTFOUND=return] files
protocols: nis [NOTFOUND=return] files
rpc: nis[NOTFOUND=return] files
ethers: nis[NOTFOUND=return] files
netmasks: nis[NOTFOUND=return] files
bootparams: nis[NOTFOUND=return] files
publickey: nis[NOTFOUND=return] files

netgroup: nis

automount: files nis
aliases: files nis
[remainder of file content not shown]
```

**2. Verify that the changes you made to the /etc/nsswitch.conf are correct.**

**CODE EXAMPLE 8-46** Verifying the /etc/nsswitch.conf File Changes

```
# grep '^hosts:' /etc/nsswitch.conf
hosts:    cluster files nis [NOTFOUND=return]
#
```

### 3. Set up IPMP validation testing using available network adapters.

The adapters qfe2 and qfe3 are used in the examples.

#### a. Statically configure the IPMP test address for each adapter.

**CODE EXAMPLE 8-47** Statically Configuring the IPMP Test Address for Each Adapter

```
# cat >> /etc/hosts << EOF
#
# Test addresses for scnode-A
#
192.168.2.2      `uname -n`-qfe2
192.168.2.3      `uname -n`-qfe2-test
192.168.3.2      `uname -n`-qfe3
192.168.3.3      `uname -n`-qfe3-test
#
# Test addresses for scnode-B
#
192.168.2.4      `uname -n`-qfe2
192.168.2.5      `uname -n`-qfe2-test
192.168.3.4      `uname -n`-qfe3
192.168.3.5      `uname -n`-qfe3-test
#
# IP Addresses for LogicalHostnames
#
192.168.2.10     lh-qfs1

EOF
```

#### b. Dynamically configure the IPMP adapters.

**CODE EXAMPLE 8-48** Dynamically Configuring the IPMP Adapters

```
# ifconfig qfe2 plumb `uname -n`-qfe2-test netmask + broadcast + deprecated \
    -failover -standby group ipmp0 up
# ifconfig qfe2 addif `uname -n`-qfe2 up
# ifconfig qfe3 plumb `uname -n`-qfe3-test netmask + broadcast + deprecated \
    -failover -standby group ipmp0 up
# ifconfig qfe3 addif `uname -n`-qfe3 up
```

#### c. Validate the configuration



**CODE EXAMPLE 8-49** Dynamically Configuring the IPMP Adapters

```
# cat > /etc/hostname.qfe2 << EOF
`uname -n`-qfe2-test netmask + broadcast + deprecated -failover -standby \
group ipmp0 up addif `uname -n`-qfe2 up
EOF
# cat > /etc/hostname.qfe3 << EOF
`uname -n`-qfe3-test netmask + broadcast + deprecated -failover -standby \
group ipmp0 up addif `uname -n`-qfe3 up
EOF
```

## ▼ To Configure HA-NFS and the Sun StorEdge QFS File System for High Availability

This section provides an example of how to configure HA-NFS. For more information about HA-NFS, see the *Sun Cluster Data Service for Network File System (NFS) Guide for Solaris OS* and your NFS documentation.

### 1. Create the NFS share point for the Sun StorEdge QFS file system.

Note that the share point is contained within the `/global` file system, not within the Sun StorEdge QFS file system.

**CODE EXAMPLE 8-50** Creating the NFS Share Points for the File Systems

```
# mkdir -p /global/nfs/SUNW.nfs
# echo "share -F nfs -o rw /global/qfsnfs1" > \
/global/nfs/SUNW.nfs/dfstab.nfs1-res
```

### 2. Create the NFS resource group.

```
# scrgadm -a -g nfs-rg -y PathPrefix=/global/nfs
```

### 3. Add a logical host to the NFS resource group.

```
# scrgadm -a -L -g nfs-rg -l lh-nfs1
```

### 4. Configure the `HAStoragePlus` resource type.

**CODE EXAMPLE 8-51** Configuring the `HAStoragePlus` Resource Type

```
# scrgadm -c -g nfs-rg -h scnode-A,scnode-B
# scrgadm -a -g nfs-rg -j qfsnfs1-res -t SUNW.HAStoragePlus \
-x FilesystemMountPoints=/global/qfsnfs1 \
-x FilesystemCheckCommand=/bin/true
```

5. Bring the resource group online.

```
# scswitch -Z -g nfs-rg
```

6. Configure the NFS resource type and set a dependency on the `HAStoragePlus` resource.

**CODE EXAMPLE 8-52** Configuring the NFS Resource Type

```
# scrgadm -a -g nfs-rg -j nfs1-res -t SUNW.nfs -y \  
Resource_dependencies=qfsnfs1-res
```

7. Use the `scswitch(1M) -e -j` command to bring the NFS resource online.

```
# scswitch -e -j nfs1-res
```

The NFS resource `/net/lh-nfs1/global/qfsnfs1` is fully configured and highly available.

8. Before you announce the availability of the highly available NFS file system on the Sun StorEdge QFS file system, ensure that the resource group can be switched between all configured nodes without errors and can be taken online and offline.

**CODE EXAMPLE 8-53** Testing the Resource Group

```
# scswitch -z -g nfs-rg -h scnode-A  
# scswitch -z -g nfs-rg -h scnode-B  
# scswitch -F -g nfs-rg  
# scswitch -Z -g nfs-rg
```

## Example 3

This example shows how to configure the unshared Sun StorEdge QFS file system with HA-NFS on VERITAS Clustered Volume manager-controlled volumes (VxVM volumes). With this configuration, you can choose whether the DID devices are contained on redundant controller-based storage using RAID-1 or RAID-5. Typically, VxVM is used only when the underlying storage is not redundant.

As shown in CODE EXAMPLE 8-1, the DID devices used in this example, `d4` through `d7`, are highly available and are contained on controller-based storage. VxVM requires that shared DID devices be used to populate the raw devices from which VxVM configures volumes. VxVM creates highly available disk groups by

registering the disk groups as Sun Cluster device groups. These disk groups are not globally accessible, but can be failed over, making them accessible to at least one node. The disk groups can be used by the `HAStoragePlus` resource type.

---

**Note** – The VxVM packages are separate, additional packages that must be installed, patched, and licensed. For information about installing VxVM, see the VxVM Volume Manager documentation.

---

To use Sun StorEdge QFS software with VxVM, you must install the following VxVM packages:

- `VRTSvlic`
- `VRTSvmddoc`
- `VRTSvmman`
- `VRTSvmpro`
- `VRTSvxvm`
- `VRTSob` and `VRTSobgui` (optional GUI packages)

This example follows these steps:

1. Configure the VxVM software.
2. Prepare to create an unshared file system.
3. Create the file system and configure the Sun Cluster nodes.
4. Validate the configuration.
5. Configure the network name service and the IPMP validation testing.
6. Configure HA-NFS and configure the file system for high availability.

## ▼ To Configure the VxVM Software

This section provides an example of how to configure the VxVM software for use with the Sun StorEdge QFS software. For more detailed information about the VxVM software, see the VxVM documentation.

1. **Determine the status of DMP (dynamic multipathing) for VERITAS.**

```
# vxddmpadm listctlr all
```

2. **Use the `scdidadm(1M)` utility to determine the HBA controller number of the physical devices to be used by VxVM.**

As shown in the following example, the multi-node accessible storage is available from `scnode-A` using HBA controller `c6`, and from node `scnode-B` using controller `c7`.

**CODE EXAMPLE 8-54** Determining the HBA Controller Number of the Physical Devices

```
# scdidadm -L
[ some output deleted]
4   scnode-A:/dev/dsk/c6t60020F20000037D13E26595500062F06d0 /dev/did/dsk/d4
4   scnode-B:/dev/dsk/c7t60020F20000037D13E26595500062F06d0 /dev/did/dsk/d4
```

3. Use VxVM to configure all available storage as seen through controller c6.

```
# vxddmpadm getsubpaths ctrlr=c6
```

4. Place all of this controller's devices under VxVM control.

```
# vxdiskadd fabric_
```

5. Create a disk group, create volumes, and then start the new disk group.

```
# /usr/sbin/vxdg init qfs-dg qfs-dg00=disk0 \
qfsdg01=disk1 qfsdg02=disk2 qfsdg03=disk3
```

Ensure that the previously started disk group is active on this system.

**CODE EXAMPLE 8-55** Validating that the Disk Group is Active on This System

```
# vxvg import nfsdg
# vxvg free
```

6. Configure two mirrored volumes for Sun StorEdge QFS metadata and two volumes for Sun StorEdge QFS file data volumes.

These mirroring operations are performed as background processes, given the length of time they take to complete.

**CODE EXAMPLE 8-56** Configure Metadata and Data Volumes

```
# vxassist -g nfsdg make m1 10607001b
# vxassist -g nfsdg mirror m1&
# vxassist -g nfsdg make m2 10607001b
# vxassist -g nfsdg mirror m2&
# vxassist -g nfsdg make m10 201529000b
# vxassist -g nfsdg mirror m10&
# vxassist -g nfsdg make m11 201529000b
# vxassist -g nfsdg mirror m11&
```

7. Configure the previously created VxVM disk group as a Sun Cluster-controlled disk group.

```
# scconf -a -D type=vxvm,name=nfsdg,nodelist=scnode-A:scnode-B
```

## ▼ To Prepare to Create a Sun StorEdge QFS File System

Perform this procedure on each node that is a potential host of the file system.

1. Add the Sun StorEdge QFS file system entry to the `mcf` file.

**CODE EXAMPLE 8-57** Addition of the File System to the `mcf` File

```
# cat >> /etc/opt/SUNWsamfs/mcf <<EOF
# Sun StorEdge QFS file system configurations
#
# Equipment      Equipment  Equipment  Family    Device    Additional
# Identifier      Ordinal   Type       Set       State     Parameters
# -----
qfsnfs1          100       ma         qfsnfs1   on
/dev/vx/dsk/nfsdg/m1    101       mm         qfsnfs1
/dev/vx/dsk/nfsdg/m2    102       mm         qfsnfs1
/dev/vx/dsk/nfsdg/m10   103       mr         qfsnfs1
/dev/vx/dsk/nfsdg/m11   104       mr         qfsnds1
EOF
```

For more information about the `mcf` file, see the *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*.

2. Validate that the `mcf` configuration is correct.

```
# /opt/SUNWsamfs/sbin/sam-fsd
```

## ▼ To Create the Sun StorEdge QFS File System and Configure Sun Cluster Nodes

1. On each node that is a potential host of the file system, use the `samd(1M)` `config` command.

This command signals to the Sun StorEdge QFS daemon that a new Sun StorEdge QFS configuration is available.

```
# samd config
```

2. From one node in the Sun Cluster system, use the `sammkfs(1M)` command to

create the Sun StorEdge QFS file system.

```
# sammkfs qfsnfs1 < /dev/null
```

3. On each node that is a potential host of the file system, perform the following:
  - a. Use the **mkdir(1M)** command to create a global mount point for the file system, use the **chmod(1M)** command to make **root** the owner of the mount point, and use the **chown(1M)** command to make the mount point usable by **other** with read/write (755) access.

**CODE EXAMPLE 8-58** Creating a Global Mount Point for the qfsnfs1 File System

```
# mkdir /global/qfsnfs1
# chmod 755 /global/qfsnfs1
# chown root:other /global/qfsnfs1
```

- b. Add the Sun StorEdge QFS file system entry to the **/etc/vfstab** file.

Note that the mount options field contains the **sync\_meta=1** value.

**CODE EXAMPLE 8-59** Adding the File System Entry to the **/etc/vfstab** File

```
# cat >> /etc/vfstab << EOF
# device      device      mount      FS      fsck      mount      mount
# to mount    to fsck    point      type     pass     at boot    options
#
qfsnfs1      -        /global/qfsnfs1  samfs    2         no        sync_meta=1
EOF
```

## ▼ To Validate the Configuration

1. Validate that all nodes that are potential hosts of the file system are configured correctly.

To do this, move the disk group that you created in “To Configure the VxVM Software” on page 287 to the node, and mount and then unmount the file system. Perform this validation one node at a time.

**CODE EXAMPLE 8-60** Validating the Configuration

```
# scswitch -z -D nfsdg -h scnode-B
# mount qfsnfs1
# ls /global/qfsnfs1
lost+found/
# umount qfsnfs1
```

2. Ensure that the required Sun Cluster resource types have been added to the

resource configuration.

```
# scrgadm -p | egrep "SUNW.HAStoragePlus|SUNW.LogicalHostname|SUNW.nfs"
```

If you cannot find a required Sun Cluster resource type, add it with one or more of the following commands.

**CODE EXAMPLE 8-61** Adding Sun Cluster Resources to the Resource Configuration

```
# scrgadm -a -t SUNW.HAStoragePlus
# scrgadm -a -t SUNW.LogicalHostname
# scrgadm -a -t SUNW.nfs
```

## ▼ To Configure the Network Name Service and the IPMP Validation Testing

This section provides an example of how to configure the network name service and the IPMP validation testing. For more information, see the *Sun Cluster Software Installation Guide for Solaris OS*.

1. Use **vi** or another text editor to edit the `/etc/nsswitch.conf` file so that it looks in the Sun Cluster and files for node names.

Perform this step before you configure the NIS server.

**CODE EXAMPLE 8-62** Editing the /etc/nsswitch File to Look in the Sun Cluster and Files for Node Names

```
# cat /etc/nsswitch.conf
#
# /etc/nsswitch.nis:
#
# An example file that could be copied over to /etc/nsswitch.conf; it
# uses NIS (YP) in conjunction with files.
#
# the following two lines obviate the "+" entry in /etc/passwd and /etc/group.
passwd:    files nis
group:     files nis

# Cluster s/w and local /etc/hosts file take precedence over NIS
hosts:     cluster files nis [NOTFOUND=return]
ipnodes:   files
# Uncomment the following line and comment out the above to resolve
# both IPv4 and IPv6 addresses from the ipnodes databases. Note that
# IPv4 addresses are searched in all of the ipnodes databases before
# searching the hosts databases. Before turning this option on, consult
# the Network Administration Guide for more details on using IPv6.
# ipnodes: nis [NOTFOUND=return] files

networks:  nis[NOTFOUND=return] files
protocols: nis [NOTFOUND=return] files
rpc:       nis[NOTFOUND=return] files
ethers:    nis[NOTFOUND=return] files
netmasks: nis[NOTFOUND=return] files
bootparams: nis[NOTFOUND=return] files
publickey: nis[NOTFOUND=return] files

netgroup:  nis

automount: files nis
aliases:   files nis
[remainder of file content not shown]
```

**2. Verify that the changes you made to the /etc/nsswitch.conf are correct.**

**CODE EXAMPLE 8-63** Verifying the /etc/nsswitch.conf File Changes

```
# grep '^hosts:' /etc/nsswitch.conf
hosts:    cluster files nis [NOTFOUND=return]
#
```



### 3. Set up IPMP validation testing using available network adapters.

The adapters qfe2 and qfe3 are used as examples.

#### a. Statically configure IPMP test address for each adapter.

**CODE EXAMPLE 8-64** Statically Configuring the IPMP Test Address for Each Adapter

```
# cat >> /etc/hosts << EOF
#
# Test addresses for scnode-A
#
192.168.2.2      `uname -n`-qfe2
192.168.2.3      `uname -n`-qfe2-test
192.168.3.2      `uname -n`-qfe3
192.168.3.3      `uname -n`-qfe3-test
#
# Test addresses for scnode-B
#
192.168.2.4      `uname -n`-qfe2
192.168.2.5      `uname -n`-qfe2-test
192.168.3.4      `uname -n`-qfe3
192.168.3.5      `uname -n`-qfe3-test
#
# IP Addresses for LogicalHostnames
#
192.168.2.10     lh-qfs1
EOF
```

#### b. Dynamically configure IPMP adapters.

**CODE EXAMPLE 8-65** Dynamically Configuring the IPMP Adapters

```
# ifconfig qfe2 plumb `uname -n`-qfe2-test netmask + broadcast + deprecated \
    -failover -standby group ipmp0 up
# ifconfig qfe2 addif `uname -n`-qfe2 up
# ifconfig qfe3 plumb `uname -n`-qfe3-test netmask + broadcast + deprecated \
    -failover -standby group ipmp0 up
# ifconfig qfe3 addif `uname -n`-qfe3 up
```

#### c. Validate the configuration.

#### CODE EXAMPLE 8-66 Validating the IPMP Configuration

```
# cat > /etc/hostname.qfe2 << EOF
`uname -n`-qfe2-test netmask + broadcast + deprecated -failover -standby \
group ipmp0 up addif `uname -n`-qfe2 up
EOF

# cat > /etc/hostname.qfe3 << EOF
`uname -n`-qfe3-test netmask + broadcast + deprecated -failover -standby \
group ipmp0 up addif `uname -n`-qfe3 up
EOF
```

### ▼ To Configure HA-NFS and the Sun StorEdge QFS File System for High Availability

This section provides an example of how to configure HA-NFS. For more information about HA-NFS, see the *Sun Cluster Data Service for Network File System (NFS) Guide for Solaris OS* and your NFS documentation.

1. On each node that is a potential host of the file system, create the NFS share point for the Sun StorEdge QFS file system.

Note that the share point is contained within the /global file system, not within the Sun StorEdge QFS file system.

#### CODE EXAMPLE 8-67 Creating the NFS Share Point for the File System

```
# mkdir -p /global/qfsnfs1/SUNW.nfs
# echo "share -F nfs -o rw /global/qfsnfs1" > \
/global/qfsnfs1/SUNW.nfs/dfstab.nfs1-res
```

2. From one node in the Sun Cluster system, create the NFS resource group.

```
# scrgadm -a -g nfs-rg -y PathPrefix=/global/nfs
```

3. Add a logical host to the NFS resource group.

```
# scrgadm -a -L -g nfs-rg -l lh-nfs1
```

4. Configure the `HASStoragePlus` resource type.

**CODE EXAMPLE 8-68** Configuring the `HASStoragePlus` Resource Type

```
# scrgadm -c -g nfs-rg -h scnode-A,scnode-B
# scrgadm -a -g nfs-rg -j qfsnfs1-res -t SUNW.HASStoragePlus \
  -x FilesystemMountPoints=/global/qfsnfs1 \
  -x FilesystemCheckCommand=/bin/true
```

5. Bring the resource group online.

```
# scswitch -Z -g nfs-rg
```

6. Configure the NFS resource type and set a dependency on the `HASStoragePlus` resource.

```
# scrgadm -a -g nfs-rg -j nfs1-res -t SUNW.nfs -y \
  Resource_dependencies=qfsnfs1-res
```

7. Bring the NFS resource online.

```
# scswitch -e -j nfs1-res
```

The NFS resources `/net/lh-nfs1/global/qfsnfs1` is fully configured and highly available.

8. Before you announce the availability of the highly available NFS file system on the Sun StorEdge QFS file system, validate that the resource group can be switched between all configured nodes without errors and taken online and offline.

**CODE EXAMPLE 8-69** Testing the Resource Group

```
# scswitch -z -g nfs-rg -h scnode-A
# scswitch -z -g nfs-rg -h scnode-B
# scswitch -F -g nfs-rg
# scswitch -Z -g nfs-rg
```

---

# Changing the Sun StorEdge QFS Configuration

This section demonstrates how to make changes to, disable, or remove the Sun StorEdge QFS shared or unshared file system configuration. It contains the following sections:

- “To Change the Shared File System Configuration” on page 296
- “To Disable HA-NFS on a File System That Uses Raw Global Devices” on page 297
- “To Disable HA-NFS on a File System That Uses Solaris Volume Manager-Controlled Volumes” on page 298
- “To Disable HA-NFS on a Sun StorEdge QFS File System That Uses VxVM-Controlled Volumes” on page 300

## ▼ To Change the Shared File System Configuration

This procedure is based on the example in “Example Configuration” on page 259.

1. **Log into each node as the `oracle` user and shut down the database instance and stop the listener.**

**CODE EXAMPLE 8-70** Shutting Down the Database Instance and Listener

```
$ sqlplus "/as sysdba"
SQL > shutdown immediate
SQL > exit
$ lsnrctl stop listener
```

2. **Log into the metadata server as `superuser` and bring the metadata server resource group into the unmanaged state.**

**CODE EXAMPLE 8-71** Bringing the Resource Group Into an Unmanaged State

```
# scswitch -F -g qfs-rg
# scswitch -u -g qfs-rg
```

At this point, the shared file systems are unmounted on all nodes. You can now apply any changes to the file systems’ configuration, mount options, and so on. You can also re-create the file systems, if necessary. To use the file systems again after recreating them, follow the steps in “Example Configuration” on page 259.

If you want to make changes to the metadata server resource group configuration or

to the Sun StorEdge QFS software (For example, you might need to upgrade to new packages.), continue to Step 3.

3. As superuser, remove the resource, the resource group, and the resource type, and verify that everything is removed.

**CODE EXAMPLE 8-72** Disabling Resource Groups

```
# scswitch -n -j qfs-res
# scswitch -r -j qfs-res
# scrgadm -r -g qfs-rg
# scrgadm -r -t SUNW.qfs
# scstat
```

At this point, you can re-create the resource group to define different names, node lists, and so on. You can also remove or upgrade the Sun StorEdge QFS shared software, if necessary. After the new software is installed, the metadata resource group and the resource can be recreated and can be brought online.

## ▼ To Disable HA-NFS on a File System That Uses Raw Global Devices

Use this procedure to disable HA-NFS on an unshared Sun StorEdge QFS file system that is using raw global devices. This example procedure is based on “Example 1” on page 268.

1. Use the `scswitch(1M) -F -g` command to take the resource group offline.

```
# scswitch -F -g nfs-rg
```

2. Disable the NFS, Sun StorEdge QFS, and LogicalHost resource types.

**CODE EXAMPLE 8-73** Disabling the Resource Types

```
# scswitch -n -j nfs1-res
# scswitch -n -j qfsnfs1-res
# scswitch -n -j lh-nfs1
```

3. Remove the previously configured resources.

**CODE EXAMPLE 8-74** Removing the Resources

```
# scrgadm -r -j nfs1-res
# scrgadm -r -j qfsnfs1-res
# scrgadm -r -j lh-nfs1
```

4. Remove the previously configured resource group.

```
# scrgadm -r -g nfs-rg
```

5. Clean up the NFS configuration directories.

```
# rm -fr /global/nfs
```

6. Disable the resource types used, if they were previously added and are no longer needed.

**CODE EXAMPLE 8-75** Disabling the Resource Types That are no Longer Needed

```
# scrgadm -r -t SUNW.HAStoragePlus
# scrgadm -r -t SUNW.LogicalHostname
# scrgadm -r -t SUNW.nfs
```

## ▼ To Disable HA-NFS on a File System That Uses Solaris Volume Manager-Controlled Volumes

Use this procedure to disable HA-NFS on an unshared Sun StorEdge QFS file system that is using Solstice DiskSuite/Solaris Volume Manager-controlled volumes. This example procedure is based on “Example 2” on page 277.

1. Take the resource group offline.

```
# scswitch -F -g nfs-rg
```

2. Disable the NFS, Sun StorEdge QFS, and LogicalHost resources types

**CODE EXAMPLE 8-76** Disabling the Resource Types

```
# scswitch -n -j nfs1-res
# scswitch -n -j qfsnfs1-res
# scswitch -n -j lh-nfs1
```

3. Remove the previously configured resources.

CODE EXAMPLE 8-77 Removing the Previously Configured Resources

```
# scrgadm -r -j nfs1-res
# scrgadm -r -j qfsnfs1-res
# scrgadm -r -j lh-nfs1
```

4. Remove the previously configured resource group.

```
# scrgadm -r -g nfs-rg
```

5. Clean up the NFS configuration directories.

```
# rm -fr /global/nfs
```

6. Disable the resource types used, if they were previously added and are no longer needed.

CODE EXAMPLE 8-78 Disabling the Resource Types

```
# scrgadm -r -t SUNW.HAStoragePlus
# scrgadm -r -t SUNW.LogicalHostname
# scrgadm -r -t SUNW.nfs
```

7. Delete RAID-5 and RAID-1 sets.

CODE EXAMPLE 8-79 Deleting the RAID-5 and RAID-1 Sets

```
# metaclear -s nfsdg -f d30 d20 d21 d22 d23 d11 d1 d2 d3 d4
```

8. Remove mediation detection of drive errors.

CODE EXAMPLE 8-80 Removing the Mediation Detection of Drive Errors

```
# metaset -s nfsdg -d -m scnode-A
# metaset -s nfsdg -d -m scnode-B
```

9. Remove the shared DID devices from the `nfsdg` disk group.

```
# metaset -s nfsdg -d -f /dev/did/dsk/d4 /dev/did/dsk/d5 \
    /dev/did/dsk/d6 /dev/did/dsk/d7
```

10. Remove the configuration of disk group `nfsdg` across nodes in the Sun Cluster

system.

```
# metaset -s nfsdg -d -f -h scnode-A scnode-B
```

11. Delete the metadatabase, if it is no longer needed.

**CODE EXAMPLE 8-81** Deleting the Metadatabase

```
# metadb -d -f /dev/dsk/c0t0d0s7
# metadb -d -f /dev/dsk/c1t0d0s7
# metadb -d -f /dev/dsk/c2t0d0s7
```

## ▼ To Disable HA-NFS on a Sun StorEdge QFS File System That Uses VxVM-Controlled Volumes

Use this procedure to disable HA-NFS on an unshared Sun StorEdge QFS file system that is using VxVM-controlled volumes. This example procedure is based on “Example 3” on page 286.

1. Take the resource group offline.

```
# scswitch -F -g nfs-rg
```

2. Disable the NFS, Sun StorEdge QFS, and LogicalHost resources types.

**CODE EXAMPLE 8-82** Disabling the Resource Types

```
# scswitch -n -j nfs1-res
# scswitch -n -j qfsnfs1-res
# scswitch -n -j lh-nfs1
```

3. Remove the previously configured resources.

**CODE EXAMPLE 8-83** Removing the Resources

```
# scrgadm -r -j nfs1-res
# scrgadm -r -j qfsnfs1-res
# scrgadm -r -j lh-nfs1
```

4. Remove the previously configured resource group.

```
# scrgadm -r -g nfs-rg
```



5. Clean up the NFS configuration directories.

```
# rm -fr /global/nfs
```

6. Disable the resource types used, if they were previously added and are no longer needed.

**CODE EXAMPLE 8-84** Disabling the Resource Types That are no Longer Needed

```
# scrgadm -r -t SUNW.HAStoragePlus
# scrgadm -r -t SUNW.LogicalHostname
# scrgadm -r -t SUNW.nfs
```

7. Delete the subdisk.

```
# vxdg destroy nfsdg
```

8. Remove the VxVM devices.

```
# vxdisk rm fabric_0 fabric_1 fabric_2 fabric_3 fabric_4
```



## Advanced Topics

---

This chapter discusses advanced topics that are beyond the scope of basic system administration and usage. This chapter contains the following sections:

- “Daemons, Processes, and Tracing” on page 303
- “Using the `setfa(1)` Command to Set File Attributes” on page 307
- “WORM File Systems” on page 310
- “Accommodating Large Files” on page 325
- “Multireader File System” on page 325
- “Using the SAN-QFS File System in a Heterogeneous Computing Environment” on page 327
- “I/O Performance” on page 336
- “Increasing Large File Transfer Performance” on page 337
- “Qwrite” on page 341
- “Setting the Write Throttle” on page 342
- “Setting the Flush-Behind Rate” on page 342

---

## Daemons, Processes, and Tracing

It is useful to have an understanding of system daemons and processes when you are debugging. This section describes the Sun StorEdge QFS and Sun StorEdge SAM-FS daemons and processes. It also provides information about daemon tracing.

### Daemons and Processes

All Sun StorEdge QFS and Sun StorEdge SAM-FS daemons are named in the form `sam-daemon_named`, which is `sam-`, followed by the daemon name, and followed by the lowercase letter `d`. This convention allows the daemons to be identified easily. Processes are named in a similar manner; the difference is that they do not end in the

lowercase letter d. TABLE 9-1 shows some of the daemons and processes that can be running on your system (others, such as `sam-genericd` and `sam-catserverd`, might also be running depending on system activities).

**TABLE 9-1** Daemons and Processes

Process	Description
<code>sam-archiverd</code>	Automatically archives Sun StorEdge SAM-FS files. This process runs as long as the Sun StorEdge SAM-FS file system is mounted.
<code>sam-fsd</code>	Master daemon.
<code>sam-rftd</code>	Transfers data between multiple Sun StorEdge SAM-FS host systems.
<code>sam-robotd</code>	Starts and monitors automated library media changer control daemons.
<code>sam-scannerd</code>	Monitors all manually mounted removable media devices. The scanner periodically checks each device for inserted archive media cartridges.
<code>sam-sharefsd</code>	Invokes the Sun StorEdge QFS shared file system daemon.
<code>sam-releaser</code>	Attempts to release disk space occupied by previously archived files on Sun StorEdge SAM-FS file systems until a low water mark is reached. The releaser is started automatically when a high water mark is reached on disk cache and stops when it has finished releasing files. This is a process, not a daemon.
<code>sam-stagealld</code>	Controls the associative staging of Sun StorEdge SAM-FS files.
<code>sam-stagerd</code>	Controls the staging of Sun StorEdge SAM-FS files.
<code>sam-rpcd</code>	Controls the remote procedure call (RPC) application programming interface (API) server process.

When running Sun StorEdge QFS or Sun StorEdge SAM-FS software, `init` starts the `sam-fsd` daemon as part of `/etc/inittab` processing. It is started at `init` levels 0, 2, 3, 4, 5, and 6. It should restart automatically in case of kill or failure.

When running Sun StorEdge SAM-FS software, the `sam-fsd` daemon creates the following processes:

- `sam-archiverd`. The `sam-archiverd` daemon starts the `sam-arcopy` and the `sam-arfind` processes.
- `sam-catserverd`. Issuing a `samd(1M) stop` command stops this daemon.
- `sam-rftd`.
- `sam-initd`.
- `sam-robotd`. Issuing a `samd(1M) stop` command stops this daemon.
- `sam-scannerd`. Issuing a `samd(1M) stop` command stops this daemon.
- `sam-sharefsd`. One process is created for each Sun StorEdge QFS shared file system.

- `sam-stagealld`.
- `sam-stagerd`.

## Trace Files

Several Sun StorEdge QFS and Sun StorEdge SAM-FS processes can write messages to trace files. These messages contain information about the state and progress of the work performed by the daemons. The messages are primarily used by Sun Microsystems staff members to improve performance and diagnose problems. The message content and format are subject to change from release to release.

Trace files can be used in debugging. By default, trace files are not enabled. You can enable trace files for Sun StorEdge SAM-FS software by editing the `defaults.conf` file. You can enable tracing for all processes, or you can enable tracing for individual processes. For information about the processes that you can trace, see the `defaults.conf(4)` man page.

By default, the trace files are written to the `/var/opt/SUNWsamfs/trace` directory. In that directory, the trace files are named for the processes (`archiver`, `catserver`, `fsd`, `ftpd`, `recycler`, `sharefsd`, and `stager`). You can change the names of the trace files by specifying directives in the `defaults.conf` configuration file. You can also set a limit on the size of a trace file and rotate your tracing logs. For information about controlling tracing, see the `defaults.conf(4)` man page.

## Trace File Content

Trace file messages contain the time and source of the message. The messages are produced by events in the processes. You can select the events by using directives in the `defaults.conf` file.

The default events are as follows:

- Customer notification `syslog` or `notify` file messages
- Nonfatal program errors
- Fatal `syslog` messages
- Process initiation and completion
- Other miscellaneous events

You can also trace the following events:

- Memory allocations
- Interprocess communication
- File actions
- Operator messages
- Queue contents when changed
- Other miscellaneous events

The default message elements (program name, process id (PID), and time) are always included and cannot be excluded. Optionally, the messages can also contain the following elements:

- The date. (The time is always included.)
- The source file name and line number.
- The event type.

## Trace File Rotation

To prevent the trace files from growing indefinitely, the `sam-fsd` daemon monitors the size of the trace files and periodically executes the following command:

```
/opt/SUNWsamfs/sbin/trace_rotate
```

This script moves the trace files to sequentially numbered copies. You can modify this script to suit your operation. Alternatively, you can provide this function using `cron(1)` or some other facility.

## Determining Which Processes Are Being Traced

To determine which processes are being traced currently, enter the `sam-fsd(1M)` command at the command line. CODE EXAMPLE 9-1 shows the output from this command.

**CODE EXAMPLE 9-1** `sam-fsd(1M)` Command Output

```
# sam-fsd
Trace file controls:
sam-amld      /var/opt/SUNWsamfs/trace/sam-amld
               cust err fatal misc proc date
               size    0    age 0
sam-archiverd /var/opt/SUNWsamfs/trace/sam-archiverd
               cust err fatal misc proc date
               size    0    age 0
sam-catserverd /var/opt/SUNWsamfs/trace/sam-catserverd
               cust err fatal misc proc date
               size    0    age 0
sam-fsd       /var/opt/SUNWsamfs/trace/sam-fsd
               cust err fatal misc proc date
               size    0    age 0
sam-rftd      /var/opt/SUNWsamfs/trace/sam-rftd
               cust err fatal misc proc date
               size    0    age 0
sam-recycler  /var/opt/SUNWsamfs/trace/sam-recycler
```

**CODE EXAMPLE 9-1** `sam-fsd(1M)` Command Output (*Continued*)

```

                                cust err fatal misc proc date
                                size    0    age 0
sam-sharefsd /var/opt/SUNWsamfs/trace/sam-sharefsd
                                cust err fatal misc proc date
                                size    0    age 0
sam-stagerd  /var/opt/SUNWsamfs/trace/sam-stagerd
                                cust err fatal misc proc date
                                size    0    age 0
sam-serverd  /var/opt/SUNWsamfs/trace/sam-serverd
                                cust err fatal misc proc date
                                size    0    age 0
sam-clientd  /var/opt/SUNWsamfs/trace/sam-clientd
                                cust err fatal misc proc date
                                size    0    age 0
sam-mgmt     /var/opt/SUNWsamfs/trace/sam-mgmt
                                cust err fatal misc proc date
                                size    0    age 0
License: License never expires.
```

For more information about enabling trace files, see the `defaults.conf(4)` man page and the `sam-fsd(1M)` man page.

---

## Using the `setfa(1)` Command to Set File Attributes

The Sun StorEdge QFS and Sun StorEdge SAM-FS file systems allow end users to set performance attributes for files and directories. Applications can enable these performance features on a per-file or per-directory basis. The following sections describe how the application programmer can use these features to select file attributes for files and directories, to preallocate file space, to specify the allocation method for the file, and to specify the disk stripe width.

For more information about implementing the features described in the following subsections, see the `setfa(1)` man page.

### Selecting File Attributes for Files and Directories

File attributes are set using the `setfa(1)` command. The `setfa(1)` command sets attributes on a new or existing file. The file is created if it does not already exist.

You can set attributes on a directory as well as a file. When using `setfa(1)` with a directory, files and directories created within that directory inherit the attributes set in the original directory. To reset attributes on a file or directory to the default, use the `-d` (default) option. When the `-d` option is used, attributes are first reset to the default and then other attributes are processed.

## Preallocating File Space

An end user can preallocate space for a file. This space is associated with a file so that no other files in the file system can use the disk addresses allocated to this file. Preallocation ensures that space is available for a given file, which avoids a file system full condition. Preallocation is assigned at the time of the request rather than when the data is actually written to disk.

Note that space can be wasted when preallocating files. If the file size is less than the allocation amount, the kernel allocates space to the file from the current file size up to the allocation amount. When the file is closed, space below the allocation amount is not freed.

You can preallocate space for a file by using the `setfa(1)` command with either the `-L` or the `-l` (lowercase letter L) options. Both options accept a file length as their argument. You can use the `-L` option for an existing file, and that file either can be empty or it can contain data. Use the `-l` option for a file that has no data yet. If you use the `-l` option, the file cannot grow beyond its preallocated limit.

For example, to preallocate a 1-gigabyte file named `/qfs/file_alloc`, type the following:

```
# setfa -l 1g /qfs/file_alloc
```

After space for a file has been preallocated, truncating a file to 0 length or removing the file returns all space allocated for a file. There is no way to return only part of a file's preallocated space to the file system. In addition, if a file is preallocated in this manner, there is no way to extend the file beyond its preallocated size in future operations.



# Selecting a File Allocation Method and Stripe Width

By default, a file created uses the allocation method and stripe width specified at mount time (see the `mount_samfs(1M)` man page). However, an end user might want to use a different allocation scheme for a file or directory of files, and this can be accomplished by using the `setfa(1)` command with the `-s` (stripe) option.

The allocation method can be either round-robin or striped. The `-s` option determines the allocation method and the stripe width, and TABLE 9-2 shows the effect of this option.

**TABLE 9-2** File Allocations and Stripe Widths

<i>-s stripe</i>	Allocation Method	Stripe Width	Explanation
0	Round-robin	n/a	The file is allocated on one device until that device has no space.
1-255	Striped	1-255 DAUs	The file stripes across all disk devices with this number of DAUs per disk.

The following example shows how to create a file explicitly by specifying a round-robin allocation method:

```
# setfa -s 0 /qfs/100MB.rrobin
```

The following example shows how to create a file explicitly by specifying a striped allocation method with a stripe width of 64 DAUs (preallocation is not used):

```
# setfa -s 64 /qfs/file.stripe
```

## Selecting a Striped Group Device

Striped group devices are supported for Sun StorEdge QFS file systems only.

A user can specify that a file begin allocation on a particular striped group. If the file allocation method is round-robin, the file is allocated on the designated stripe group.

CODE EXAMPLE 9-2 shows `setfa(1)` commands that specify that `file1` and `file2` be independently spread across two different striped groups.

**CODE EXAMPLE 9-2** `setfa(1)` Commands to Spread Files Across Striped Groups

```
# setfa -g0 -s0 file1
# setfa -g1 -s0 file2
```

This capability is particularly important for applications that must achieve levels of performance that approach raw device speeds. For more information, see the `setfa(1)` man page.

---

## WORM File Systems

Write Once Read Many (WORM) technology is used in many applications because of the integrity of the data and the accepted legal admissibility of stored files that use the technology. Beginning with release 4, update 3, of the Sun StorEdge QFS software, a WORM feature is available as an add-on Sun StorEdge QFS package called `SUNWsamfswm`.

---

**Note** – The WORM feature is licensed separately from the Sun StorEdge QFS file system. Contact your local Sun sales representative for information about obtaining the WORM package.

---

The WORM feature offers default and customizable file-retention periods, data and path immutability, and subdirectory inheritance of the WORM setting.

## Enabling the WORM Feature

Use the `worm_capable` mount option to enable the WORM feature. This option can be placed in `/etc/vfstab` or typed on the command line when the file system is mounted. The `worm_capable` attribute is stored in the mount table and enables WORM files to be created in directories anywhere in the file system.

---

**Note** – You must have system administration privileges to set the `worm_capable` mount option in `/etc/vfstab`.

---

After the WORM feature has been enabled, the file system's superblock is updated to reflect the WORM capability. Any subsequent attempt to rebuild the file system through `sammkfs` will fail.

---

**Note** – Use care when applying the WORM option, because the file data and path cannot be changed after the files have the WORM feature applied. Once this feature is applied to a file, it is irrevocable.

---

The `worm_capable` mount option enables a file system to contain WORM files, but it does not automatically create WORM files. To create a WORM file, you must first make the directory that contains the file WORM capable. To do this, create an ordinary directory and then use the `ssum` utility with the `-w` option to set the WORM bit on the directory. The directory can now contain WORM files.

After setting the `worm_capable` attribute on a parent directory, you can use the `ssum` utility with the `-w` option to set the WORM bit on files in that directory. A WORM, or *retained*, file is created and populated like a normal file.

The WORM feature also includes file-retention periods that can be customized. Assigning a retention period to a file maintains the WORM features in that file for the specified period of time. Do one of the following to set a retention period for a file:

- Use the `-e` option with `ssum` when setting the WORM bit on a file.

The `ssum` utility is used both to set the WORM feature on a directory and to set the retention period on a file. The granularity of a file's retention period is in minutes.
- Use the `def_retention` mount option to set a default retention period.
- Use the system-wide default retention period of 30 days.

With the addition of the WORM feature, three states are possible for a file in a Sun StorEdge QFS file system:

- Normal
- Retained
- Expired

The normal state represents the state of an ordinary file in Sun StorEdge SAM-QFS. A transition to the retained, or *active*, state occurs when the WORM bit is set on a file with the `ssum` utility. The expired, or *over*, state occurs when the file's retention period is exceeded.

When the WORM bit is set on a file and a retention period is assigned, the file's path and data are immutable. When the retention period expires, the state is changed to "expired" but the path and data remain immutable.

When a file is in an expired state, only two operations are available:

- Extension of the retention period (The retention period can never be shortened.)
- Deletion of the file

If the retention period is extended, the file's state returns to "active" and the new end date and duration are set accordingly.

Both hard and soft links to files can be used with the WORM feature. Hard links can be established only with files that reside in a WORM-capable directory. After a hard link is created, it has the same WORM characteristics as the original file. Soft links can also be established, but a soft link cannot use the WORM features. Therefore, soft links to WORM files can be created in any directory in the Sun StorEdge SAM-QFS file system.

Another attribute of the WORM feature is directory inheritance. New directories that are created under a directory that includes the `worm_capable` attribute inherit this attribute from their parent. The WORM bit can be set on any file whose parent directory is WORM-capable. Ordinary users can set the WORM feature on directories and files that they own or have access to by using normal UNIX permissions.

---

**Note** – If a WORM-capable directory contains no WORM files, it can be deleted.

---

## Using the `ssum` Utility

The `ssum` utility can be used to set the WORM bit and the retention period on a file. The WORM-specific `ssum` options are as follows:

- w**      Sets the WORM bit of the file or directory. After it is set, this bit cannot be cleared. When you use this option on a directory, you enable the directory to contain WORM files. When you use this option on a file, the file is retained for a given period.

You can use the `-w` and `-e` options simultaneously.

- e**      Sets the retention period for a file. The retention period is specified as the period from the current date forward and consists of the string `MyNdOhPm`, where `M`, `N`, `O`, and `P` are arbitrary non-negative integers. The characters `y`, `d`, `h`, and `m` represent the number of years, days, hours, and minutes, respectively, for which the file is to be retained. To retain a file permanently, use a value of 0 minutes. Partial string values such as `460d`, which represents 460 days, are acceptable. After a retention period is set, it can only be extended, not shortened.

You can use the `-w` and `-e` options simultaneously.

- y Specifies that the user will not be prompted for confirmation when setting the WORM bit for a file or directory, or setting or extending the retention period for a file.

## Using `sls` to View WORM Files

Use the `sls` command to view WORM file attributes. The `-D` option shows whether a directory is WORM-capable. Use this option on a file to display when the retention period began, when it will end, the current retention state, and the duration as specified on the command line.

The retention start period is stored in the file's `changed` attribute field. The end of the retention period is stored in the file's `retention-end` attribute field. This time is displayed as a calendar date. An additional line in the `sls` output shows the retention period state and duration.

The following is an example of how `sls -D` displays a file's retention status:

```
sls -D test

test:
mode: -r--r--r--  links:    1  owner: root group: other
length: 5  admin id: 0  inode: 1027.1
access: Oct 30 01:35  modification: Oct 30 01:35
changed: Oct 30 01:44  retention-end: Apr 2 2006 08:56
creation: Oct 30 01:35  residence: Oct 30 01:35
retention: active retention-period: 0y, 154d, 7h, 12m
checksum: gen  no_use  not_val  algo: 0
```

In this example, the retention state is active, as shown by the `retention: active` designation, meaning that the file has the WORM bit set. The retention period started on Oct 30 01:44 and will end on Apr 2 2006 08:56. The retention period was specified to be 0 years, 154 days, 7 hours, and 12 minutes.

## Using `sfind` to Find WORM Files

Use the `sfind` utility to search for files that have certain retention periods. Six `sfind` options are available for these searches:

- ractive Finds files whose retention period is active.
- rover Finds files whose retention period has expired.

<code>-rafter date</code>	Finds files whose retention period will end after the specified date. The date is specified as <code>YYYYMMDDHHmm</code> , where <code>YYYY</code> is the year, <code>MM</code> is the month, <code>DD</code> is the day, <code>HH</code> is the hour, and <code>mm</code> is minutes.
<code>-rremain time</code>	Finds files that have retention periods with at least the specified amount of time left. The time is specified as <code>MyNdOhPm</code> , where <code>M</code> , <code>N</code> , <code>O</code> , and <code>P</code> are arbitrary non-negative integers and <code>y</code> , <code>d</code> , <code>h</code> , and <code>m</code> represent the number of years, days, hours, and minutes, respectively.
<code>-rlonger time</code>	Finds files that have retention periods longer than the specified amount of time. The time is specified as <code>MyNdOhPm</code> , where <code>M</code> , <code>N</code> , <code>O</code> , and <code>P</code> are arbitrary non-negative integers and <code>y</code> , <code>d</code> , <code>h</code> , and <code>m</code> represent the number of years, days, hours, and minutes, respectively.
<code>-rpermanent</code>	Finds files whose retention period is permanent.

## WORM Examples

This section presents some examples that show how to set up and use the new WORM feature of the Sun StorEdge QFS product.

### Mount Options

This example shows the two WORM mount options. The file system `samfs1` mounted at `/samfs1` is WORM-capable and has the default retention period for files set to 60 minutes.

```
root@ns-east-155]# cat /etc/vfstab
```

#device	device	mount	FS	fsck	mount	mount
#to mount	to	fsck	point	type	pass	at boot options
#						
fd	-		/dev/fd	fd	-	no -
/proc	-		/proc	proc	-	no -
/dev/dsk/c0t0d0s1-	-		-	swap	-	no -
/dev/dsk/c0t0d0s0	/dev/rdisk/c0t0d0s0		/ufs	1	no	-
samfs1	-		/samfs1	samfs	-	yes
worm_capable,def_retention=60,bg						
swap	-		/tmp	tmpfs	-	yes -

## Creation of a WORM-Capable Directory

This example shows the mounting of the file system, creation of a WORM-capable directory, and use of the `sls` command to display the directory.

```
[root@ns-east-155]# mount samfs1
[root@ns-east-155]# cd /samfs1
[root@ns-east-155]# ls
lost+found/
[root@ns-east-155]# mkdir WORM
[root@ns-east-155]# ssum -w WORM
[root@ns-east-155]# sls -D
WORM:
  mode: drwxr-xr-x  links: 2  owner: root group: other
  length: 4096  admin id: 0  inode: 1026.1
  access: Oct 30 02:49  modification: Oct 30 02:49
  changed: Oct 30 02:49  attributes: Oct 30 02:49
  creation: Oct 30 02:49  residence: Oct 30 02:49
  worm-capable
  checksum: gen  no_use  not_val  algo: 0

lost+found:
  mode: drwx-----  links: 2  owner: root group: root
  length: 16384  admin id: 0  inode: 6.6
  access: Oct 30 02:47  modification: Oct 30 02:47
  changed: Oct 30 02:47  attributes: none
  creation: Oct 30 02:47  residence: Oct 30 02:47
```

## WORM Directory Inheritance

This example illustrates subdirectories' inheritance of the WORM feature.

```
[root@ns-east-155]# pwd
/samfs1/WORM
[root@ns-east-155]# mkdir next
[root@ns-east-155]# sls -D
next:
mode: drwxr-xr-x  links: 2  owner: root group: other
length: 4096  admin id: 0  inode: 1028.1
access: Dec 24 14:16  modification: Dec 24 14:16
changed: Dec 24 14:16  attributes: Dec 24 14:16
creation: Dec 24 14:16  residence: Dec 24 14:16
worm-capable
checksum: gen  no_use  not_val  algo: 0
```



## Creation of a WORM File

This example shows the creation of a file in the WORM-capable directory, setting of the WORM bit on the file, and use of the `sls` command to display the file's WORM features. This example does not use the `ssum -e` option to set the expiration date. Therefore, the file inherits the default retention period of the file system (60 minutes, or 1 hour).

```
[root@ns-east-155]# cd WORM
[root@ns-east-155]# echo "This is a test file" >> test
[root@ns-east-155]# sls -D
test:
mode: -rw-r--r--  links: 1  owner: root group: other
length: 20  admin id: 0  inode: 1027.1
access: Oct 30 02:50  modification: Oct 30 02:50
changed: Oct 30 02:50  attributes: Oct 30 02:50
creation: Oct 30 02:50  residence: Oct 30 02:50

checksum: gen  no_use  not_val  algo: 0

[root@ns-east-155]# ssum -w test
Setting the retention period will make the file's path and
data unchangeable.  Are you sure you want to do this? [y]
[root@ns-east-155]# sls -D
test:
mode: -r--r--r--  links: 1  owner: root group: other
length: 20  admin id: 0  inode: 1027.1
access: Oct 30 02:50  modification: Oct 30 02:50
changed: Oct 30 02:50  retention-end: Oct 30 2005 03:50
creation: Oct 30 02:50  residence: Oct 30 02:50
retention: active retention-period: 0y, 0d, 1h, 0m
checksum: gen  no_use  not_val  algo: 0
```

## WORM File System

This example shows that after the WORM feature is set and used in the file system, the file system can not be rebuilt. This feature cannot be overridden in production systems.

```
[root@ns-east-155]# cd
[root@ns-east-155]# umount samfs1
[root@ns-east-155]# sammkfs samfs1
sammkfs: Write Once Read Many partitions detected <5 of 5>
```

## Extension of the Retention Period

This example shows the use of the `-e` and `-y` options to extend the retention period and override the user prompt. In this example, the retention period is extended 2 days and 4 hours from the current time.

```
[root@ns-east-155]# mount samfs1
[root@ns-east-155]# cd /samfs1/WORM
[root@ns-east-155]# sls -D
test:
  mode: -r--r--r--  links: 1  owner: root group: other
  length: 20  admin id: 0  inode: 1027.1
  access: Oct 30 02:50  modification: Oct 30 02:50
  changed: Oct 30 02:50  retention-end: Oct 30 2005 03:50
  creation: Oct 30 02:50  residence: Oct 30 02:50
  retention: active retention-period: 0y, 0d, 1h, 0m
  checksum: gen  no_use  not_val  algo: 0

[root@ns-east-155]# ssum -w -e2d4h -y test
[root@ns-east-155]# sls -D
test:
  mode: -r--r--r--  links: 1  owner: root group: other
  length: 20  admin id: 0  inode: 1027.1
  access: Oct 30 02:50  modification: Oct 30 02:50
  changed: Oct 30 02:59  retention-end: Nov 1 2005 06:59
  creation: Oct 30 02:50  residence: Oct 30 02:50
  retention: active retention-period: 0y, 2d, 4h, 0m
  checksum: gen  no_use  not_val  algo: 0
```

## Permanent Retention

This example illustrates permanent retention.

```
[root@ns-east-155]# ssum -w -e0m -y test1
[root@ns-east-155]# sls -D
test1:
  mode: -r--r--r--  links: 1  owner: root group: other
  length: 5  admin id: 0  inode: 1027.1
  access: Dec 24 14:13  modification: Dec 24 14:13
  changed: Dec 24 14:13  retention-end:--- -- -----
  creation: Dec 24 14:13  residence: Dec 24 14:13
  retention: active retention-period: permanent
  checksum: gen  no_use  not_val  algo: 0
```

## Shortening of a Retention Period

This example shows that an attempt to shorten a retention period is an invalid operation.

```
[root@ns-east-155]# ssum -w -eld -y test
ssum: Retention period must be longer than current period.
```

## File and Path Immutability

This example shows that a file's data and path are immutable even after the retention period has expired.

```
[root@ns-east-155]# sls -D
test:
  mode: -r--r--r--  links: 1  owner: root group: other
  length: 5  admin id: 0  inode: 1027.1
  access: Dec 24 12:25  modification: Dec 24 12:25
  changed: Dec 24 12:25  retention-end: Dec 24 2004 12:26
  creation: Dec 24 12:25  residence: Dec 24 12:25
  retention:  over retention-period: 0y, 0d, 0h, 1m
  checksum: gen  no_use  not_val  algo: 0

[root@ns-east-155]# rm test
rm: test: override protection 444 (yes/no)? yes
rm: test not removed: Read-only file system
[root@ns-east-155]# mv test test1
mv: cannot rename test to test1: Read-only file system
```

## Hard and Soft Links

The following are examples of hard and soft links. Hard links can only occur in WORM-capable directories, and the hard links have the same WORM features as the original file. Soft links can occur anywhere, but have no WORM features.

```
[root@ns-east-155]# ln test1 test
[root@ns-east-155]# sls -D
test:
  mode: -r--r--r--  links: 2  owner: root group: other
  length: 5  admin id: 0  inode: 1027.1
  access: Dec 24 14:13  modification: Dec 24 14:13
  changed: Dec 24 14:26  retention-end:--- -- -----
  creation: Dec 24 14:13  residence: Dec 24 14:13
  retention: active retention-period: permanent
  checksum: gen  no_use  not_val  algo: 0

test1:
  mode: -r--r--r--  links: 2  owner: root group: other
  length: 5  admin id: 0  inode: 1027.1
  access: Dec 24 14:13  modification: Dec 24 14:13
  changed: Dec 24 14:26  retention-end:--- -- -----
  creation: Dec 24 14:13  residence: Dec 24 14:13
  retention: active retention-period: permanent
  checksum: gen  no_use  not_val  algo: 0
```

This example shows the creation of a soft link.

```
[root@ns-east-155]# cd ..
[root@ns-east-155]# ln WORM/test1
ln: cannot create link test1: Read-only file system
[root@ns-east-155]# ln -s WORM/test1
[root@ns-east-155]# sfs -D
WORM:
mode: drwxr-xr-x  links: 2  owner: root group: other
length: 4096  admin id: 0  inode: 1026.1
access: Dec 24 14:26  modification: Dec 24 14:26
changed: Dec 24 14:26  attributes: Dec 24 14:13
creation: Dec 24 14:13  residence: Dec 24 14:13
worm-capable
checksum: gen  no_use  not_val  algo: 0

lost+found:
mode: drwx-----  links: 2  owner: root group: root
length: 16384  admin id: 0  inode: 6.6
access: Dec 24 14:12  modification: Dec 24 14:12
changed: Dec 24 14:12  attributes: none
creation: Dec 24 14:12  residence: Dec 24 14:12

test1:
mode: lrwxrwxrwx  links: 1  owner: root group: other
length: 10  admin id: 0  inode: 1029.1
access: Dec 24 14:28  modification: Dec 24 14:28
changed: Dec 24 14:28  attributes: Dec 24 14:28
creation: Dec 24 14:28  residence: Dec 24 14:28
```

A file with a hard link to a WORM file cannot be removed, because it inherits the WORM characteristics.

```
[root@ns-east-155]# rm test1
[root@ns-east-155]# cd WORM
[root@ns-east-155]# rm test
rm: test: override protection 444 (yes/no)? yes
rm: test not removed: Read-only file system
```

## Using sfind

The following examples show how to use `sfind` to search for and find files.

The WORM-capable directory contains the four files shown here.

```
[root@ns-east-155]# sfs -D
test:
mode: -r--r--r--  links: 2  owner: root group: other
length: 5  admin id: 0  inode: 1027.1
access: Dec 24 14:38  modification: Dec 24 14:13
changed: Dec 24 14:26  retention-end:--- -- -----
creation: Dec 24 14:13  residence: Dec 24 14:13
retention: active retention-period: permanent
checksum: gen  no_use  not_val  algo: 0

test1:
mode: -r--r--r--  links: 2  owner: root group: other
length: 5  admin id: 0  inode: 1027.1
access: Dec 24 14:38  modification: Dec 24 14:13
changed: Dec 24 14:26  retention-end:--- -- -----
creation: Dec 24 14:13  residence: Dec 24 14:13
retention: active retention-period: permanent
checksum: gen  no_use  not_val  algo: 0

test2:
mode: -r--r--r--  links: 1  owner: root group: other
length: 5  admin id: 0  inode: 1029.3
access: Dec 24 14:37  modification: Dec 24 14:37
changed: Dec 24 14:37  retention-end: Dec 24 2004 14:38
creation: Dec 24 14:37  residence: Dec 24 14:37
retention: over retention-period: 0y, 0d, 0h, 1m
checksum: gen  no_use  not_val  algo: 0

test3:
mode: -r--r--r--  links: 1  owner: root group: other
length: 5  admin id: 0  inode: 1030.2
access: Dec 24 14:38  modification: Dec 24 14:38
changed: Dec 24 14:38  retention-end: Dec 24 2004 14:39
creation: Dec 24 14:38  residence: Dec 24 14:38
retention: over retention-period: 0y, 0d, 0h, 1m
checksum: gen  no_use  not_val  algo: 0
```

The first use of `sfind` finds all files in the active state. These files have the WORM bit set, and the retention period has *not* expired.

```
[root@ns-east-155]# sfind -ractive  
./test1  
./test
```

This example finds all files in the expired or *over* state. These files have the WORM bit set, but their retention period *has* expired.

```
[root@ns-east-155]# sfind -rover  
./test2  
./test3
```

This example finds files whose retention period expires after 12/24/2004 at 15:00.

```
[root@ns-east-155]# sfind -rafter 200412241500  
./test1  
./test
```

This example finds files for which more than 1 year, 10 days, 5 hours, and 10 minutes remain before expiration.

```
[root@ns-east-155]# sfind -rremain 1y10d5h10m  
./test1  
./test
```

This example finds files that have retention periods longer than 10 days.

```
[root@ns-east-155]# sfind -rlonger 10d  
./test1  
./test
```



This example finds all files that have permanent retention periods.

```
[root@ns-east-155]# sfind -rpermanent  
./test1  
./test
```

---

## Accommodating Large Files

When manipulating very large files, pay careful attention to the size of disk cache that is available on the system. If you try to write a file that is larger than your disk cache, behavior differs depending on the type of file system that you are using.

- If you are using the Sun StorEdge QFS file system, the system returns an `ENOSPC` error.
- If you are using the Sun StorEdge SAM-FS file system, the program blocks, waiting for space that might never exist, because the available disk space is insufficient to handle such requests.

If you are operating within a Sun StorEdge SAM-FS environment and if your application requires writing a file that is larger than the disk cache, you can segment the file with the `segment(1)` command. For more information about the `segment(1)` command, see the `segment(1)` man page or see the *Sun StorEdge SAM-FS Storage and Archive Management Guide*.

---

## Multireader File System

The multireader file system consists of a single writer host and multiple reader hosts. The `writer` and `reader` mount options that enable the multireader file system are compatible with Sun StorEdge QFS file systems only. The mount options are described in this section and on the `mount_samfs(1M)` man page.

You can mount the multireader file system on the single writer host by specifying the `-o writer` option on the `mount(1M)` command. The host system with the `writer` mount option is the only host system that is allowed to write to the file system. The `writer` host system updates the file system. You must ensure that only one host in a multireader file system has the file system mounted with the `writer` mount option enabled. If `-o writer` is specified, directories are written through to disk at each change and files are written through to disk at close.



---

**Caution** – The multireader file system can become corrupted if more than one writer host has the file system mounted at one time. It is the site's responsibility to insure that this situation does not occur.

---

You can mount a multireader file system on one or more reader hosts by specifying the `-o reader` option on the `mount(1M)` command. There is no limit to the number of host systems that can have the multireader file system mounted as a reader.

A major difference between the multireader file system and Sun StorEdge QFS shared file system is that the multireader host reads metadata from the disk, and the client hosts of a Sun StorEdge QFS shared file system read metadata over the network. The Sun StorEdge QFS shared file system supports multireader hosts. In this configuration, multiple shared hosts can be adding content while multiple reader hosts can be distributing content.

---

**Note** – You cannot specify the `writer` option on any host if you are mounting the file system as a Sun StorEdge QFS shared file system. You can, however, specify the `reader` option.

If you want a Sun StorEdge QFS shared file system client host to be a read-only host, mount the Sun StorEdge QFS shared file system on that host with both the `shared` and `reader` mount options. In addition, set the `sync_meta` mount option to 1 if you use the `reader` option in a Sun StorEdge QFS shared file system. For more information about the Sun StorEdge QFS shared file system, see “Sun StorEdge QFS Shared File System” on page 91. For more information about mount options, see the `mount_samfs(1M)` man page.

---

You must ensure that all readers in a multireader file system have access to the device definitions that describe the `ma` device. Copy the lines from the `mcf` file that resides on the primary metadata server host to the `mcf` files on the alternate metadata servers. After copying the lines, you might need to update the information about the disk controllers because, depending on your configuration, disk partitions might not show up the same way across all hosts.

In a multireader file system environment, the Sun StorEdge QFS software ensures that all servers that access the same file system can always access the current environment. When the writer closes a file, the Sun StorEdge QFS file system writes all information for that file to disk immediately. A reader host can access a file after the file is closed by the writer. You can specify the `refresh_at_eof` mount option to help ensure that no host system in a multireader file system risks getting out of sync with the file system.

By default, the metadata information for a file on a reader host is invalidated and refreshed every time a file is accessed. If the data changed, it is invalidated. This includes any type of access, whether through `cat(1)`, `ls(1)`, `touch(1)`, `open(2)`, or

other methods. This immediate refresh rate ensures that the data is correct at the time the refresh is done, but it can affect performance. Depending on your site preferences, you can use the `mount(1M)` command's `-o invalid=n` option to specify a refresh rate between 0 seconds and 60 seconds. If the refresh rate is set to a small value, the Sun StorEdge QFS file system reads the directory and other metadata information *n* seconds after the last refresh. More frequent refreshes result in more overhead for the system, but stale information can exist if *n* is nonzero.



---

**Caution** – If a file is open for a read on a reader host, there is no protection for that file being removed or truncated by the writer. You must use another mechanism, such as application locking, to protect the reader from inadvertent writer actions.

---

---

## Using the SAN-QFS File System in a Heterogeneous Computing Environment

The SAN-QFS file system enables multiple hosts to access the data stored in a Sun StorEdge QFS system at full disk speeds. This capability can be especially useful for database, data streaming, web page services, or any application that demands high-performance, shared-disk access in a heterogeneous environment.

You can use the SAN-QFS file system in conjunction with fiber-attached devices in a storage area network (SAN). The SAN-QFS file system enables high-speed access to data through Sun StorEdge QFS software and software such as Tivoli SANergy file sharing software. To use the SAN-QFS file system, you must have both the SANergy (2.2.4 or later) and the Sun StorEdge QFS software. For information about the levels of Sun StorEdge QFS and SANergy software that are supported, contact your Sun sales representative.

---

**Note** – In environments that include Solaris Operating Systems (OS), use the Sun StorEdge QFS shared file system, not the SAN-QFS file system, on the Solaris hosts.

For information about the Sun StorEdge QFS shared file system, see the “Sun StorEdge QFS Shared File System” on page 91.

For a comparison of the Sun StorEdge QFS shared file system to the SAN-QFS file system, see “SAN-QFS Shared File System and Sun StorEdge QFS Shared File System Comparison” on page 335.

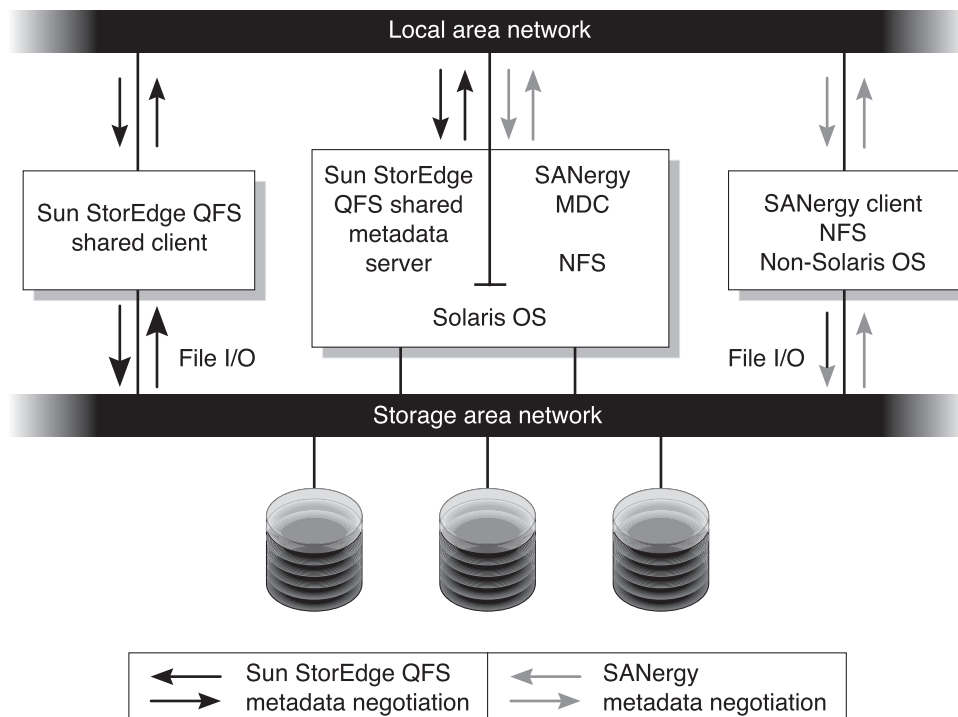
---

The following sections describe other aspects of the SAN-QFS file system:

- “Before You Begin” on page 329
- “Enabling the SAN-QFS File System” on page 330
- “Unmounting the SAN-QFS File System” on page 332
- “Troubleshooting: Unmounting a SAN-QFS File System With SANergy File Holds” on page 334
- “Block Quotas in a SAN-QFS File System” on page 334
- “File Data and File Attributes in a SAN-QFS File System” on page 335
- “Using `samgrowfs(1M)` to Expand SAN-QFS File Systems” on page 335
- “SAN-QFS Shared File System and Sun StorEdge QFS Shared File System Comparison” on page 335

FIGURE 9-1 depicts a SAN-QFS file system that uses both the Sun StorEdge QFS software and the SANergy software and shows that the clients and the MDC system manage metadata across the LAN. The clients perform I/O directly to and from the storage devices.

Note that all clients running only the Solaris OS are hosting the Sun StorEdge QFS software, and that all heterogeneous clients running an OS other than Solaris are hosting the SANergy software and the NFS software. The SAN-QFS file system’s metadata server hosts both the Sun StorEdge QFS and the SANergy software. This server acts not only as the metadata server for the file system but also as the SANergy metadata controller (MDC).



**FIGURE 9-1** SAN-QFS File System Using Sun StorEdge QFS Software and SANergy Software.

**Note** – This documentation assumes that your non-Solaris clients are hosting SANergy software and NFS software for file system sharing. The text and examples in this document reflect this configuration. If your non-Solaris clients host the Samba software instead of the NFS software, see your Samba documentation.

## Before You Begin

Before you enable the SAN-QFS file system, keep the following configuration considerations in mind and plan accordingly:

- Disks configured for use in a SAN-QFS file system cannot be under the control of a volume manager.
- To enable or to relocate the Sun StorEdge QFS metadata server in a SAN-QFS environment, the new metadata server system must be configured as a SANergy meta data controller.

# Enabling the SAN-QFS File System

The following procedures describe how to enable the SAN-QFS file system. Perform these procedures in the order in which they are presented:

- “To Enable the SAN-QFS File System on the Metadata Controller” on page 330.
- “To Enable the SAN-QFS File System on the Clients” on page 331.
- “To Install the SANergy Software on the Clients” on page 331.

## ▼ To Enable the SAN-QFS File System on the Metadata Controller

When you use the SAN-QFS file system, one host system in your environment acts as the SANergy metadata controller (MDC). This is the host system upon which the Sun StorEdge QFS file system resides.

1. **Log in to the host upon which the Sun StorEdge QFS file system resides and become `superuser`.**
2. **Verify that the Sun StorEdge QFS file system is tested and fully operational.**
3. **Install and configure the SANergy software.**  
For instructions, see your SANergy documentation.
4. **Use the `pkginfo(1)` command to verify the SANergy software release level.**

```
# pkginfo -l SANergy
```

5. **Ensure that the file system is mounted.**  
Use the `mount(1M)` command either to verify the mount or to mount the file system.
6. **Use the `share(1M)` command in the following format to enable NFS access to client hosts.**

```
MDC# share -F nfs -d qfs_file_system_name /mount_point
```

For *qfs\_file\_system\_name*, specify the name of your Sun StorEdge QFS file system, such as, `qfs1`. For more information about the `share(1M)` command, see the `share(1M)` or `share_nfs(1M)` man page.

For *mount\_point*, specify the mount point of *qfs\_file\_system\_name*.

7. **If you're connecting to Microsoft Windows clients, configure Samba, rather than NFS, to provide security and namespace features.**

To do this, add the `SANERGY_SMBPATH` environment variable in the `/etc/init.d/sanergy` file.

8. **Edit the file system table (`/etc/dfs/dfstab`) on the MDC to enable access at boot time. (Optional)**

Perform this step if you want to automatically enable this access at boot time.

9. **Proceed to “To Enable the SAN-QFS File System on the Clients” on page 331.**

## ▼ To Enable the SAN-QFS File System on the Clients

The SAN-QFS file system supports several client hosts. For example, this file system supports IRIX, Windows, AIX, and LINUX hosts. For information about the specific clients supported, see your Sun sales representative.

Every client has different operational characteristics. This procedure uses general terms to describe the actions you must take to enable the SAN-QFS file system on the clients. For information specific to your clients, see the documentation provided with your client hosts.

1. **Log in to each of the client hosts.**
2. **Edit the file system defaults table on each client and add the file system.**

For example, on a Solaris OS, edit the `/etc/vfstab` file on each client and add `qfs_file_system_name` from Step 6 to the table, as follows:

```
server:/qfs1 - /qfs1 nfs - yes noac,hard,intr,timeo=1000
```

On other operating system platforms, the file system defaults table might reside in a file other than `/etc/vfstab`. For example, on LINUX systems, this file is `/etc/fstab`.

For more information about editing the `/etc/vfstab` file, see *Sun StorEdge QFS and Sun StorEdge SAM-FS Software Installation and Configuration Guide*. For information about required or suggested NFS client mount options, see your SANergy documentation.

3. **Proceed to “To Install the SANergy Software on the Clients” on page 331.**

## ▼ To Install the SANergy Software on the Clients

The following procedure describes the SANergy installation process in general terms. For platform-specific information, consult your SANergy documentation.

### 1. Install and configure the SANergy software.

For instructions, see your SANergy documentation.

### 2. Use the `mount` command to NFS mount the file system.

Use this command with one of the following lists of mount options:

Option list 1:

```
# mount -o acregmin=0, acregmax=0, actimeo=0, noac \  
host:/mount_point/ local_mount_point
```

Option list 2:

```
# mount -noac host:/mount_point/ local_mount_point
```

For *host*, specify the MDC.

For *mount\_point*, specify the mount point of the Sun StorEdge QFS file system on the MDC.

For *local\_mount\_point*, specify the mount point on the SANergy client.

### 3. Use the SANergy `fuse` command to fuse the software.

For example:

```
# fuse|mount_point
```

For *mount\_point*, specify the mount point on the SANergy client.

## Unmounting the SAN-QFS File System

The following procedures describe how to unmount a SAN-QFS file system that is using the SANergy software. Perform these procedures in the order in which they are presented:

- “To Unmount the SAN-QFS File System on the SANergy Clients” on page 333
- “To Unmount the SAN-QFS File System on the Metadata Controller” on page 333
- “To Unmount the SAN-QFS File System on the Sun StorEdge QFS Clients” on page 333
- “To Unmount the SAN-QFS File System on the Sun StorEdge QFS Server” on page 334



## ▼ To Unmount the SAN-QFS File System on the SANergy Clients

Follow these steps for each client host on which you want to unmount the SAN-QFS file system.

1. **Log in to the client host and become `superuser`.**
2. **Use the SANergy `unfuse` command to unfuse the file system from the software.**

```
# unfuse | mount_point
```

For *mount\_point*, specify the mount point on the SANergy client.

3. **Use the `umount(1M)` command to unmount the file system from NFS.**

```
# umount host: /mount_point/ local_mount_point
```

For *host*, specify the MDC.

For *mount\_point*, specify the mount point of the Sun StorEdge QFS file system on the MDC.

For *local\_mount\_point*, specify the mount point on the SANergy client.

## ▼ To Unmount the SAN-QFS File System on the Metadata Controller

1. **Log in to the MDC system and become `superuser`.**
2. **Use the `unshare(1M)` command to disable NFS access to client hosts.**

```
MDC# unshare qfs_file_system_name /mount_point
```

For *qfs\_file\_system\_name*, specify the name of your Sun StorEdge QFS file system, such as, *qfs1*. For more information about the `unshare(1M)` command, see the `unshare(1M)` man page.

For *mount\_point*, specify the mount point of *qfs\_file\_system\_name*.

## ▼ To Unmount the SAN-QFS File System on the Sun StorEdge QFS Clients

Follow these steps on each participating client host.

1. Log in to a Sun StorEdge QFS client host and become `superuser`.
2. Use the `umount(1M)` command to unmount the file system.

```
# umount /qfs1
```

### ▼ To Unmount the SAN-QFS File System on the Sun StorEdge QFS Server

1. Log in to the host system upon which the Sun StorEdge QFS file system resides and become `superuser`.
2. Use the `umount(1M)` command to unmount the file system.

## Troubleshooting: Unmounting a SAN-QFS File System With SANergy File Holds

SANergy software issues holds on Sun StorEdge QFS files to reserve them temporarily for accelerated access. If SANergy crashes when holds are in effect, you will not be able to unmount the file system. If you are unable to unmount a SAN-QFS file system, examine the `/var/adm/messages` file and look for console messages that describe outstanding SANergy holds.

Whenever possible, allow the SANergy file-sharing function to clean up its holds, but in an emergency, or in case of a SANergy File Sharing system failure, use the `samunhold(1M)` command and the following procedure to avoid a reboot.

### ▼ To Unmount a File System in the Presence of SANergy File Holds

1. Use the `unshare(1M)` command to disable NFS access.
2. Use the `samunhold(1M)` command to release the SANergy file system holds.  
For more information about this command, see the `samunhold(1M)` man page.
3. Use the `umount(1M)` command to unmount the file system.

## Block Quotas in a SAN-QFS File System

The SANergy software does not enforce block quotas. Therefore, it is possible for you to exceed a block quota when writing a file with the SANergy software. For more information on quotas, see “Enabling Quotas” on page 228.

## File Data and File Attributes in a SAN-QFS File System

The SANergy software uses the NFS software for metadata operations, which means that the NFS close-to-open consistency model is used for file data and attributes. File data and attributes are not coherent among SANergy clients for open files.

## Using `samgrowfs(1M)` to Expand SAN-QFS File Systems

You can use the `samgrowfs(1M)` command to increase the size of a SAN-QFS file system. To perform this task, follow the procedures described in “Adding Disk Cache to a File System” on page 80. When using this procedure, be aware that the line-by-line device order in the `mcf` file must match the order of the devices listed in the file system’s superblock. The devices listed in the file system’s superblock are numbered in the order encountered in the `mcf` file (when created).

When the `samgrowfs(1M)` command is issued, the devices that had been in the `mcf` file before issuing the `samgrowfs(1M)` command keep their position in the superblock. New devices are written to subsequent entries in the order encountered.

If this new order does not match the order in the superblock, the SAN-QFS file system cannot be fused.

## SAN-QFS Shared File System and Sun StorEdge QFS Shared File System Comparison

The SAN-QFS file system and the Sun StorEdge QFS shared file system are both shared file systems with the following similarities:

- Both can stage files.
- Both are useful in data capture environments in which it is desirable that the primary file system host not be responsible for writing the data.
- Both are advantageous in environments where there is contention for writing files.

TABLE 9-3 shows the file systems differences.

**TABLE 9-3** SAN-QFS Shared File System Versus Sun StorEdge QFS Shared File System

<b>SAN-QFS File System</b>	<b>Sun StorEdge QFS Shared File System</b>
Uses NFS protocol for metadata.	Uses natural metadata.
Preferred in heterogeneous computing environments (that is, when not all hosts are Sun systems).	Preferred in homogeneous Solaris OS environments.
Useful in environments where multiple, heterogeneous hosts must be able to write data.	Multiple hosts can write. Preferred when multiple hosts must write to the same file at the same time.

## I/O Performance

The Sun StorEdge QFS and Sun StorEdge SAM-FS file systems support paged I/O, direct I/O, and switching between the I/O types. The following sections describe these I/O types.

### Paged I/O

Paged I/O (also called buffered or cached I/O) is selected by default.

### Direct I/O

Direct I/O is a process by which data is transferred directly between the user's buffer and the disk. This means that much less time is spent in the system. For performance purposes, specify direct I/O only for large, block-aligned, sequential I/O.

The `setfa(1)` command and the `sam_setfa(3)` library routine both have a `-D` option that sets the direct I/O attribute for a file and/or directory. If applied to a directory, files and directories created in that directory inherit the direct I/O attribute. After the `-D` option is set, the file uses direct I/O.

You can also select direct I/O for a file by using the Solaris OS `directio(3C)` function call. If you use the function call to enable direct I/O, it is a temporary setting. The setting lasts only while the file is active.

To enable direct I/O on a file-system basis, do one of the following:

- Specify the `-o forcedirectio` option on the `mount(1M)` command.
- Put the `forcedirectio` keyword in the mount option column of the `/etc/vfstab` file; or use it as a directive in the `samfs.cmd` file.

For more information, see the `setfa(1)`, `sam_setfa(3)`, `directio(3C)`, `samfs.cmd(4)`, and `mount_samfs(1M)` man pages.

## I/O Switching

The Sun StorEdge QFS and Sun StorEdge SAM-FS file systems support automatic I/O switching. I/O switching is a process by which you can specify that a certain amount of paged I/O should occur before the system switches to direct I/O. This automatic, direct I/O switching allows the system to perform a site-defined amount of consecutive I/O operations and then automatically switch from paged I/O to direct I/O. By default, paged I/O is performed, and I/O switching is disabled.

I/O switching should reduce page cache usage on large I/O operations. To enable this, use the `dio_wr_consec` and `dio_rd_consec` parameters as directives in the `samfs.cmd` file or as options to the `mount(1M)` command. You can also enable this by using `samu(1M)`.

For more information about these options, see the `mount_samfs(1M)` or `samfs.cmd(4)` man pages.

---

## Increasing Large File Transfer Performance

Sun StorEdge QFS and Sun StorEdge SAM-FS file systems are tuned to work with a mix of file sizes. You can increase the performance of disk file transfers for large files by enabling file system settings.

---

**Note** – Sun recommends that you experiment with performance tuning outside of a production environment. Tuning these variables incorrectly can have unexpected effects on the overall system.

If your site has a Sun Enterprise Services (SES) support contract, please inform SES if you change performance tuning parameters.

---

## ▼ To Increase File Transfer Performance

### 1. Set the maximum device read/write directive.

The `maxphys` parameter in the Solaris `/etc/system` file controls the maximum number of bytes that a device driver reads or writes at any one time. The default value for the `maxphys` parameter can differ depending on the level of your Sun Solaris OS, but it is typically around 128 kilobytes.

Add the following line to `/etc/system` to set `maxphys` to 8 megabytes:

```
set maxphys = 0x800000
```

### 2. Set the SCSI disk maximum transfer parameter.

The `sd` driver enables large transfers for a specific file by looking for the `sd_max_xfer_size` definition in the `/kernel/drv/sd.conf` file. If it is not defined, it uses the value defined in the `sd` device driver definition, `sd_max_xfer_size`, which is 1024\*1024 bytes.

To enable and encourage large transfers, add the following line at the end of the `/kernel/drv/sd.conf` file:

```
sd_max_xfer_size=0x800000;
```

### 3. Set the fibre disk maximum transfer parameter.

The `ssd` driver enables large transfers for a specific file by looking for the `ssd_max_xfer_size` definition in the `/kernel/drv/ssd.conf` file. If it is not defined, it uses the value defined in the `ssd` device driver definition, `ssd_max_xfer_size`, which is 1024\*1024 bytes.

Add the following line at the end of the `/kernel/drv/ssd.conf` file:

```
ssd_max_xfer_size=0x800000;
```

### 4. Reboot the system.

### 5. Set the `writebehind` parameter.

This step affects paged I/O only.

The `writebehind` parameter specifies the number of bytes that are written behind by the file system when performing paged I/O on a Sun StorEdge QFS or Sun StorEdge SAM-FS file system. Matching the `writebehind` value to a multiple of the RAID's read-modify-write value can increase performance.

This parameter is specified in units of kilobytes and is truncated to an 8-kilobyte multiple. If set, this parameter is ignored when direct I/O is performed. The default

`writebehind` value is 512 kilobytes. This value favors large-block, sequential I/O. Set the `writebehind` size to a multiple of the RAID 5 stripe size for both hardware and software RAID 5. The RAID 5 stripe size is the number of data disks multiplied by the configured stripe width.

For example, assume that you configure a RAID 5 device with three data disks plus one parity disk (3+1) with a stripe width of 16 kilobytes. The `writebehind` value should be 48 kilobytes, 96 kilobytes, or some other multiple, to avoid the overhead of the read-modify-write RAID 5 parity generation.

For Sun StorEdge QFS file systems, the DAU (`sammkfs(1M) -a` command) should also be a multiple of the RAID 5 stripe size. This allocation ensures that the blocks are contiguous.

You should test the system performance after resetting the `writebehind` size. The following example shows testing timings of disk writes:

```
# timex dd if=/dev/zero of=/sam/myfile bs=256k count=2048
```

You can set `writebehind` parameter from a mount option, from within the `samfs.cmd` file, from within the `/etc/vfstab` file, or from a command within the `samu(1M)` utility. For information about enabling this from a mount option, see the `-o writebehind=n` option on the `mount_samfs(1M)` man page. For information about enabling this from the `samfs.cmd` file, see the `samfs.cmd(4)` man page. For information about enabling this from within `samu(1M)`, see the `samu(1M)` man page.

## 6. Set the `readahead` parameter.

This step affects paged I/O only.

The `readahead` parameter specifies the number of bytes that are read ahead by the file system when performing paged I/O on a Sun StorEdge QFS or Sun StorEdge SAM-FS file system. This parameter is specified in units of kilobytes and is truncated to an 8-kilobyte multiple. If set, this parameter is ignored when direct I/O is performed.

Increasing the size of the `readahead` parameter increases the performance of large file transfers, but only to a point. You should test the performance of the system after resetting the `readahead` size until you see no more improvement in transfer rates. The following is an example method of testing timings on disk reads:

```
# timex dd if=/sam/myfile of=/dev/null bs=256k
```

The `readahead` parameter should be set to a size that increases the I/O performance for paged I/O. Also note that too large a `readahead` size can hurt performance. You should test various `readahead` sizes for your environment. It is important to consider the amount of memory and number of concurrent streams

when you set the `readahead` value. Setting the `readahead` value multiplied by the number of streams to a value that is greater than memory can cause page thrashing.

The default `readahead` is 1024 kilobytes. This value favors large-block, sequential I/O. For short-block, random I/O applications, set `readahead` to the typical request size. Database applications do their own `readahead`, so for these applications, set `readahead` to 0.

The `readahead` setting can be enabled from a mount option, from within the `samfs.cmd` file, from within the `/etc/vfstab` file, or from a command within the `samu(1M)` utility. For information about enabling this from a mount option, see the `-o readahead=n` option on the `mount_samfs(1M)` man page. For information about enabling this from the `samfs.cmd` file, see the `samfs.cmd(4)` man page. For information about enabling this from within `samu(1M)`, see the `samu(1M)` man page.

## 7. Set the stripe width.

The `-o stripe=n` option on the `mount(1M)` command specifies the stripe width for the file system. The stripe width is based on the disk allocation unit (DAU) size. The *n* argument specifies that *n* \* DAU bytes are written to one device before switching to the next device. The DAU size is set when the file system is initialized by the `sammkfs(1M) -a` command.

If `-o stripe=0` is set, files are allocated to file system devices using the round-robin allocation method. Each file is created on the next device. Each file is completely allocated on this device until that device is full. Round robin is the preferred setting for a multistream environment. If `-o stripe=n` is set to an integer greater than 0, files are allocated to file system devices using the stripe method. To determine the appropriate `-o stripe=n` setting, try varying the setting and taking performance readings. Striping is the preferred setting for turnkey applications with a required bandwidth.

You can also set the stripe width from the `/etc/vfstab` file or from the `samfs.cmd` file.

For more information about the `mount(1M)` command, see the `mount_samfs(1M)` man page. For more information about the `samfs.cmd` file, see the `samfs.cmd(4)` man page.



---

# Qwrite

The Qwrite capability can be enabled in Sun StorEdge QFS environments.

By default, the Sun StorEdge QFS file systems disable simultaneous reads and writes to the same file. This is the mode defined by the UNIX `vnode` interface standard, which gives exclusive access to only one write while other writers and readers must wait. Qwrite enables simultaneous reads and writes to the same file from different threads.

The Qwrite feature can be used in database applications to enable multiple simultaneous transactions to the same file. Database applications typically manage large files and issue simultaneous reads and writes to the same file. Unfortunately, each system call to a file acquires and releases a read/write lock inside the kernel. This lock prevents overlapped (or simultaneous) operations to the same file. If the application itself implements file locking mechanisms, the kernel locking mechanism impedes performance by unnecessarily serializing I/O.

Qwrite can be enabled in the `/etc/vfstab` file, in the `samfs.cmd` file, and as a mount option. The `-o qwrite` option on the `mount(1M)` command bypasses the file system locking mechanisms (except for applications accessing the file system through NFS) and lets the application control data access. If `qwrite` is specified, the file system enables simultaneous reads and writes to the same file from different threads. This option improves I/O performance by queuing multiple requests at the drive level.

The following example uses the `mount(1M)` command to enable Qwrite on a database file system:

```
# mount -F samfs -o qwrite /db
```

For more information about this feature, see the `qwrite` directive on the `samfs.cmd(4)` man page or the `-o qwrite` option on the `mount_samfs(1M)` man page.

---

## Setting the Write Throttle

By default, the Sun StorEdge QFS and Sun StorEdge SAM-FS file systems set the -  
o `wr_throttle=n` option to the `mount(1M)` command to 16 megabytes. The -  
o `wr_throttle=n` option limits the number of outstanding write kilobytes for one  
file to *n*.

If a file has *n* write kilobytes outstanding, the system suspends an application that  
attempts to write to that file until enough bytes have completed the I/O to allow the  
application to be resumed.

If your site has thousands of streams, such as thousands of NFS-shared workstations  
accessing the file system, you can tune the -o `wr_throttle=n` option in order to  
avoid memory stales. Generally, the number of streams multiplied by  
1024 x the *n* argument to the -o `wr_throttle=n` option should be less than the  
total size of the host system's memory minus the memory needs of the Solaris OS. In  
other words:

$$\text{number\_of\_streams} * n * 1024 < \text{total\_memory} - \text{Solaris\_OS\_memory\_needs}$$

For turnkey applications, you might want to use a size larger than the default 16,384  
kilobytes because this keeps more pages in memory.

---

## Setting the Flush-Behind Rate

Two mount parameters control the flush-behind rate for pages written sequentially  
and stage pages. The `flush_behind` and `stage_flush_behind` mount  
parameters are read from the `samfs.cmd` file, the `/etc/vfstab` file, or from the  
`mount(1M)` command.

The `flush_behind=n` mount parameter sets the maximum flush-behind value.  
Modified pages that are being written sequentially are written to disk  
asynchronously to help the Sun Solaris VM layer keep pages clean. To enable this  
feature, set *n* to be an integer,  $16 \leq n \leq 8192$ . By default, *n* is set to 0, which disables  
this feature. The *n* argument is specified in kilobyte units.

The `stage_flush_behind=n` mount parameter sets the maximum stage flush-behind value. Stage pages that are being staged are written to disk asynchronously to help the Sun Solaris VM layer keep pages clean. To enable this feature, set *n* to be an integer such that,  $16 \leq n \leq 8192$ . By default, *n* is set to 0, which disables this feature. The *n* argument is specified in kilobyte units.

For more information about these mount parameters, see the `mount_samfs(1M)` man page or the `samfs.cmd(4)` man page.

---

## Tuning the Number of Inodes and the Inode Hash Table

The Sun StorEdge QFS and Sun StorEdge SAM-FS file systems allow you to set the following two tunable parameters in the `/etc/system` file:

- `ninodes`
- `nhino`

To enable nondefault settings for these parameters, edit the `/etc/system` file, and then reboot your system.

The following sections describe these parameters in more detail.

### The `ninodes` Parameter

The `ninodes` parameter specifies the maximum number of default inodes. The value for `ninodes` determines the number of in-core inodes that Sun StorEdge QFS and Sun StorEdge SAM-FS keep allocated to themselves, even when applications are not using many inodes.

The format for this parameter in the `/etc/system` file is as follows:

```
set samfs:ninodes = value
```

The range for *value* is  $16 \leq \text{value} \leq 2000000$ . The default *value* for `ninodes` is one of the following:

- A *value* that is equal to the `ncsize` setting. The `ncsize` parameter is a Solaris tuning parameter that specifies the number of entries in the directory name look-up cache (DNLC). For more information about `ncsize`, see the *Solaris Tunable Parameters Reference Manual*.

- 2000. The file systems set `ninodes` to 2000 if the `ncsize` setting is zero or out of range.

For example:

```
set samfs:ninodes = 4000
```

## The nhino Parameter

The `nhino` parameter specifies the size of the in-core inode hash table.

The format for this parameter in the `/etc/system` file is as follows:

```
set samfs:nhino = value
```

The range for *value* is  $1 \leq \text{value} \leq 1048756$ . *value* must be a nonzero power of two. The default *value* for `nhino` is one of the following:

- A value that is equal to the `ninodes` value divided by eight and then, if necessary, rounded up to the nearest power of two. For example, assume that the following line exists in `/etc/system`:

```
set samfs:ninodes 8000
```

For this example, if `nhino` is not set, the system assumes 1024, which is 8000 divided by 8 and then rounded up to the nearest power of two.

- 512. The file systems set `nhino` to 512 if the `ninodes` setting is out of range.

For example:

```
set samfs:nhino = 1024
```

## When to Set the ninodes and nhino Parameters

When searching for an inode by number (after obtaining an inode number from a directory or after extracting an inode number from an NFS file handle), the Sun StorEdge QFS and Sun StorEdge SAM-FS file systems search their cache of in-core inodes. To speed this process, they maintain a hash table to decrease the number of inodes they must check.

A larger hash table reduces the number of comparisons and searches, at a modest cost in memory usage. If the `nhino` value is too large, the system is slower when undertaking operations that sweep through the entire inode list (inode syncs and unmounts). For sites that manipulate large numbers of files and sites that do extensive amounts of NFS I/O, it can be advantageous to set these parameter values to larger than the defaults.

If your site has file systems that contain only a small number of files, it might be advantageous to make these numbers smaller than the defaults. This could be the case, for example, if you have a file system into which you write large single-file `tar(1)` files to back up other file systems.



# Glossary

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## A

- addressable storage** The storage space encompassing online, nearline, offsite, and offline storage that is user-referenced through a Sun StorEdge QFS or Sun StorEdge SAM-FS file system.
- archive media** The media to which an archive file is written. Archive media can be removable tape or magneto-optical cartridges in a library. In addition, archive media can be a mount point on another system.
- archive storage** Copies of file data that have been created on archive media.
- archiver** The archive program that automatically controls the copying of files to removable cartridges.
- audit (full)** The process of loading cartridges to verify their VSNs. For magneto-optical cartridges, the capacity and space information is determined and entered into the automated library's catalog.
- automated library** A robotically controlled device designed to automatically load and unload removable media cartridges without operator intervention. An automated library contains one or more drives and a transport mechanism that moves cartridges to and from the storage slots and the drives.

---

## B

- backup storage** A snapshot of a collection of files for the purpose of preventing inadvertent loss. A backup includes both the file's attributes and associated data.

**block allocation map** A bitmap representing each available block of storage on a disk and indicating whether the block is in use or free.

**block size** See DAU.

---

## C

**cartridge** A physical entity that contains media for recording data. A tape or optical disk. Sometimes referred to as *a piece of media*, *a volume*, or *the medium*.

**catalog** A record of the VSNs in an automated library. There is one catalog for each automated library, and at a site, there is one historian for all automated libraries.

**client-server** The model of interaction in a distributed system in which a program at one site sends a request to a program at another site and awaits a response. The requesting program is called the client. The program satisfying the response is called the server.

**connection** The path between two protocol modules that provides reliable stream delivery service. A TCP connection extends from a TCP module on one machine to a TCP module on the other.

---

## D

**data device** For a Sun StorEdge QFS or Sun StorEdge SAM-FS file system, a device or group of devices upon which file data is stored.

**DAU** (Disk allocation unit) The basic unit of online storage. Also called block size.

In addition, the Sun StorEdge QFS file systems support a fully adjustable DAU, sized from 16 kilobytes through 65,528 kilobytes. The DAU you specify must be a multiple of 8 kilobytes.

The Sun StorEdge SAM-FS file systems support both a small and a large DAU. The small DAU is 4 kilobytes ( $2^{14}$  or 4096 bytes). The large DAU is 16, 32, or 64 kilobytes. The available DAU size pairs are 4 and 16; 4 and 32; and 4 and 64.

**device logging** A configurable feature that provides device-specific error information used to analyze device problems.



<b>device scanner</b>	Software within the Sun StorEdge SAM-FS file system that periodically monitors the presence of all manually mounted removable devices and that detects the presence of mounted cartridges that can be requested by a user or other process.
<b>direct access</b>	A file attribute (stage never) designating that a nearline file can be accessed directly from the archive media and need not be retrieved to disk cache.
<b>direct-attached library</b>	An automated library connected directly to a server using a SCSI interface. A SCSI attached library is controlled directly by the Sun StorEdge SAM-FS software by using the SCSI standard for automated libraries.
<b>direct I/O</b>	An attribute used for large block-aligned sequential I/O. The <code>setfa(1)</code> command's <code>-D</code> option is the direct I/O option. It sets the direct I/O attribute for a file or directory. If applied to a directory, the direct I/O attribute is inherited.
<b>directory</b>	A file data structure that points to other files and directories within the file system.
<b>disk allocation unit</b>	See DAU.
<b>disk buffer</b>	When using Sun SAM-Remote software, the disk buffer is a buffer on the server system that is used when archiving data from the client to the server.
<b>disk cache</b>	The disk-resident portion of the Sun StorEdge SAM-FS file system software. It is used to create and manage data files between online disk cache and archive media. Individual disk partitions or an entire disk can be used as disk cache.
<b>disk space thresholds</b>	An administrator-defined amount of disk space that is available to a user. This defines the range of desirable disk cache utilization. The high threshold indicates the maximum level of disk cache utilization. The low threshold indicates the minimum level of disk cache utilization. The releaser controls disk cache utilization based on these predefined disk space thresholds.
<b>disk striping</b>	The process of recording a file across several disks, thereby improving access performance and increasing overall storage capacity. See also entries for striping.
<b>drive</b>	A mechanism for transferring data to and from a removable media volume.

---

## E

<b>Ethernet</b>	A local-area, packet-switched network technology. Originally designed for coaxial cable, it is now found running over shielded, twisted-pair cable. Ethernet is a 10- or 100-Mbytes/sec LAN.
-----------------	--

**extent array** The array within a file's inode that defines where each data block assigned to the file is located on the disk.

---

## F

**family device set** See Family Set.

**Family Set** A storage device that is represented by a group of independent physical devices, such as a collection of disks or the drives within an automated library. Also see storage Family Set.

**FDDI** (Fiber distributed data interface) A 100-Mbytes/sec fiber-optic LAN.

**fibre channel** The ANSI standard that specifies high-speed serial communication between devices. Fibre channel is used as one of the bus architectures in SCSI-3.

**fiber-distributed data interface** See FDDI.

**file system** A hierarchical collection of files and directories.

**file system specific directives** Archiver and releaser directives that follow global directives, are specific to a particular file system, and begin with `fs =`. File system specific directives apply until the next `fs =` directive line or until the end of file is encountered. If multiple directives affect a file system, the file system-specific directives override the global directives.

**FTP** (File transfer protocol) An internet protocol for transferring files between two hosts over a TCP/IP network.

---

## G

**global directives** Archiver and releaser directives that apply to all file systems and that appear before the first `fs =` line.

**grace period** For disk quotas, this is the amount of time that can elapse during which a user is allowed to create files and allocate storage after the user reaches their soft limit.

---

## H

**hard limit** For disk quotas, a maximum limit on file system resources, blocks and inodes, that users cannot exceed.

---

## I

**indirect block** A disk block that contains a list of storage blocks. The Sun StorEdge QFS and Sun StorEdge SAM-FS file systems have up to three levels of indirect blocks. A first-level indirect block contains a list of blocks used for data storage. A second-level indirect block contains a list of first-level indirect blocks. A third-level indirect block contains a list of second-level indirect blocks.

**inode** Index node. A data structure used by the file system to describe a file. An inode describes all the attributes associated with a file other than the name. The attributes include ownership, access, permission, size, and the file location on the disk system.

**inode file** A special file (`.inodes`) on the file system that contains the inode structures for all files resident in the file system. All Sun StorEdge QFS and Sun StorEdge SAM-FS inodes are 512 bytes long. The inode file is a metadata file, which is separated from file data in the Sun StorEdge QFS file systems.

---

## K

**kernel** The central controlling program that provides basic system facilities. The UNIX kernel creates and manages processes, provides functions to access the file system, provides general security, and supplies communication facilities.

---

## L

**LAN** Local area network.

<b>lease</b>	In a Sun StorEdge QFS shared file system, a lease grants a client host permission to perform an operation on a file for as long as the lease is valid. The metadata server issues leases to each client host. The leases are renewed as necessary to permit continued file operations.
<b>library</b>	See automated library.
<b>library catalog</b>	See catalog.
<b>local file system</b>	A file system that is installed on one node of a Sun Cluster and is not made highly available to another node. Also a file system that is installed on a standalone server.
<b>LUN</b>	Logical unit number.

---

## M

<b>mcf</b>	Master configuration file. The file that is read at initialization time that defines the relationships between the devices (the topology) within a Sun StorEdge QFS or Sun StorEdge SAM-FS environment.
<b>media</b>	Tape or optical disk cartridges.
<b>media recycling</b>	The process of recycling or reusing archive media with low use. Archive media with low use is archive media with few active files.
<b>metadata</b>	Data about data. Metadata is the index information needed to locate the exact data position of a file on a disk. It consists of information about files, directories, access control lists, symbolic links, removable media, segmented files, and the indexes of segmented files. Metadata must be protected because if data is lost, the metadata that locates the data must be restored before the lost data can be retrieved.
<b>metadata device</b>	A separate device (for example, a solid-state disk or mirrored device) upon which Sun StorEdge QFS file system metadata is stored. Separating the file data from the metadata can increase performance. In the <code>mcf</code> file, a metadata device is declared as an <code>mm</code> device within an <code>ma</code> file system.
<b>mirror writing</b>	The process of maintaining two copies of a file on disjointed sets of disks to prevent loss from a single disk failure.
<b>mount point</b>	The directory on which a file system is mounted.
<b>multireader file system</b>	The Sun StorEdge QFS multireader file system is a single-writer, multireader capability that enables you to specify a file system that can be mounted on multiple hosts. Multiple hosts can read the file system, but only one host can write to the file system. Multiple readers are specified with the <code>-o reader</code>

option on the `mount(1M)` command. The single-writer host is specified with the `-o writer` option on the `mount(1M)` command. For more information on the `mount(1M)` command, see the `mount_samfs(1M)` man page.

---

## N

- name space** The metadata portion of a collection of files that identifies the file, its attributes, and its storage locations.
- nearline storage** Removable media storage that requires robotic mounting before it can be accessed. Nearline storage is usually less expensive than online storage, but it incurs a somewhat longer access time.
- network-attached automated library** A library, such as those from StorageTek, ADIC/Grau, IBM, or Sony, that is controlled using a software package supplied by the vendor. The Sun StorEdge SAM-FS file system interfaces with the vendor software using a Sun StorEdge SAM-FS media changer daemon designed specifically for the automated library.
- NFS** Network file system. A Sun distributed file system that provides transparent access to remote file systems on heterogeneous networks.
- NIS** The SunOS 4.0 (minimum) Network Information Service. A distributed network database containing key information about the systems and the users on the network. The NIS database is stored on the master server and all the slave servers.

---

## O

- offline storage** Storage that requires operator intervention for loading.
- offsite storage** Storage that is remote from the server and is used for disaster recovery.
- online storage** Storage that is immediately available (for example, disk cache storage).

---

## P

- partition** A portion of a device or a side of a magneto-optical cartridge.

**preallocation** The process of reserving a contiguous amount of space on the disk cache for writing a file. This ensures that the space is contiguous. Preallocation can be performed only on zero-sized files. That is, the `setfa -l` command can be specified only for a file that is size zero. For more information, see the `setfa(1)` man page.

**prioritizing preview requests** Assigning priority to archive and stage requests that cannot be immediately satisfied.

**pseudo device** A software subsystem or driver with no associated hardware.

---

## Q

**quota** The amount of system resources that a user is allowed to consume.

---

## R

**RAID** Redundant array of independent disks. A disk technology that uses several independent disks to reliably store files. It can protect against data loss from a single disk failure, can provide a fault-tolerant disk environment, and can provide higher throughput than individual disks.

**recycler** A Sun StorEdge SAM-FS utility that reclaims space on cartridges that is occupied by expired archive copies.

**release priority** A method of calculating the release priority of a file within a file system by multiplying various weights by the corresponding file properties and then summing the results.

**releaser** A Sun StorEdge SAM-FS component that identifies archived files and releases their disk cache copies, thus making more disk cache space available. The releaser automatically regulates the amount of online disk storage to high and low thresholds.

**remote procedure calls** See RPC.

**removable media file** A special type of user file that can be accessed directly from where it resides on a removable media cartridge, such as magnetic tape or optical disk cartridge. Also used for writing archive and stage file data.

**robot** The portion of an automated library that moves cartridges between storage slots and drives. Also called a transport.

**round robin** A data access method in which entire files are written to logical disks in a sequential fashion. When a single file is written to disk, the entire file is written to the first logical disk. The second file is written to the next logical disk, and so on. The size of each file determines the size of the I/O.

By default, Sun StorEdge QFS and Sun StorEdge SAM-FS file systems implement striped data access unless striped groups are present. Files are round-robin if round robin access is specified. If the file system contains mismatched striped groups, striping is not supported and round robin is forced.

Also see glossary entries for disk striping and striping.

**RPC** Remote procedure calls. The underlying data exchange mechanism used by NFS to implement custom network data servers.

---

## S

**samfsdump** A program that creates a control structure dump and copies all the control structure information for a given group of files. It is analogous to the UNIX `tar(1)` utility, but it does not generally copy file data.

**samfsrestore** A program that restores inode and directory information from a control structure dump.

**SCSI** Small Computer System Interface. An electrical communication specification commonly used for peripheral devices such as disk and tape drives and automated libraries.

**small computer system interface** See SCSI.

**soft limit** For disk quotas, a threshold limit on file system resources (blocks and inodes) that you can temporarily exceed. Exceeding the soft limit starts a timer. When you exceed the soft limit for the specified time (default is one week), no further system resources can be allocated until you reduce file system use to a level below the soft limit.

**staging** The process of copying a nearline or offline file from archive storage back to online storage.

**storage Family Set** A set of disks that are collectively represented by a single disk family device.

**storage slots** Locations inside an automated library in which cartridges are stored when not being used in a drive. If the library is direct-attached, the contents of the storage slots are kept in the automated library's catalog.

<b>stripe size</b>	The number of disk allocation units (DAUs) to allocate before moving to the next device of a stripe. If <code>stripe=0</code> , the file system uses round-robin access, not striped access.
<b>striped group</b>	A collection of devices within a Sun StorEdge QFS file system and defined in the <code>mcf</code> file as one (usually two) or more <code>gXXX</code> devices. Striped groups are treated as one logical device and are always striped with a size equal to the disk allocation unit (DAU). You can specify up to 128 striped groups within a file system, but you can specify no more than 252 total devices.
<b>striping</b>	A data access method in which files are simultaneously written to logical disks in an interlaced fashion. All Sun StorEdge QFS and Sun StorEdge SAM-FS file systems enable you to declare either striped or round robin access for each individual file system. The Sun StorEdge QFS file systems enable you to declare striped groups within each file system. Also see the glossary entry for round robin.
<b>Sun StorEdge QFS</b>	A high-speed UNIX file system that separates the file system metadata from the file data by storing them on separate devices. The Sun StorEdge QFS software controls the access to all files stored and all devices configured in the master configuration file ( <code>mcf</code> ).
<b>Sun StorEdge SAM-FS</b>	The Sun Storage and Archive Manager File System. The Sun StorEdge SAM-FS software controls the access to all files stored and all devices configured in the master configuration file ( <code>mcf</code> ).
<b>Sun SAM-QFS</b>	The Sun SAM-QFS software combines the Sun StorEdge SAM-FS software with the Sun StorEdge QFS file system. Sun SAM-QFS offers a high-speed, standard UNIX file system interface to users and administrators in conjunction with the storage and archive management utilities. It uses many of the commands available in the Sun StorEdge SAM-FS command set as well as standard UNIX file system commands.
<b>Sun SAM-Remote client</b>	A Sun SAM-Remote client is a Sun StorEdge SAM-FS system that establishes a Sun SAM-Remote client daemon that contains a number of pseudodevices. It might or might not have its own library devices. The client depends on a Sun SAM-Remote server for archive media for one or more archive copies.
<b>Sun SAM-Remote server</b>	The Sun SAM-Remote server is both a full-capacity Sun StorEdge SAM-FS storage management server and a Sun SAM-Remote server daemon that defines libraries to be shared among Sun SAM-Remote clients.
<b>superblock</b>	A data structure in the file system that defines the basic parameters of the file system. It is written to all partitions in the storage Family Set and identifies the partition's membership in the set.



---

## T

- tar** Tape archive. A standard file and data recording format used by the Sun StorEdge SAM-FS software for archive images.
- TCP/IP** Transmission Control Protocol/Internet Protocol. The internet protocols responsible for host-to-host addressing and routing, packet delivery (IP), and reliable delivery of data between application points (TCP).
- thresholds** A mechanism for defining the desirable available storage window for online storage. Thresholds set the storage goals for the releaser. Also see disk space thresholds.
- timer** Quota software that keeps track of the time elapsed between a user reaching a soft limit and a hard limit being imposed on the user.

---

## V

- volume** A named area on a cartridge for sharing data. A cartridge has one or more volumes. Double-sided cartridges have two volumes, one on each side.
- volume overflow** A capability that enables the system to span a single file over multiple volumes. Volume overflow is useful for sites using very large files that exceed the capacity of their individual cartridges.
- VSN** Volume serial name. If you are archiving to removable media cartridges, the VSN is a logical identifier for magnetic tape and optical disk that is written in the volume label. If you are archiving to disk cache, this is the unique name for the disk archive set.

---

## W

- WORM** Write once read many. A storage classification for media that can be written only once but read many times.



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