QFS, SAM-FS, and SAM-QFS Installation and Configuration Guide

Sun Microsystems, Inc.
Part Number 816-1787-10

LSC Publication Number SG-0007
Revision 3.5.0-20

1270 Eagan Industrial Road, Suite 160, Eagan, Minnesota 55121-1231 U.S.A.

New Features

The *QFS, SAM-FS, and SAM-QFS Installation and Configuration Guide*, publication SG-0007, revision 3.5.0-20, supports the QFS, SAM-FS, and SAM-QFS 3.5.0-20 releases running on the Solaris 2.6, 2.7, and 2.8 platforms. This manual was derived from the *SAM-FS System Administrator's Guide*, publication SG-0001, revision 3.5.0, and from the *QFS Administrator's Guide*, publication SG-0004, revision 3.4.

The LSC 3.5.0-20 releases support the following new features in the QFS, SAM-FS, and SAM-QFS environments:

- Solaris 2.8 operating system. LSC products can now be installed on servers running the Solaris 2.8 operating system.
- SAN-QFS file system. The QFS file system can be used in conjunction with fiber-attached devices in a Storage Area Network (SAN). When the SAN-QFS license key from LSC is enabled, the QFS file system enables high-speed access to data using software such as Tivoli SANergy File Sharing.
- ACSLS 5.4. The SAM-FS and SAM-QFS environments now support the StorageTek ACSLS 5.4 release for network-attached StorageTek automated libraries.
- New devices. The SAM-FS and SAM-QFS environments now support the following devices:

Device	Comments
Exabyte Mammoth-2 drive	Equipment type `xm` in your LSC `mcf` file.
Fujitsu M8100 drive	Equipment type `fd` in your LSC `mcf` file.
Sony DTF-2 drive	Equipment type `so` in your LSC `mcf` file.
Sony network-attached automated library and drives	Sites with Sony network-attached automated libraries use the Sony DZC-8000S interface. Such automated libraries are equipment type `pe` in your LSC `mcf` file. The drives are equipment type `so` in your `mcf` file. Sites with automated libraries attached through this interface need to add the `LSCsony` (`samsony`) package at installation time.
StorageTek 9940 drive	Equipment type `sf` in your LSC `mcf` file.

- Documentation restructuring. The LSC manual set has been restructured in order to make the documentation more modular. Certain parts of the *SAM-FS System Administrator's Guide*, publication SG-0001, have been moved into new manuals or man pages.

  The following table indicates the topic that was affected by this restructuring, where it used to reside in the LSC documentation set prior to the 3.5.0-20 release, and where it resides in the documentation set as of the 3.5.0-20 release:

Topic	Pre-3.5.0-20 Location	3.5.0-20 Location
QFS installation and configuration.	*QFS Administrator's Guide*, publication SG-0004.	*QFS, SAM-FS, and SAM-QFS Installation and Configuration Guide*, publication SG-0007.

Topic	Pre-3.5.0-20 Location	3.5.0-20 Location
SAM-FS installation and configuration.	*SAM-FS System Administrator's Guide*, publication SG-0001, chapter 2.	*QFS, SAM-FS, and SAM-QFS Installation and Configuration Guide*, publication SG-0007.
QFS file system overview, reference, and operations information.	*QFS Administrator's Guide*, publication SG-0004.	*LSC File System Administrator's Guide*, publication SG-0006.
SAM-FS file system overview, reference, and operations information	*SAM-FS System Administrator's Guide*, publication SG-0001, chapter 5 and part of chapter 14.	*LSC File System Administrator's Guide*, publication SG-0006.
Application Programmer Interface (API) overview	*SAM-FS System Administrator's Guide*, publication SG-0001, chapter 12.	`intro_libsam`(3) man page.
Storage and archive management operational, reference, and disaster recovery information	*SAM-FS System Administrator's Guide*, publication SG-0001, chapters 3, 4, 6, 7, 8, 9, 10, 11, 13, and 14; appendixes A and B.	*SAM-FS and SAM-QFS Storage and Archive Management Guide*, publication SG-0008

Record of Revision

Revision	Description
3.5.0	October 2000. Original printing.
3.5.0-20	November 2000. Supports the LSC 3.5.0-20 releases.

Table of Contents

Chapter 3 - QFS Initial Installation Procedure 3-1

Chapter 4 - QFS Upgrade Procedure 4-1

Chapter 5 - SAM-FS and SAM-QFS Initial Installation Procedure 5-1

This manual describes the installation and upgrade procedures for the QFS, SAM-FS, and SAM-QFS software products, release 3.5.0-20, running on the Solaris 2.6, 2.7, and 2.8 operating system platforms. It is written for system administrators responsible for setting up and maintaining LSC software. You, the system administrator, are assumed to be knowledgeable about Solaris operating system procedures, including creating accounts, performing system backups, and other basic Solaris system administrator tasks.

Other LSC software products, such as SAM-Remote, can be licensed for use within the QFS, SAM-FS, and SAM-QFS environments. For more information on these products, see the Licensing subsection in this preface.

This manual describes how to install, upgrade, and configure the QFS, SAM-FS, and SAM-QFS release packages. It is organized as follows:

Section	Title
Chapter 1	Overview
Chapter 2	System requirements
Chapter 3	QFS initial installation procedure
Chapter 4	QFS upgrade procedure
Chapter 5	SAM-FS and SAM-QFS initial installation procedure
Chapter 6	SAM-FS and SAM-QFS upgrade procedure
Appendix A	LSC Product Support

In addition to the preceding sections, the glossary section defines terms used in LSC documentation.

Conventions

The following conventions and terms are used throughout this manual:

Convention	Meaning
`Courier`	The fixed-space courier font denotes literal items such as commands, files, path names, system prompts, system output, and messages. For example: `/etc/opt/LSCsamfs/mcf`
`Bold courier`	The **`bold courier`** font denotes text you enter at the shell prompt. For example: `server#` **`sls –D`**

Convention	Meaning
[ ]	Brackets enclose optional portions of commands or optional arguments to commands.
Italic	Italics indicate either a variable or a term being defined. For a variable, you must replace the variable with a real name or value. For example: `server# mount` *mnt_pt*
|	The pipe symbol indicates that one of two or more optional arguments must be specified.

Certain terms are used throughout this manual. Many terms can be found in the glossary, but some of the most commonly used ones are as follows:

Term	Meaning
Archiving	Automatically copying online, magnetic disk cache files to archive media.
Automated library	An automated device for storing tape and optical cartridges.
Cartridge	A tape or magneto optical cartridge.
Partition	A side of a magneto optical disk or a partition on an Ampex tape.
Staging	Automatically copying files located on archive media back to online disk.
Volume	A named area on a cartridge for storing data. A cartridge has one or more volumes. Double-sided cartridges have two volumes, one on each side.

Other LSC Publications

In addition to this manual, the following LSC publications might be useful to you:

- *Migration Toolkit Guide*, publication SG-0002
- *SAM-Remote Administrator's Guide*, SG-0003
- *SAM-FS Man Page Reference Manual*, publication SR-0005
- *LSC File System Administrator's Guide*, publication SG-0006
- *SAM-FS and SAM-QFS Storage and Archive Management Guide*, SG-0008
- *Peripherals and Third-Party Software Supported*, LSC URL `http://www.lsci.com/lsci/services/supported-peripherals.shtml`

To order additional manuals, please send us a request using one of the methods described in the "Reader Comments" subsection.

Other File System Publications

In addition to publications from LSC, the following publications on UNIX file systems might interest you:

- Filesystem Hierarchy Standard (FHS) web pages at the following URL:
  `http://www.pathname.com/fhs/2.0/fhs-toc.html`
- Sun Microsystems online documentation web pages at the following URL:
  `http://docs.sun.com`

Licensing

Licenses for LSC products can be obtained from LSC. In some cases, the capabilities that these additional licenses can provide are described in this document because these products can be used in conjunction with this product. For information on obtaining licenses for LSC software, contact your sales representative, your Authorized Service Provider (ASP), or LSC.

The following LSC products are licensed separately:

- Migration Toolkit
- QFS standalone
- SAM-FS
- SAM-QFS
- SAM-Remote client
- SAM-Remote server
- SAM-Segment
- SAN-QFS

This document and the programs described in it are furnished under license from LSC and cannot be used, copied, or disclosed without prior approval from LSC in accordance with such license.

Reader Comments

If you have comments about the technical accuracy, content, or organization of this document, please let us know. We value your comments and will respond to them promptly. You can contact us by one of the following methods:

- Send email to `info@lsci.com`
- Send a facsimile (FAX) with your comments to "Technical Publications" in Eagan, Minnesota. Our fax number is: +1-651-554-1540
- Send written comments to the following address:

  LSC, Inc.
  Publications Department
  1270 Eagan Industrial Road
  Suite 160
  Eagan, MN 55121-1231
  USA

Overview
Chapter 1

Before installing an LSC software package, you must set up and configure the hardware to be used. The environment typically consists of the following:

- A server based on SPARC technology running the 2.6, 2.7, or 2.8 Solaris operating system.
- A disk cache consisting of RAID devices, SCSI disks, or both.
- One or more automated libraries with one or more tape or optical drives. This requirement applies to the SAM-FS and SAM-QFS release packages. This requirement does not apply to the QFS release package.

This chapter describes the characteristics of the QFS, SAM-FS, and SAM-QFS release packages. It contains the following topics:

- Release package contents
- Directories and files created

Release Package Contents

The LSC software packages are made available via anonymous FTP and CD-ROM in Solaris `pkgadd`(1M) format. These packages reflect the Solaris version for the platform upon which you will be installing LSC software. For information on the directories and files provided with the release package, see the `README` and `CHANGES` files provided with the software.

The LSC software releases include the following release packages:

Package To Install	Installed Package	Description	Used By (Licensed Product)
`samqfs`	`LSCqfs`	QFS standalone software package. This package is not needed if you are installing the SAM-QFS software package.	QFS
`sampkg`	`LSCsamfs`	Storage and archive management (SAM) software package. This package must be installed prior to all other packages if you are installing the SAM-FS or SAM-QFS software.	SAM-FS, SAM-QFS

Package To Install	Installed Package	Description	Used By (Licensed Product)
samgui	LSCgui	Graphical User Interface (GUI) tools based on Java technology. (optional)	SAM-FS, SAM-QFS
samjre	LSCjre	Java runtime environment. This optional package needs to be installed only if you want to use the GUI tools. (optional)	SAM-FS, SAM-QFS
samibm	LSCibm	IBM 3494 automated library package. (optional)	SAM-FS, SAM-QFS
samstk	LSCstk	StorageTek (ACSLS) automated library package. (optional)	SAM-FS, SAM-QFS
samdst	LSCdst	Ampex tape drive package. (optional)	SAM-FS, SAM-QFS
samsony	LSCsony	Sony network-attached automated library support package. (optional)	SAM-FS, SAM-QFS
samdoc	LSCdoc	LSC documentation in PDF format. (optional)	QFS, SAM-FS, SAM-QFS

LSC releases are identified using characters arranged in the following format:

platform.*major*.*minor*-*bugfix*

platform	The leftmost and platform release number.
major	The release level of a major feature release.
minor	The release level of a minor feature release.
bugfix	The bugfix number. A number of 1 through 99 indicates a bugfix release. A letter from A through Z indicates a beta release. The base release of a first feature release of a major release might not contain a bugfix level.

Examples:

3.3.1 is a minor release.
3.3.1-4 is bugfix 4 of the 3.3.1 minor release.
3.5.0 is a major release with no minor release revisions and no bugfixes.
3.5.0-3 is bugfix 3 of the 3.5.0 major release.

Directories and Files Created

This subsection describes the directories and files associated with LSC products. Additional information about the files in this subsection can be obtained from the man pages after they have been installed.

Directories Created

The following table lists the directories created when LSC products are installed:

Directory	Content	Used By
`/dev/samst`	Device driver special files.	SAM-FS, SAM-QFS
`/var/opt/LSCsamfs`	Device catalogs, the catalog trace file, and log files.	SAM-FS, SAM-QFS
`/etc/opt/LSCsamfs`	Configuration files.	QFS, SAM-FS, SAM-QFS
`/opt/LSCsamfs/bin`	User command binaries.	QFS, SAM-FS, SAM-QFS
`/opt/LSCsamfs/client`	Files for RPC API client.	QFS, SAM-FS, SAM-QFS
`/opt/LSCsamfs/examples`	Various example configuration files.	QFS, SAM-FS, SAM-QFS
`/opt/LSCsamfs/jre`	Java runtime environment for the GUI tools.	SAM-FS, SAM-QFS
`/opt/LSCsamfs/include`	API include files.	QFS, SAM-FS, SAM-QFS
`/opt/LSCsamfs/lib`	Relocatable libraries.	QFS, SAM-FS, SAM-QFS
`/opt/LSCsamfs/man`	`man`(1) pages.	QFS, SAM-FS, SAM-QFS
`/opt/LSCsamfs/sbin`	System administrator commands and daemon binaries.	QFS, SAM-FS, SAM-QFS

Directory	Content	Used By
`/opt/LSCsamfs/doc`	Contains the `CHANGES` file, the `README` file, the `README_PUBS` file, and all LSC manuals. The LSC manuals are in PDF format. `CHANGES` summarizes software changes since the last release. `README` summarizes the current release's features. `README_PUBS` explains the documentation included in the `LSCdoc` package.	QFS, SAM-FS, SAM-QFS

Files Created

The following table lists the files created when LSC products are installed:

File	Description	Used By
`/etc/opt/LSCsamfs/inquiry.conf`	Vendor and product identification strings for recognized SCSI devices.	SAM-FS, SAM-QFS
`/kernel/drv/samst`	Driver for SCSI media changers, optical drives, and non-motion I/O for tape drives.	SAM-FS, SAM-QFS
`/kernel/drv/samst.conf`	Configuration file for `samst` driver.	SAM-FS, SAM-QFS
`/kernel/fs/samfs`	Solaris 32-bit file system module.	QFS, SAM-FS, SAM-QFS
`/kernel/fs/sparcv9/samfs`	Solaris 64-bit file system module.	QFS, SAM-FS, SAM-QFS
`/kernel/sys/samsys`	System call module.	QFS, SAM-FS, SAM-QFS
`/kernel/sys/sparcv9/samsys`	Solaris 32-bit system call module.	QFS, SAM-FS, SAM-QFS
`/kernel/sys/sparcv9/samsys64`	Solaris 64-bit system call module.	QFS, SAM-FS, SAM-QFS

The LSC file systems have dynamically loadable components that are stored in the Solaris `/kernel` directory (see preceding list). You can determine the modules that are loaded by

using the `modload`(1M) and `modinfo`(1M) commands. Typically, the file system module is loaded with the kernel at boot time using directives in `/etc/system`. Alternatively, the file system module can be loaded when the file system is first mounted after the LSC software is installed. The file system module can be unloaded when no LSC file systems are mounted by using the `modunload`(1M) command.

Site Files

LSC products use certain files that you create. The following table lists the files you create that are used by LSC products:

File	Description	Used By
`/etc/opt/LSCsamfs/LICENSE.3.5`	License file. For more information, see the licensing information pertinent to your installation in this chapter.	QFS, SAM-FS, SAM-QFS
`/etc/opt/LSCsamfs/archiver.cmd`	Archiver command file. For more information, see the `archiver.cmd`(4) man page or see the *SAM-FS and SAM-QFS Storage and Archive Management Guide*, publication SG-0008.	SAM-FS, SAM-QFS
`/etc/opt/LSCsamfs/samfs.cmd`	File system mount parameter command file. For more information, see the `samfs.cmd`(4) man page or see the *LSC File System Administrator's Guide*, publication SG-0006.	QFS, SAM-FS, SAM-QFS
`/etc/opt/LSCsamfs/recycler.cmd`	Recycler command file. For more information, see the `recycler.cmd`(4) man page or see the *SAM-FS and SAM-QFS Storage and Archive Management Guide*, publication SG-0008.	SAM-FS, SAM-QFS
`/etc/opt/LSCsamfs/releaser.cmd`	Releaser command file. For more information, see the `releaser.cmd`(4) man page or see the *SAM-FS and SAM-QFS Storage and Archive Management Guide*, publication SG-0008.	SAM-FS, SAM-QFS

File	Description	Used By
`/etc/opt/LSCsamfs/preview.cmd`	Previewer command file. For more information, see the `preview.cmd`(4) man page or see the *SAM-FS and SAM-QFS Storage and Archive Management Guide*, publication SG-0008.	SAM-FS, SAM-QFS
`/etc/opt/LSCsamfs/defaults.conf`	Miscellaneous default values. For more information, see the `defaults.conf`(4) man page.	SAM-FS, SAM-QFS
`/etc/opt/LSCsamfs/mcf`	Master configuration file. For more information, see the `mcf`(4) man page.	QFS, SAM-FS, SAM-QFS

Modified System Files

During installation, LSC software adds information to certain Solaris system files. These system files are ASCII text files. Solaris uses these files to identify loadable kernel modules by number rather than by name.

The following table lists the system files that are modified during the installation of LSC software packages:

File	Description	Used By
`/etc/name_to_sysnum`	System call information file. The lines added are as follows: `samsys 180` `samsys64 181` (for Solaris 2.7 and above)	QFS, SAM-FS, SAM-QFS
`/etc/name_to_major`	Maps driver to major number.	SAM-FS, SAM-QFS

System Requirements
Chapter 2

This chapter outlines the system requirements that must be met prior to the installation of LSC software packages. These requirements are as follows:

- Verify the environment
- Obtain superuser access
- Verify disk cache
- Verify disk space
- Verify Solaris patches
- Verify removable media devices (SAM-FS and SAM-QFS packages only)
- Verify the LSC software license

The following subsections describe these requirements in more detail.

WARNING

If you have not read the `README` file delivered with this release, please do so before continuing. The LSC 3.5.0 releases included significant restructuring changes as compared to previous revisions. Failure to recognize these changes could cause dramatic changes in script behavior. The `README` file is included in the FTP instructions and is on the CD-ROM distribution. If your LSC software is already installed, it is located in `/opt/LSCsamfs/doc/README`.

Requirement 1: Verify the Environment

LSC products run on the following platforms, all of which contain a SPARC processor:

- SPARCstation 4 workstations and above
- Sun Ultra 1 workstations and above
- Sun Enterprise 1000 servers and above

Verify that you are installing your software package on one of the preceding systems and that the system is up and running prior to installing any LSC software. The system must be capable of reading the release CD-ROM, be network-attached to another system capable of reading CD-ROMs, or be capable of accessing the release package via FTP.

Although not officially supported by LSC, all LSC software has been installed on SPARC clones.

LSC software relies on a properly configured Solaris 2.6, 2.7, or 2.8 operating system. Check to see that your server is running one of these levels of Solaris by entering the following command:

```
server# uname -sr
SunOS 5.7
```

SunOS 5.*x*.*y* levels correspond to Solaris 2.*x*.*y* levels. The above system is running Solaris 2.7.

Requirement 2: Obtain Superuser Access

You must have super user (`root`) access to the system upon which the LSC software is to be installed.

Requirement 3: Verify Disk Cache

The LSC file system requires a certain amount of disk cache for the creation and management of data files and directories. For QFS and SAM-QFS, at least two disk devices or partitions are required, one for file data and one for metadata. Multiple disk devices or partitions increase I/O performance.

The disk devices or partitions do not require any special formatting, nor do they need to have a UNIX file system made on them. Make sure that the disks and partitions that you are using are not currently in use and do not contain any existing data because any existing data is lost when you make the LSC file system.

For SAM-FS and SAM-QFS, the disk must be attached to the server using a fiber channel or SCSI controller. Individual disk partitions can be specified for a disk, or the entire disk can be used as a disk cache. Disk arrays, including those under the control of third-party volume management software, are supported.

Use the `format`(1M) command to see the disks attached to your system. The following example shows three disks attached to a server, one internal disk connected via controller `0` on the first target (`c0t1d0`) and two external disks connect via controller `1` on targets `1` and `2` (`c1t1d0` and `c1t2d0`):

```
server# format
0. c0t1d0 <SUN1.05 cyl 2036 alt 2 hd 14 sec 72>
   /iommu@f,e0000000/sbus@f,e0001000/espdma@f,400000/esp@f,800000/sd@1,0
1. c1t1d0 <SEAGATE-ST424-0116 cyl 2604 alt 2 hd 19 sec 84>
   /iommu@f,e0000000/sbus@f,e0001000/dma@2,81000/esp@2,80000/sd@1,0
2. c1t2d0 <SEAGATE-ST424-0119 cyl 2604 alt 2 hd 19 sec 84>
   /iommu@f,e0000000/sbus@f,e0001000/dma@2,81000/esp@2,80000/sd@2,0
```

Note that the `format`(1M) command requires you to enter `CTRL-D` to exit.

The amount of disk cache needed depends upon the size of the files being managed, the frequency of use for the files, the applications using the files, and other factors. Rough estimates differ depending on the environment, too. These differences are as follows:

- For QFS, an estimate can be determined using the following algorithm:

  Disk Cache = Largest File (in bytes) +
  Amount of space needed for working files

  Metadata Cache = ((Number of Files + Number of Directories) * 512) +
  16384 * Number of Directories

- For SAM-FS, an estimate can be determined using the following algorithm:

  Disk Cache = Largest File (in bytes) +
  ((Number of Files + Number of Directories) * 512) +
  4096 * Number of Directories +
  Amount of space needed for working files

- For SAM-QFS, an estimate can be determined using the following algorithm:

  Disk Cache = Largest File (in bytes) +
  ((Number of Files + Number of Directories) * 512) +
  4096 * Number of Directories +
  Amount of space needed for working files

  Metadata Cache = ((Number of Files + Number of Directories) * 512) +
  16384 * Number of Directories

Requirement 4: Verify Disk Space

The LSC software requires a certain amount of disk space in the `/` (`root`), `/opt`, and `/var` directories. The actual amount needed varies depending on the packages you install. The following list shows the minimum amount of disk space required in these various directories:

Directory	SAM-FS, SAM-QFS Disk Space Needed	QFS Disk Space Needed
`/` (root) directory	1,328 – 1,335 kilobytes	1,268 kilobytes
`/opt` directory	9,833 – 22,087 kilobytes	4,400 kilobytes
`/var` directory	163 – 231 kilobytes	122 kilobytes

Note that log files are written to the `/var` directory, so the sizes shown in the preceding two lists should be considered a minimum amount for the `/var` directory. 30 megabytes or more is recommended.

The individual installation packages require the following amounts of space:

Package	Space on / (root)	Space on /opt	Space on /var
LSCqfs (samqfs)	1,268 kilobytes	4,400 kilobytes	122 kilobytes
LSCsamfs (sampkg)	1,328 kilobytes	9,833 kilobytes	163 kilobytes
LSCjre (samjre)	0 kilobytes	6,563 kilobytes	7 kilobytes
LSCgui (samgui)	4 kilobytes	753 kilobytes	28 kilobytes
LSCdst (samdst)	0 kilobytes	176 kilobytes	6 kilobytes
LSCibm (samibm)	0 kilobytes	231 kilobytes	6 kilobytes
LSCstk (samstk)	2 kilobytes	1,714 kilobytes	6 kilobytes
LSCsony (samsony)	1 kilobyte	420 kilobytes	7 kilobytes
LSCdoc (samdoc)	0 kilobytes	2,397 kilobytes	8 kilobytes

Determine the amount of space you have by issuing the df(1M) command, as follows:

```
server# df -k /
Filesystem        kbytes  used    avail capacity   Mounted on
/dev/dsk/c0t1dos0 76767   19826   49271    29%     /

server# df -k /opt
Filesystem        kbytes  used    avail capacity   Mounted on
/dev/dsk/c0t1dos4 192423  59006  114177    35%     /opt
```

For the / (root) directory, the number in the avail column needs to be 4096 or higher. For the /opt directory, the number in the avail column needs to be 7168 or higher.

If there is not enough room for the software under each directory, either remove the existing files under each directory or re-partition the disk to make more space available to each file system. To repartition a disk, see the your Solaris system administration documentation.

Requirement 5: Verify Solaris Patches

The latest patches recommended by SunSoft for the Solaris operating system are required. An updated list of Solaris patches required prior to installation is included with the LSC software in a file called README. This list can also be accessed from the LSC website (http://www.lsci.com/) on the Services page.

To determine which patches are installed on your system, enter the following:

```
server# showrev -p | more
```

If the required patches are not listed in the output from the `showrev`(1M) command, you need to install them before installing any LSC release packages. Patches are provided to customers with a Sun Microsystems maintenance contract via CD-ROM, anonymous FTP, and the Sun Microsystems website (`http://sunsolve.Sun.COM`). LSC is not authorized to redistribute patches to Sun Microsystems customers.

To install a patch, load the CD-ROM or transfer the patch software to your system. Follow the instructions outlined in the *Patch Installation Instructions and Special Install Instructions* in the `README` file.

NOTE

Installation of certain Solaris patches results in the overwriting of the `/etc/name_to_sysnum` file. The `/etc/name_to_sysnum` file identifies loadable kernel modules by number rather than by name. If this file is overwritten by a patch installation, the LSC system call number does not exist. A system panic can occur if you attempt to start LSC processes and mount LSC file systems if the system call number is not present in this file.

To resolve this problem, make a copy of the `/etc/name_to_sysnum` file prior to installing Solaris patches. After patch installation, check the file to ensure that the `samsys` entry (for example, `samsys 180`) is present in the file. If the entry is not present, add it to the file or reinstall the LSC software.

Requirement 6: Verify Removable Media Devices (SAM-FS and SAM-QFS Packages Only)

The SAM-FS and SAM-QFS environments should include at least one removable media device for archiving files. This device can be a single tape or optical drive or it can be multiple devices such as the drives within an automated library.

The SAM-FS and SAM-QFS environments support a wide variety of removable media devices. A list of currently supported drives and libraries is available from the LSC website (`http://www.lsci.com`) on the `Services` page.

The device that you are using must be attached and recognized by the server. If the removable media device is already connected and communicating with the server, skip to the next requirement.

Instructions for attaching removable media devices to a server are presented in this subsection. These are general guidelines for attaching removable media hardware to a server. For explicit instructions on connecting these peripherals to a server, refer to the hardware installation guide supplied with the automated library and drives.

The general connection guidelines are as follows:

1. Power down the server for connecting devices. Use the `init`(1M) command as follows:

   ```
   server# init 0
   ```

This command brings down the system to the PROM level. At this point, it is safe to power off the server and peripherals. For more information on this, see the documentation from the hardware vendor for proper power-on and power-off sequences.

2. Ensure that the removable media devices and the disk to be used for disk cache are connected. Ensure that the SCSI target IDs are unique for each controller. For example, if you are using the internal SCSI host adapter, the internal disk drive ID is usually `3`; therefore, any peripheral connected to the internal bus must not have an ID of `3`. Typically the internal disk drive ID is `3` for Sparc systems and `0` for Ultra systems.

3. Power on the peripherals and server according to the manufacturer's recommended sequence. Before the server boots, press the `Stop` key and the `A` key simultaneously to interrupt the boot process. Then enter the following at the PROM `ok` prompt:

   ```
   >ok  probe-scsi-all
   ```

   This command returns a series of entries for each device connected to the system through a SCSI interface.

   You also need to verify devices attached through fiber channel interfaces. Enter the following commands to locate the host adaptor directory, select an item, and display the fiber channel host bus adaptor (HBA) devices:

   ```
   >ok  show-devs
   /output_line1
   /output_line2
   >ok  select select /output_line1
   >ok  show children
   output
   ```

   If the server does not acknowledge all of the devices (disk drives, tape or optical drives, the automated library, and so on), you should check the cabling. Cabling is often the problem when devices and controllers are not communicating. Ensure again that each device has a unique target ID. Do not proceed until all devices appear when probed.

   In some instances, SCSI devices might use a target number greater than `6` or a Logical Unit Number (LUN) greater than `0`. This occurs when using DLT 2700 drives, which use a LUN of `1`. If this is the case with your system, you must edit the `/kernel/drv/samst.conf` file when installed.

   For more information, see chapter 5, "SAM-FS and SAM-QFS Initial Installation Procedure".

4. Boot the server using the reconfiguration option as follows:

   ```
   >ok  boot -r
   ```

Requirement 7: Verify the LSC Software License

If you do not have an LSC license key for the release level that you are installing, contact your Authorized Service Provider (ASP) or LSC. For information on contacting your ASP or LSC, see appendix A, "LSC Product Support".

You will need the following identification information:

- Company purchase order (PO) number
- Company name, address, phone, and contact information
- Host ID upon which the LSC software is to be licensed. To display the host ID on your system, use the `hostid`(1) command.
- The LSC product you are installing.
- The server upon which the software is to be installed. (QFS package only)

To install the SAM-FS or SAM-QFS packages, you need the following information for each automated library to be used in the SAM-FS or SAM-QFS environment:

- The vendor name and the model of the automated library and the type of cartridge used in the automated library.
- The number of slots for the automated library and the media type.
- LSC optional products to be used with this license. For more information on additional LSC products, see the "Licensing" subsection in this manual's preface.

The license keys for the SAM-FS and SAM-QFS packages allow the system to run indefinitely unless one of the following conditions is present:

- You were issued a temporary license. When a temporary license expires, the system is no longer able to load and unload cartridges, or to archive, stage, or release files.
- You have exceeded the number of slots allowed for the license. If you exceed the number of slots for which the system is licensed, you cannot import or label cartridges. Access continues unaffected for files already on disk.

If your license expires, you can mount LSC file systems, but you cannot archive or stage files in the SAM-FS or SAM-QFS environment.

QFS Initial Installation Procedure
Chapter 3

This chapter describes the procedure for installing and configuring LSC QFS standalone software for the first time. Use this procedure if this is the initial installation of the QFS standalone software package at your site.

The step-by-step procedure in this chapter describes obtaining the files, installing the software packages on your server, and configuring the software to match the hardware at your site. This subsection also describes the steps needed to initialize the QFS file system and procedures for checking the status of your system. For most of the procedures in this subsection, you must have superuser (`root`) access.

If you are upgrading QFS software on an existing server, see chapter 4, "QFS Upgrade Procedure".

Step 1: Obtain the Release Files

The QFS software can be obtained on a CD-ROM or by anonymous FTP. Contact your ASP or LSC for information on obtaining the software in one of these ways.

If you have a CD-ROM, run the Solaris Volume Manager, insert the CD-ROM, and change the directory to the QFS software files by using the following command:

```
server# cd /cdrom/cdrom0
```

WARNING

If you have not read the `README` file delivered with this release, please do so before continuing. The QFS 3.5.0 release includes significant restructuring changes as compared to previous revisions. Failure to recognize these changes could cause dramatic changes in script behavior. The `README` file is included in the FTP instructions and is on the CD-ROM distribution. After your QFS software is installed, it is located in `/opt/LSCsamfs/doc/README`.

Step 2: Add the Packages

The QFS file system uses the Solaris packaging utilities for adding and deleting software. As such, you must be logged in as superuser (`root`) to make changes to software packages. The `pkgadd`(1M) utility prompts you to confirm various actions necessary to install the LSC packages.

On the CD-ROM, the QFS packages and all optional products reside in the `/cdrom/cdrom0` directory organized by Solaris version.

To satisfy product dependencies, the `samqfs` package must be installed first. Run the `pkgadd`(1M) command to install all packages. Answer `all` to the first question, and answer `yes` to each of the others:

```
server# pkgadd -d samqfs     (must be first)
```

If you want to install LSC documentation, install it now. Manuals are available in PDF format. Add this package as follows:

```
server# pkgadd -d samdoc     (optional)
```

Step 3: Reboot the System

Reboot the server using the reconfiguration option, as follows:

```
server# reboot -- -r
```

Changes associated with adding the LSC system call number to the `/etc/name_to_sysnum` file are enabled at this time.

NOTE

Failure to reboot the system at this time can cause a system panic.

Step 4: Set Up `PATH` and `MANPATH` Variables

For users who will be executing the QFS user commands (for example, `sls`(1)), add `/opt/LSCsamfs/bin` to the users' `PATH` variables.

For users who need to access the QFS man pages, add `/opt/LSCsamfs/man` to the `MANPATH` variable.

For users, such as superusers, who need to access the administrator commands, add `/opt/LSCsamfs/sbin` to the `PATH` variable.

In the Bourne or Korn shells, edit the `.profile` file, change the `PATH` and `MANPATH` variables, and export the variables. For example:

```
PATH=$PATH:/opt/LSCsamfs/bin:/opt/LSCsamfs/sbin
MANPATH=$MANPATH:/opt/LSCsamfs/man
export PATH MANPATH
```

In the C shell, change your `.login` and/or `.cshrc` file. For example, the path statement in your `.cshrc` file might look like this:

```
set path = ($path /opt/LSCsamfs/bin /opt/LSCsamfs/sbin)
```

For example, in the C shell, the `MANPATH` statement in your `.login` file might look like this:

```
setenv MANPATH /usr/local/man:opt/SUNWspro:/$OPENWINHOME/\
share/man:/usr/share/man:/opt/LSCsamfs/man
```

Step 5: License the QFS Software

License keys are required to run the QFS software and associated products from LSC. For information on license keys, see chapter 2, "System Requirements".

The QFS file system uses encrypted license keys. The license keys consist of encoded alphanumeric strings. You receive one or more license keys depending on the system configuration and the products being licensed.

Verify whether or not the following file exists:

`/etc/opt/LSCsamfs/LICENSE.3.5`

If the `/etc/opt/LSCsamfs/LICENSE.3.5` file does not exist, create it.

Starting in column one, place the license keys you have obtained from your ASP or from LSC on the first and succeeding lines in the `/etc/opt/LSCsamfs/LICENSE.3.5` file.

Each license key must be on a separate line, and all keys must start in column one. No other keywords, host IDs, comments, or other information can appear in the `LICENSE.3.5` file. The license becomes effective when the QFS file system is mounted.

The license keys allow the system to run indefinitely unless you were issued a temporary license.

Step 6: Configure the QFS File System

Each QFS environment is unique. The system requirements and hardware used differ from site to site. It is up to you, the system administrator at your site, to set up the specific configuration for your QFS environment.

The topology of the equipment managed by the QFS file system is defined in the master configuration file, `/etc/opt/LSCsamfs/mcf`. This file specifies the devices and file systems included in the environment. Each piece of equipment is assigned a unique equipment identifier in the `mcf` file.

To configure QFS devices, create a master configuration file in `/etc/opt/LSCsamfs/mcf` that contains a line for each device and/or family set in your configuration. The `mcf` contains information that enables you to identify the disk slices to be used and organize them into QFS file systems.

NOTE

For information on file system design considerations, see the *LSC File System Administrator's Guide*, publication SG-0006.

When you create the `mcf` file, delimit the fields in each line with spaces or tabs. Comment lines entered into this file must start with a pound sign (#). Some fields are optional, so use a dash (–) to indicate omitted fields. The following line shows the format for the fields of each line entry in the `mcf` file:

```
Equipment   Equipment  Equipment  Family  Device  Additional
identifier  ordinal    type       set     state   parameters
```

The following list shows the information to be contained in each field and whether or not the field is a required or optional field:

Field	Description
`Equipment identifier`	Required. This field is either the name of the file system or a `/dev/dsk` entry for a disk partition or disk slice.
`Equipment ordinal`	Required. Enter a unique integer from 1 to 32757.
`Equipment type`	Required. Enter a 2-character or 3-character code for the device type, as follows: • The `ma` device type defines a QFS file system. • The `mm` device type defines a metadata device. • The `mr` device type defines a round robin or striped data device. • The `g`*XXX* device type defines a striped group data device. Striped groups start with the letter `g` followed by a 1-, 2-, or 3-digit integer. For example, `g2` or `g14` are both valid values for a striped group. For more information on equipment types, see the `mcf`(4) man page.
`Family set`	Required. The family set organizes all devices with the same family set name together as a QFS file system.
`Device state`	Optional. If unspecified, this field should contain a dash (-) character. If specified, this field should contain either `on` or `off`. Enter a state for the device for when the QFS file system is initialized.
`Additional parameters`	Required. For a disk slice, this field points to the `/dev/rdsk` entry.

For more information on this file, see the `mcf`(4) man page. There is an example `mcf` file located in `/opt/LSCsamfs/examples/mcf`.

CAUTION

If you give the wrong partition names, you risk damaging user or system data. This is true when creating any type of file system. The risk is greatest if a UFS file system is not mounted.

Make sure you specify disk partitions that are not in use on your system. Do not use overlapping partitions. If an LSC file system attempts to use a partition that is already in use, the LSC software issues a message to indicate that the device is busy.

The following example shows file system entries in an `mcf` file:

```
#
# QFS file system configuration
#
# Equipment       Equip  Equip Fam   Dev    Additional
# Identifier      Ord    Type  Set   State  Parameters
# ----------      -----  ----- ----  -----  ----------
qfs1               1     ma    qfs1
/dev/dsk/c1t0d0s0 11     mm    qfs1  on     /dev/rdsk/c1t0d0s0
/dev/dsk/c1t1d0s2 12     mr    qfs1  on     /dev/rdsk/c1t1d0s2
/dev/dsk/c1t2d0s2 13     mr    qfs1  on     /dev/rdsk/c1t2d0s2
/dev/dsk/c1t3d0s2 14     mr    qfs1  on     /dev/rdsk/c1t3d0s2
```

Note that all QFS configurations could have automated libraries and other removable media devices defined as well, essentially extending the size of the disk cache. Removable media device configurations are not shown. For information on configuring removable media devices, chapter 5, “SAM-FS and SAM-QFS Initial Installation Procedure”.

Example Configuration 1

The Solaris `format`(1M) command reports that the disks are partitioned as follows:

1. c1t0d0 <SEAGATE-ST15230W-0168 cyl 3974 alt 2 hd 19 sec 111>
   /iommu@0,10000000/sbus@0,10001000/QLGC,isp@1,10000/sd@0,0

```
Current partition table (original):
Total disk cylinders available: 3974 + 2 (reserved cylinders)
Part    Tag           Flag   Cylinders     Size        Blocks
0       root          wm     0-3499        3.52GB      (3500/0/0)
1       root          wm     3500-3972     487.09MB    (473/0/0)
2       backup        wu     0-3973        4.00GB      (3974/0/0)
3       unassigned    wm     0             0           (0/0/0)
4       unassigned    wm     0             0           (0/0/0)
5       unassigned    wm     0             0           (0/0/0)
6       unassigned    wm     0             0           (0/0/0)
7       unassigned    wm     0             0           (0/0/0)
```

2. c1t1d0 <SEAGATE-ST15230W-0168 cyl 3974 alt 2 hd 19 sec 111>
   /iommu@0,10000000/sbus@0,10001000/QLGC,isp@1,10000/sd@1,0

```
Current partition table (original):
Total disk cylinders available: 3974 + 2 (reserved cylinders)
Part    Tag           Flag   Cylinders     Size        Blocks
0       root          wm     1000-3973     2.99GB      (2974/0/0)
1       unassigned    wu     0             0           (0/0/0)
2       backup        wu     0-3973        4.00GB      (3974/0/0)
3       unassigned    wm     0             0           (0/0/0)
4       unassigned    wm     0             0           (0/0/0)
5       root          wm     0-999         1.01GB      (1000/0/0)
6       unassigned    wm     0             0           (0/0/0)
7       unassigned    wm     0             0           (0/0/0)
```

One file system (`qfs1`) is placed on slice `0` of disk `c1t0d0` and slice `5` of `c1t1d0`. Another file system (`qfs2`) is created on slice `1` of disk `c1t0d0` and slice `0` of disk `c1t1d0`.

Begin writing the `mcf` file for this example configuration by defining the file system and its disk partitions, as follows:

1. Make an `ma` entry for the first file system. The name of this file system (`qfs1`) is used later when writing the `/etc/vfstab` entry for the file system and making the file system.
2. Make an `mm` entry listing the partition(s) that comprise the metadata for the `qfs1` file system.
3. Make a series of `mr` entries listing the partitions that comprise the file data for the `qfs1` file system.
4. Make similar entries for the second (`qfs2`) file system.

The resulting `mcf` file is as follows:

```
# Disk cache configuration for 2 file systems: qfs1, qfs2
#
# Equipment       Eq    Eq   Fam.  Dev.    Additional
# Identifier      Ord  Type  Set   State   Parameters
#-----------      ---   --  ------ ------  ------------------
qfs1                1   ma  qfs1
/dev/dsk/c1t0d0s0  11   mm  qfs1   on    /dev/rdsk/c1t0d0s0
/dev/dsk/c2t0d0s0  12   mr  qfs1   on    /dev/rdsk/c2t0d0s0
/dev/dsk/c3t0d0s0  13   mr  qfs1   on    /dev/rdsk/c3t0d0s0
#
#
qfs2               20   ma  qfs2
/dev/dsk/c1t1d0s1  21   mm  qfs2   on    /dev/rdsk/c1t1d0s1
/dev/dsk/c2t1d0s1  22   mr  qfs2   on    /dev/rdsk/c2t1d0s1
/dev/dsk/c3t1d0s1  23   mr  qfs2   on    /dev/rdsk/c3t1d0s1
```

NOTE

Be sure that the `/dev/dsk` and `/dev/rdsk` names on each line reference the same c*n*t*n*d*n*s*n* partition.

Example Configuration 2

The example server has a StorageTek Clarion RAID device with four StorageTek OPENstorage 9153 disk drives. Each drive has 34 gigabytes of storage.

The Solaris `format`(1M) command reports that the disks are partitioned as follows:

```
server# format
Searching for disks…done

AVAILABLE DISK SELECTIONS:
    0. c0t0d0 <SUN4.2G cyl 3880 alt 2 hd 16 sec 135>
       /sbus@1f,0/SUNW,fas@e,8800000/sd@0,0
    1. c0t1d0 <SEAGATE-ST39140WC-1206 cyl 9004 alt 2 hd 8 sec 246>
```

```
       /sbus@1f,0/SUNW,fas@e,8800000/sd@1,0
    2. c2t4d0 <STK-OPENstorage9153-0205 cyl 17338 alt 2 hd 64 sec 64>
       /pseudo/rdnexus@2/rdriver@4,0
    3. c2t4d1 <STK-OPENstorage9153-0205 cyl 17338 alt 2 hd 64 sec 64>
       /pseudo/rdnexus@2/rdriver@4,1
    4. c2t2d2 <STK-OPENstorage9153-0205 cyl 34977 alt 2 hd 64 sec 64>
       /pseudo/rdnexus@2/rdriver@4,2
    5. c2t4d3 <STK-OPENstorage9153-0205 cyl 34977 alt 2 hd 64 sec 64>
       /pseudo/rdnexus@2/rdriver@4,3
    6. c3t2d0 <SEAGATE-ST15230W-0168 cyl 3974 alt 2 hd 19 sec 111>
       /sbus@1f,0/QLGC,isp@2,10000/sd@2,0
```

One file system named `qfs1` is created on disks `c2t4d0`, `c2t4d1`, `c2t4d2`, and `c2t4d3`. Each disk is partitioned identically with slice `0` consuming the entire disk. The following is an example partition map for these disks:

```
Part    Tag          Flag    Cylinders    Size       Blocks
----    ---          ----    ---------    ----       ------
0       usr          wm      0-17377      33.86GB    (17337/0/0)
                                                     71012352
1       unassigned   wm      0            0          (0/0/0)
2       backup       wu      0-17377      33.86GB    (17337/0/0)
                                                     71012352
3       unassigned   wm      0            0          (0/0/0)
4       unassigned   wm      0            0          (0/0/0)
5       unassigned   wm      0            0          (0/0/0)
6       unassigned   wm      0            0          (0/0/0)
7       unassigned   wm      0            0          (0/0/0)
```

The file system entries in the `mcf` file are as follows:

```
# QFS file system configuration example
#
# Equipment       Equip  Equip  Fam   Dev    Additional
# Identifier      Ord    Type   Set   State  Parameters
# ----------      -----  -----  ----  -----  ----------
qfs1              10     ma     qfs1
/dev/dsk/c1t1d0s0 11     mm     qfs1  on  /dev/rdsk/c1t1d0s0
/dev/dsk/c2t4d0s0 12     mr     qfs1  on  /dev/rdsk/c2t4d0s0
/dev/dsk/c2t4d1s0 13     mr     qfs1  on  /dev/rdsk/c2t4d1s0
/dev/dsk/c2t4d2s0 14     mr     qfs1  on  /dev/rdsk/c2t4d2s0
/dev/dsk/c2t4d3s0 15     mr     qfs1  on  /dev/rdsk/c2t4d3s0
```

In the preceding `mcf` file, the lines are as follows:

- Line 1 defines the QFS file system. The name of this file system, `qfs1`, is used later when writing the `/etc/vfstab` entry for the file system and when making the file system.
- Line 2 shows an `mm` device type entry for the metadata device. Note that this entry is not part of the RAID device described previously. A separate disk is used for caching inode information, leaving the RAID for high-speed data accesses.
- Lines 3, 4, and 5 are the data devices using the `mr` device type.

Note that you must make certain that the `/dev/dsk` and the `/dev/rdsk` names on each line reference the same c*n*t*n*d*n*s*n* partition.

Example Configuration 3

This example configuration illustrates a QFS file system that separates the metadata on to a low-latency disk. Round-robin allocation is used on four disk drives.

The following assumptions are used:

- The metadata device is a single partition (`s0`) used on controller 0, LUN 0.
- The data devices consist of four disks attached to controller 1. Each disk is on a separate LUN (1-4).

NOTE

For completeness, this example includes information on modifying the `/etc/vfstab` system file and on making the file system using the `sammkfs`(1M) command. These steps are described in more detail in later in this chapter.

Step 1: Write the `mcf` File

The following is a sample `mcf` file for a round-robin disk configuration:

```
# QFS disk cache configuration – Round-robin mcf sample
#
# Equipment       Eq   Eq    Fam.  Dev.    Additional
# Identifier      Ord  Type  Set   State   Parameters
#-----------      ---   --  ------ ------  -----------------
qfs1                1   ma   qfs1
/dev/dsk/c0t0d0s0  11   mm   qfs1    on    /dev/rdsk/c0t0d0s0
/dev/dsk/c1t1d0s0  12   mr   qfs1    on    /dev/rdsk/c1t1d0s0
/dev/dsk/c1t2d0s5  13   mr   qfs1    on    /dev/rdsk/c1t2d0s5
/dev/dsk/c1t3d0s0  14   mr   qfs1    on    /dev/rdsk/c1t3d0s0
/dev/dsk/c1t4d0s1  15   mr   qfs1    on    /dev/rdsk/c1t4d0s1
```

Step 2: Modify the `/etc/vfstab` File

The `/etc/vfstab` is edited. Because the QFS file system uses round-robined allocation as a default, no stripe width is necessary.

To explicitly set round-robin on the file system, set the `stripe=0` as follows:

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

Step 3: Run the `sammkfs`(1M) Command

Initialize the QFS file system by using the `sammkfs(1M)`. The default DAU is 16 kilobytes, but the following example sets the DAU size to 64 kilobytes:

```
server# sammkfs -a 64 qfs1
```

Example Configuration 4

This sample configuration illustrates a QFS file system that again separates the metadata onto a low-latency disk. File data is striped to four disk drives.

The following assumptions are used:

- The metadata device is a single partition (`s6`) used on controller 0, LUN 0.
- The data devices consist of four disks attached to controller 1. Each disk is on a separate LUN (1-4). All partitions are used on the entire disk drive (`s2`).

NOTE

For completeness, this example includes information on modifying the `/etc/vfstab` system file and on making the file system using the `sammkfs`(1M) command. These steps are described in more detail in later in this chapter.

Step 1. Write the `mcf` File

Write the `mcf` file using the disk configuration assumptions. The following is a sample `mcf` file for a striped disk configuration:

```
# QFS disk cache configuration – Striped Disk mcf sample
#
# Equipment       Eq   Eq    Fam.  Dev.    Additional
# Identifier      Ord  Type  Set   State   Parameters
#-----------      ---   --  ------ ------  ------------------
qfs1                10   ma  qfs1
/dev/dsk/c0t1d0s6  11   mm  qfs1     on    /dev/rdsk/c0t1d0s6
/dev/dsk/c1t1d0s2  12   mr  qfs1     on    /dev/rdsk/c1t1d0s2
/dev/dsk/c1t2d0s2  13   mr  qfs1     on    /dev/rdsk/c1t2d0s2
/dev/dsk/c1t3d0s2  14   mr  qfs1     on    /dev/rdsk/c1t3d0s2
/dev/dsk/c1t4d0s2  15   mr  qfs1     on    /dev/rdsk/c1t4d0s2
```

Step 2: Modify the `/etc/vfstab` File

Set the stripe width using the `stripe=` option. The following example sets the stripe width equal to one disk allocation unit (DAU):

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

This setting stripes file data across all four of the `mr` data drives with a stripe width of one DAU. Note the DAU is the allocation unit you set when you initialize the file system (see "Step 3", following).

Step 3: Run the `sammkfs`(1M) Command

Initialize the QFS file system using the `sammkfs`(1M) command. The following examples set the DAU size to 128 kilobytes:

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

With this striped disk configuration, any file written to this file system is striped across all of the devices in increments of 128 kilobytes. Files less than the aggregate stripe width times the number of devices still use 128 kilobytes of disk space. Files larger than 128 kilobytes have space allocated for them as needed in total space increments of 128 kilobytes.

Metadata is written to device 11 only.

Example Configuration 5

Striped groups allow you to group RAID devices together for very large files. Normally, a DAU is represented by one bit in the bit maps. With striped groups, however, there is only one DAU per striped group. 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.

NOTE

A DAU is the minimum disk space allocated. The minimum disk space allocated in a striped group is as follows:

allocation_unit X *number of disks in the group*

Writing a single byte of data fills the entire striped group. The use of striped groups is for very specific applications. Make sure that you understand the effects of using striped groups with your file system.

The devices within a group must be the same size. It is not possible to increase the size of a striped group. You can add additional striped groups, however.

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

The following assumptions are used:

- The metadata device is a single partition (`s6`) used on controller 0, LUN 0.
- The data devices consist of four disks (two groups of two identical disks) attached to controller 1. Each disk is on a separate LUN (1-4). All partitions are used on the entire disk drive (`s2`).

NOTE

For completeness, this example includes information on modifying the `/etc/vfstab` system file and on making the file system using the `sammkfs`(1M) command. These steps are described in more detail in later in this chapter.

Step 1. Write the `mcf` File

Write the `mcf` file using the disk configuration assumptions. The following is a sample `mcf` file for a striped groups configuration:

```
# QFS disk cache configuration – Striped Groups mcf sample
#
# Equipment       Eq   Eq    Fam.  Dev.    Additional
# Identifier      Ord  Type  Set   State   Parameters
#-----------      ---   --  ------ ------  ------------------
qfs1               10   ma  qfs1
/dev/dsk/c0t1d0s6  11   mm  qfs1     on    /dev/rdsk/c0t1d0s6
/dev/dsk/c1t1d0s2  12   g0  qfs1     on    /dev/rdsk/c1t1d0s2
/dev/dsk/c1t2d0s2  13   g0  qfs1     on    /dev/rdsk/c1t2d0s2
/dev/dsk/c0t3d0s2  14   g1  qfs1     on    /dev/rdsk/c0t3d0s2
/dev/dsk/c0t4d0s2  15   g1  qfs1     on    /dev/rdsk/c0t4d0s2
```

Step 2: Modify the /etc/vfstab File

Set the stripe width using the stripe= option. This sample sets the stripe width equal to zero, which essentially specifies a round-robined allocation from striped group g0 to striped group g1:

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

Step 3: Run the sammkfs(1M) Command

Initialize the QFS file system using the sammkfs(1M) command. The -a option is not used with striped groups because the DAU is equal to the size of an allocation, or the size, of each group.

```
server# sammkfs qfs1
```

In this example, there are two striped groups, g0 and g1. With stripe=0 in /etc/vfstab, devices 12 and 13 are striped; devices 14 and 15 are striped; and files are round robined around the 2 striped groups. You are really treating a striped group as a bound entity. That is, the configuration of a striped group, once it is created, cannot be changed.

You cannot change these groups without issuing another sammkfs(1M) command.

Step 7: Create the samfs.cmd File (Optional)

The /etc/opt/LSCsamfs/samfs.cmd file can be created as the place from which mount parameters are read. Creating this file may be beneficial if you are configuring multiple QFS systems with multiple mount parameters. Information can be provided in the samfs.cmd file, in the /etc/vfstab file, and on the mount(1M) command. The directive lines in the samfs.cmd file serve as defaults, but they can be overridden by options on the mount(1M) command.

Certain features can be more easily managed from a samfs.cmd file. These features include the following:

- Striping.
- The shared reader, which allows a file system to be shared by multiple servers.
- Readahead, which specifies the number of bytes that are read ahead when performing paged I/O.
- Writebehind, which specifies the number of bytes that are written behind when performing paged I/O.
- Qwrite, which enables simultaneous reads and writes to the same file from different threads.

For more information on the samfs.cmd file, see the *LSC File System Administrator's Guide*, publication SG-0006, or see the samfs.cmd(4) man page. For more information on the /etc/vfstab file, see "Step 8: Create the Mount Point and Update the /etc/vfstab File" later in this procedure. For more information on the mount(1M) command, see the mount_samfs(1M) man page.

Step 8: Create the Mount Point and Update the `/etc/vfstab` File

Edit the `/etc/vfstab` file and make an entry for each QFS file system. An example entry follows:

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

The various fields and their content are as follows:

Field	Field Title and Content
1	Device to mount. The name of the QFS file system to mount. This must be the same name as specified in the `mcf` file.
2	Device to `fsck`. Must be a dash (`-`) character. The dash indicates that there are no options. This prevents the system from performing an `fsck` on the QFS file system. For more information on this process, see the `fsck`(1M) man page.
3	Mount point. For example, `/qfs1`.
4	File system type. Must be `samfs`.
5	`fsck`(1M) pass. Must be a dash (`-`) character. A dash indicates that there are no options.
6	Mount at boot. Specifying `yes` in this field causes the QFS file system to be automatically mounted at boot time. Specifying `no` in this field indicates that you do not want to automatically mount the file system. For information on the format of these entries, see the `mount_samfs`(1M) man page.
7	Mount parameters. A list of comma-separated parameters (with no spaces) that are used in mounting the file system. For example, `stripe=1` specifies a stripe width of one DAU. For a list of available mount options, see the `mount_samfs`(1M) man page.

The example in this step assumes that `/qfs1` is the mount point of the `qfs1` file system. You can select a different name and substitute it for `/qfs1`, if you want. First, create the mount point, as follows:

```
server# mkdir /qfs1
```

Next, if you want, change the permissions, owner, or group owner of the `/qfs1` directory when it is not mounted:

```
server# chmod 555 /qfs1
server# chown root /qfs1
server# chgrp other /qfs1
```

NOTE

If you configured multiple mount points, repeat these steps for each mount point, using a different mount point (such as `/qfs1`) and family set name (such as `qfs1`) each time.

Step 9: Make the File System

Using the sammkfs(1M) command and the family set names that you have defined, create a file system for each family set.

For example, the following command creates a file system for family set name qfs1:

```
server# sammkfs –a 128 qfs1
```

At this point, the system generates a message similar to the following:

```
server# sammkfs qfs1
Building ‘qfs1’ will destroy the contents of devices:
               /dev/dsk/c1t0d0s0
               /dev/dsk/c3t1d0s6
               /dev/dsk/c3t1d1s6
               /dev/dsk/c3t2d0s6
Do you wish to continue? [y/N]
```

Enter y in response to this message to continue the file system creation process.

CAUTION

Running sammkfs(1M) creates a new file system. It removes all data currently contained in the partition associated with the file system in the /etc/opt/LSCsamfs/mcf file.

Step 10: Start Up and Shut Down the QFS File System

The mount(1M) command mounts a QFS file system. For information on the mount(1M) command, see the mount_samfs(1M) man page.

Change the /etc/vfstab mount at boot parameter to yes. This specifies that QFS file systems be mounted by /etc/rc2.d/S01MOUNTFSYS.

Manual Start Up and Shut Down

Several commands are used to manually start up and shut down the QFS system. The following examples assume that /qfs1 is the mount point and qfs1 is the file system.

Enter the following commands to perform manual startup and to set the permissions on /qfs1 to allow appropriate read and write access:

```
server# mount /qfs1
server# chmod 755 /qfs1
server# df –k          # Allows you to determine whether qfs1 is mounted
```

Enter the following commands to perform manual shutdown:

```
server# umount /qfs1
server# df –k          # Allows you to determine whether qfs1 is unmounted
```

Automatic Start Up and Shut Down

To perform an automated start up, perform the following tasks:

1. Ensure that the mount at boot parameter is `yes` in the `/etc/vfstab` file.
2. Boot the system. Go to run level `3` (multiuser mode) using the `init`(1M) command with the `3` option.

Step 11: Share the File System with Client Machines

The Solaris `share`(1M) command must be run to make the file system available for mounting by remote systems. `share`(1M) commands are typically placed in the `/etc/dfs/dfstab` file and are executed automatically by Solaris when entering `init`(1M) state 3.

For example, on the server, enter a line like the following:

```
server# share -F nfs -o rw=client1:client2 -d “QFS" /qfs1
```

NOTE

If you write a `share`(1M) command like the preceding example command into the `/etc/dfs/dfstab` file, Solaris shares the file system after the next system reboot. If you want to share the file system immediately, you must type the `share`(1M) command at a root shell prompt. If there are no shared file systems when Solaris boots, the NFS server is not started. You must reboot after adding the first `share` entry to this file.

Some NFS mount parameters can affect the performance of an NFS mounted QFS file system. You can set these parameters in the `/etc/vfstab` file as follows:

- `timeo =` *n*
  This value sets the NFS timeout to *n* tenths of a second. The default is 11 tenths of a second. For performance purposes, LSC recommends using the default value. You can increase or decrease the value appropriately to your system.
- `rsize =` *n*
  This value sets the read buffer size to *n* bytes. In NFS 2, change the default value (8192) to 32768. In NFS 3, retain the default value of 32768.
- `wsize =` *n*
  This value sets the write buffer size to *n* bytes. In NFS 2, change the default value (8192) to 32768. In NFS 3, retain the default value of 32768.

For more information on these parameters, see the `mount_nfs`(1M) man page.

Step 12: Mount the File System on the Client Machines

On the client systems, mount the server’s QFS file system at a convenient mount point.

In the following example, `server:/qfs1` is mounted on `/qfs1`, and information is entered into the `/etc/vfstab` file:

```
server:/qfs1 - /qfs1  nfs - no hard,intr,timeo=60
```

Next, on the command line, enter the `mount` command, as follows:

```
client# mount /qfs1
```

The automounter can also do this, if it is preferred. Follow your site procedures for adding `server:/qfs1` to your automounter maps.

NOTE

It is strongly recommended that clients mount the file system with the `hard` option. At times, there may be a significant delay in the QFS file system's response to client requests. This can occur when a requested file resides on a cartridge that must be loaded into a DLT tape drive. If the `hard` option is not specified, the client can return an error instead of retrying the operation until it completes.

If you use the `soft` option, make sure you set the value of `retrans` to a large number such as 120 (the default is 5). This sets the number of NFS retransmissions.

Step 13: Establish Periodic Dumps Using `qfsdump(1M)`

The server should periodically create a control structure dump using `qfsdump`(1M). When using the `qfsdump`(1M) command, please note the following:

- A `qfsdump`(1M) dump taken under release 3.5.0 cannot be restored at earlier releases of the QFS software because of new data structures needed to support data inclusion.
- A `qfsdump`(1M) dump can be very large. The `qfsdump`(1M) command does not have any tape management or estimations as does `ufsdump`(1M). You need to weigh space considerations when using `qfsdump`(1M). For more information on these commands, see the `qfsdump`(1M) and `ufsdump`(1M) man pages.

This dump does not include the data stored in your file system, but it does include information necessary to quickly locate the data on your removable media devices. This information is necessary to recover from a cache disk failure. Use `qfsrestore`(1M) to restore the control structure dump after initializing the file system if such a failure occurs.

For example, you can make an entry in `root`'s `crontab` file so the `cron` daemon runs `qfsdump` periodically:

```
10 0 * * * (cd /samfs1; qfsdump –B 512 –f /dev/rmt/0cbn)
```

If you have multiple QFS file systems, make similar entries for each. Make sure you save each dump in a separate file.

For more information on using `qfsdump`(1M), see the `qfsdump`(1M) man page and the *LSC File System Administrator's Guide*, publication SG-0006.

QFS Upgrade Procedure
Chapter 4

This chapter describes upgrading a server to a new release of the QFS software. Use this procedure if you are upgrading your QFS file system.

All steps in this subsection must be performed as superuser (`root`).

Step 1: Obtain the Release Files

The QFS software can be obtained on a CD-ROM or by anonymous FTP. Contact your ASP or LSC for information on obtaining the software in one of these ways.

WARNING

If you have not read the `README` file delivered with this release, please do so before continuing. The QFS 3.5.0 release includes significant restructuring changes as compared to previous revisions. Failure to recognize these changes could cause dramatic changes in script behavior. The `README` file is included in the FTP instructions and is on the CD-ROM distribution. After your QFS software is installed, it is located in `/opt/LSCsamfs/doc/README`.

If you have a CD-ROM, run the Solaris Volume Manager, insert the CD-ROM, and change the directory to the QFS software files using the following command:

```
server# cd /cdrom/cdrom0
```

Step 2: Back Up Each QFS File System

If you do not have current backup files for each of your QFS file systems, create them now using `qfsdump`(1M) or by copying the inodes file using `dd`(1M), as follows:

1. Back up each QFS file system using `qfsdump`(1M). The location to which you dump each system should be outside the QFS file system.

   The following example assumes that you have a file system named `qfs1` (mounted at `/qfs1`) that you want to back up to `qfs1.bak`, which exists outside of the QFS file system:

   ```
   server# cd /qfs1
   server# qfsdump –B 512 –f /dev/rmt/0cbn
   ```

The `qfsdump`(1M) command dumps file names and inode information, not data. For more information on this, see the `qfsdump`(1M) man page.

2. Back up any site-defined scripts. Because of the directory restructuring in the QFS 3.5.0 system, any scripts stored in `/etc/fs/samfs` could be destroyed during an upgrade. Scripts in directories created by the QFS system in an earlier version could also be destroyed. After the QFS 3.5.0 software is installed, you can move the scripts to a location in `/var/opt`.

You need to back up files for each file system, so repeat the preceding steps for each file system in your QFS environment. For more information on this, see chapter 3, "QFS Initial Installation Procedure".

Step 3: Unmount the File Systems

Using the Solaris `umount`(1M) command, unmount each QFS file system.

If you encounter difficulty unmounting a file system, it might be because you or another user are using files or because you or another user have changed to directories in the file system. Use the `fuser`(1M) command to determine whether or not any processes are still busy. If any are still busy, you must terminate them by using the `kill`(1M) command. For example, you can enter the following command to determine whether or not processes are still running on the `qfs1` file system:

```
server# fuser –uc /qfs1
```

If you are still unable to unmount the file system, issue the Solaris `unshare`(1M) command on the QFS file system as follows:

```
server # unshare pathname
```

In the preceding format, *pathname* is the path to the QFS file system that you are trying to unmount. After issuing the `unshare`(1M) command on the path to the QSFS file system, try unmounting the file system again. For more information on this, see the `unshare`(1M) man page.

If all previous attempts to unmount the QFS file system still fail, edit the `/etc/vfstab` file. When editing this file, change all QFS file systems from `yes` or `delay` to `no`. Then reboot your system.

Step 4: Remove Existing QFS Software

Use the `pkginfo`(1) command, as follows, to determine which QFS software packages are installed on your system:

```
server# pkginfo | grep LSC
```

Use the `pkgrm`(1M) command to remove the existing QFS software. You must remove all existing QFS packages before installing the new packages. If you are using any of the optional LSC packages as described at the beginning of this chapter, you should make sure that you

remove these packages prior to the main `LSCqfs` package. The install script prompts you to confirm several of the removal steps.

The following example removes the `LSCdoc` package and the `LSCqfs` package:

```
server# pkgrm LSCdoc LSCqfs
```

The `LSCqfs` package must be the last package removed.

Step 6: Add the Packages

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

On the CD-ROM, the QFS packages and all optional products reside in the `/cdrom/cdrom0` directory organized by Solaris version.

To satisfy product dependencies, you must upgrade `samqfs` first. Run the `pkgadd`(1M) command to upgrade all packages, answering `yes` to each question:

```
server# pkgadd -d samqfs     (must be first)
```

If you want to install LSC documentation, install it now. Manuals are available in PDF format. Add this package as follows:

```
server# pkgadd -d samdoc     (optional)
```

Step 7: Update the License Keys

You must update the license keys for the QFS 3.5.0 release. If you are upgrading from a QFS release prior to 3.5.0, you need to place a new license key in the following file:

`/etc/opt/LSCsamfs/LICENSE.3.5`

To obtain new license keys, contact your ASP or LSC.

For more information on QFS license keys, see the information on licensing new QFS software in chapter 3, “QFS Initial Installation Procedure”.

Step 8: Verify the New Master Configuration File

The topology of the equipment managed by the QFS file system is defined in the master configuration file, `/etc/opt/LSCsamfs/mcf`. This file specifies the devices, automated libraries, and file systems included in the environment. Each piece of equipment is assigned a unique equipment identifier in the `mcf` file.

Verify that a new `mcf` file exists in `/etc/opt/LSCsamfs/mcf`.

NOTE

For information on file system design considerations, see the *LSC File System Administrator's Guide*, publication SG-0006.

Step 9: Modify the `/etc/vfstab` File (Optional)

If you modified the `/etc/vfstab` file in "Step 3: Unmount the File Systems", edit this file again and change all QFS file systems from `no` to `yes` or `delay`.

Step 10: Reboot the System (Optional)

If you are upgrading from the QFS 3.3.1 release on Solaris 2.7, which is a 32-bit release, and are now upgrading to a 64-bit release, you need to use the `reboot`(1M) command to reboot at this point in order to build the 64-bit kernel.

Step 11: Mount the File System(s) (Optional)

You must perform this step if you have not modified the `/etc/vfstab` file to have `yes` or `delay`.

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

In the following example, `qfs1` is the file system name to be mounted:

```
server# mount qfs1
```

Step 12: Relink API-dependent Applications (Optional)

If you are running applications that use the QFS application programmer interface (API) and you are using static linking, you should relink these applications at this time.

SAM-FS and SAM-QFS Initial Installation Procedure
Chapter 5

This chapter describes the step-by-step procedure for installing and configuring the SAM-FS and SAM-QFS software for the first time. Use this procedure if this is the initial installation of the SAM-FS or SAM-QFS software package at your site.

This step-by-step procedure describes copying and installing the software packages to your server and configuring the software to match the hardware at your site. This subsection also describes the steps needed to initialize the SAM-FS and SAM-QFS file systems and procedures for checking the status of your system.

For most of the procedures in this subsection, you must have superuser (`root`) access.

If you are upgrading SAM-FS or SAM-QFS software on an existing server, see chapter 6, "SAM-FS and SAM-QFS Upgrade Procedure".

Step 1: Obtain the Release Files

The SAM-FS and SAM-QFS software can be obtained on a CD-ROM or by anonymous FTP. Contact your ASP or LSC for information on obtaining the software in one of these ways.

If you have a CD-ROM, run the Solaris Volume Manager, insert the CD-ROM, and change to the directory containing the SAM-FS or SAM-QFS software files by using the following command:

```
server# cd /cdrom/cdrom0
```

WARNING

If you have not read the `README` file delivered with this release, please do so before continuing. The SAM-FS and SAM-QFS 3.5.0 releases include significant restructuring changes as compared to previous revisions. Failure to recognize these changes could cause dramatic changes in script behavior. The `README` file is included in the FTP instructions and is on the CD-ROM distribution. After your software is installed, it is located in `/opt/LSCsamfs/doc/README`.

Step 2: Add the Administrator Group (Optional)

By default, SAM-FS and SAM-QFS administrator commands can be executed by `root` only. However, during installation you can supply an administrator group name. This allows members of the administrator group to execute all administrator commands except for

star(1M), samfsck(1M), samgrowfs(1M), sammkfs(1M), and samd(1M). The administrator commands are located in /opt/LSCsamfs/sbin.

If you want to enable an administrator group, choose a group name. The pkgadd(1M) process prompts you for this group name. This task is performed in "Step 3: Add the Packages".

Add the administrator group name. Do this by either using your site's procedure and the groupadd(1M) command or by editing the /etc/group file. The following is an entry from the group file designating an administrator group for LSC software. In this example, the samadm group consists of both the adm and operator users:

```
samadm::1999:adm,operator
```

You can also define an operator group that is allowed access only to the GUI tools, which are libmgr(1M), samtool(1M), robottool(1M), previewtool(1M), and devicetool(1M). This group can be defined in the /etc/opt/LSCsamfs/defaults.conf file as described later in "Step 10: Set Up Default Values" and in the defaults.conf(4) man page.

You can add or remove the administrator group after installing the package by running the set_admin.sh(1M) command. This action performs the same function that occurs when you select an administrator group during the package install. You can also undo the effect of this selection and make the programs in /opt/LSCsamfs/sbin executable only by root. For more information on this command, see the set_admin.sh(1M) man page.

Step 3: Add the Packages

LSC software uses the Solaris packaging utilities for adding and deleting software. As such, you must be logged in as superuser (root) to make changes to software packages. The pkgadd(1M) utility prompts you to confirm various actions necessary to install the LSC packages.

On the CD-ROM, the SAM-FS and SAM-QFS packages, and all optional products, reside in the /cdrom/cdrom0 directory organized by Solaris version.

To satisfy product dependencies, sampkg must be installed first. Run the pkgadd(1M) command to install all packages. Answer all to the first question, and answer yes to each of the others:

```
server# pkgadd -d sampkg      (must be installed first)
```

When you install sampkg, you are asked if you want to define an administrator group. Select y to accept the default (no administrator group) or select n if you want to define an administrator group. You can also reset permissions on certain commands later by using the set_admin.sh(1M) command. For more information on this command, see the set_admin.sh(1M) man page.

If your LSC environment includes certain network-attached automated libraries, such as certain models from StorageTek, ADIC, IBM, or Sony, you may need to install one or more vendor-specific media changer packages. LSC supplies these packages. For information on

whether or not you need to install a vendor-specific daemon package, see the *SAM-FS and SAM-QFS Storage and Archive Management Guide*, publication SG-0008.

To install one or more of these packages, install them using `pkgadd`(1M), as follows:

```
server# pkgadd -d samstk      (optional StorageTek package)
server# pkgadd -d samdst      (optional Ampex package)
server# pkgadd -d samibm      (optional IBM package)
server# pkgadd -d samsony     (optional Sony package)
```

If you want to use the GUI tools included with the SAM-FS or SAM-QFS software package, install them now. The GUI tools require the presence of a Java runtime environment. Add the Java runtime environment and the GUI tool package as follows:

```
server# pkgadd -d samjre      (optional)
server# pkgadd -d samgui      (optional)
```

If you want to install LSC documentation, install it now. Manuals are available in PDF format. Add this package as follows:

```
server# pkgadd -d samdoc      (optional)
```

Step 4: Add Tape Support to the `st.conf` File

Some tape devices are not, by default, supported in the Solaris kernel. If your environment uses any of the devices listed in `/opt/LSCsamfs/examples/st.conf_changes`, you must modify the `/kernel/drv/st.conf` file. The `st`(7D) tape driver configuration file for all supported tape drives is `st.conf`. By modifying this file and using the SAM-FS or SAM-QFS software, you enable the normally unsupported drives to work with the software.

The following drives are not officially supported in all Solaris revisions:

- DLT 2000, 2200, 2500, 2700, 4000, 4500, 4700, 7000, 8000
- StorageTek 9940 and 9840; StorageTek RedWood SD-3; and StorageTek TimberLine 9490
- IBM 3590 Magstar, IBM 3570
- Sony DTF-2, Sony DTF-1, Sony Advanced Intelligent Tape (AIT), SDX-500C, SDX-300C
- Fujitsu M8100

If you want any of the preceding devices to operate within your environment, read the `/opt/LSCsamfs/examples/st.conf_changes` file into `/kernel/drv/st.conf`.

Notes on Target and LUN Numbers

In some instances, SCSI devices may use a target number greater than `6` or a LUN greater than `0`. This occurs, for example, with DLT 2700 devices, which use a LUN of `1`. In this

case, you must edit both the `/kernel/drv/samst.conf` and the `/kernel/drv/st.conf` files.

For LUNs `1` through `7`, make the following changes:

1. Edit `/kernel/drv/st.conf`. Add the following lines for each target/LUN combination, making the appropriate substitutions. For example, the following uses target `4`, LUN `1`:

   ```
   name="st" class="scsi"
   target=4 lun=1
   ```

2. Edit `/kernel/drv/samst.conf`. Un-comment or add the appropriate lines for each device, as follows:

   ```
   name="samst" class="scsi"
   target=4 lun=1
   ```

3. If you want to use targets `8` through `15`, edit `/kernel/drv/st.conf` and find the following line:

   ```
   # In case there are wide tape drives, one can use these targets.
   ```

   Un-comment the pair of lines for each target following this comment.

   Then, edit `/kernel/drv/samst.conf`. Add lines for each target/LUN combination, substituting appropriately. For example, the following uses target `9`, LUN `2`:

   ```
   name="samst" class="scsi"
   target=9 lun=2
   ```

4. If you have added new devices since running `pkgadd`(1M), run the following command to create the device entries in `/dev/samst`:

   ```
   server# /opt/LSCsamfs/sbin/samdev
   ```

Examples

The following examples show various `st.conf` files and error conditions.

Example 1: The following is an example of a `/kernel/drv/st.conf` file that has been modified to add support in the Solaris kernel for both the StorageTek 9840 tape drive and the DLT 7000 tape drive:

```
tape-config-list =
"STK 9840", "STK 9840 Fast Access", "CLASS_9840",
"QUANTUM DLT7000", "DLT 7000 tape drive", "dlt7-tape";
CLASS_9840 = 1,0x36,0,0x1d679,1,0x00,0;
dlt7-tape = 1,0x36,0,0xd679,4,0x82,0x83,0x84,0x85,3;
```

Errors can occur if the `st.conf` file is not configured properly during LSC software installation. The following are examples show typical error messages and suggestions for problem resolution.

Example 2: The following message is found in the `sam-log` file:

```
May 18 12:38:18 baggins genu-30[374]: Tape device 31 is
default type. Update '/kernel/drv/st.conf'.
```

Corresponding messages are found in the device log for an associated drive. These messages are as follows:

```
1999/05/18 12:34:27*0000 Initialized. tp
1999/05/18 12:34:28*1002 Device is QUANTUM , DLT7000
1999/05/18 12:34:28*1003 Serial CX901S4929, rev 2150
1999/05/18 12:34:28*1005 Known as Linear Tape(lt)
1999/05/18 12:34:32 0000 Attached to process 374
1999/05/18 12:38:18 1006 Slot 1
1999/05/18 12:38:18 3117 Error: Device is type default.
Update /kernel/drv/st.conf
```

The preceding messages indicate that the appropriate changes have not been made to `/kernel/drv/st.conf`.

Step 5: Reboot System

Reboot the server using the reconfiguration option, as follows:

```
server# reboot -- -r
```

Changes to the `st.conf`, `samst.conf` and the `/etc/name_to_sysnum` files are enabled at this time.

NOTE

Failure to reboot the system at this time can cause a system panic.

Step 6: Set Up `PATH` and `MANPATH` Variables

For users running the SAM-FS or SAM-QFS user commands (for example, `sls`(1)), add `/opt/LSCsamfs/bin` to the users' `PATH` variables.

To run the administrator commands, add `/opt/LSCsamfs/sbin` to the `PATH` variable.

To use LSC man pages, add `/opt/LSCsamfs/man` to the `MANPATH` variable.

In the Bourne or Korn shells, edit the `.profile` file, change the `PATH` and `MANPATH` variables, and export the variables. For example:

```
PATH=$PATH:/opt/LSCsamfs/bin:/opt/LSCsamfs/sbin
MANPATH=$MANPATH:/opt/LSCsamfs/man
export PATH MANPATH
```

In the C shell, change your `.login` and/or `.cshrc` file. For example, the path statement in your `.cshrc` file might look like this:

```
set path = ($path /opt/LSCsamfs/bin /opt/LSCsamfs/sbin)
```

For example, in the C shell, the `MANPATH` statement in your `.login` file might look like this:

```
setenv MANPATH /usr/local/man:opt/SUNWspro:/$OPENWINHOME/\
share/man:/usr/share/man:/opt/LSCsamfs/man
```

Step 7: License the LSC Software

License keys are required to run all LSC software products. Licenses are assigned to specific `hostid` identifiers and are not transferable. For information on license keys, see chapter 2.

The SAM-FS and SAM-QFS environments use encrypted license keys. The license keys consist of encoded alphanumeric strings. You receive one or more license keys depending on the system configuration and the products being licensed.

Verify whether or not the following file exists:

`/etc/opt/LSCsamfs/LICENSE.3.5`

If the `/etc/opt/LSCsamfs/LICENSE.3.5` file does not exist, create it.

Starting in column one, place the license keys you have obtained from your ASP or from LSC on the first and succeeding lines in the `/etc/opt/LSCsamfs/LICENSE.3.5` file.

Each license key must be on a separate line and all keys must start in column one. No other keywords, host IDs, comments, or other information can appear in the `LICENSE.3.5` file. The license becomes effective the next time `sam-initd` is started.

The license keys allow the system to run indefinitely unless one of the following conditions is present:

- You were issued a temporary license. When a temporary license expires, the system is no longer able to load and unload cartridges, or to archive, stage, and release files.
- You have exceeded the number of slots allowed for the license. If you exceed the number of slots for which the system is licensed, you cannot import or label media. Access continues unaffected for files already on disk.
- You have changed the hardware with which the LSC software must interoperate. These types of changes include changes to drives, automated libraries, and servers. Licenses are assigned to a specific `hostid` and are not transferable.

After the system is running, you can view the current license settings from the `samu`(1M) utility's `l` (the letter l, for license) display.

Step 8: Configure System Logging

The SAM-FS and SAM-QFS systems log errors, cautions, warnings, and other messages using the standard Solaris `syslog`(3) interface. By default, the LSC facility is `local7`. Add a line similar to the following example to the `/etc/syslog.conf` file:

```
local7.debug    /var/adm/sam-log
```

You can read this line from `/opt/LSCsamfs/examples/syslog.conf_changes`.

NOTE

The preceding entry is all one line and has a TAB character (not a space) between the fields.

After adding this line, create an empty log file, identify the process identifier (PID) for `syslogd`(1M), and send the `syslogd` PID a HUP signal. The following command sequence creates a log file in `/var/adm/sam-log`, identifies the PID, and sends the HUP:

```
server# touch /var/adm/sam-log
server# ps -ef | grep syslogd
server# kill -HUP syslogd-pid
```

For more information, see the `syslog.conf`(4) and `syslogd`(1M) man pages. A different logging facility can be set in the `/etc/opt/LSCsamfs/defaults.conf` file.

Step 9: Configure the Environment

Each LSC software environment is unique. The system requirements and hardware used differ from site to site. The SAM-FS and SAM-QFS environments support a wide variety of tape and optical devices, automated libraries, and disk drives. It is up to you, the system administrator at your site, to set up the specific configuration for your environment.

The topology of the equipment managed by the SAM-FS or SAM-QFS file system is defined in the master configuration file, `/etc/opt/LSCsamfs/mcf`. This file specifies the devices, automated libraries, and file systems included in the environment. Each piece of equipment is assigned a unique equipment identifier in the `mcf` file.

NOTE

For information on file system design considerations, see the *LSC File System Administrator's Guide*, publication SG-0006.

To configure SAM-FS or SAM-QFS devices, create a master configuration file in `/etc/opt/LSCsamfs/mcf` that contains a line for each device and/or family set in your configuration. The `mcf` contains information that enables you to perform the following tasks:

- Identify the disk slices to be used and organize them into file systems.
- Identify the media drives to be used and organize them into libraries.

NOTE

The instructions for creating the `mcf` file differ depending on whether you are creating a SAM-FS or SAM-QFS environment.

If you are installing the SAM-FS environment, all configuration instructions are contained in this subsection.

If you are installing the SAM-QFS environment, the instructions for storage and archive management device configuration are contained in this subsection. The instructions for configuring the QFS file system, however, are contained in chapter 3, "QFS Initial Installation Instructions".

When you create the `mcf` file, delimit the fields in each line with spaces or tabs. Comment lines entered into this file must start with a pound sign (#). Some fields are optional, so use a dash (–) to indicate omitted fields. The following line shows the format for the fields of each line entry in the `mcf` file:

```
Equipment   Equipment  Equipment  Family  Device  Additional
identifier  ordinal    type       set     state   parameters
```

The following list shows the information to be contained in each field and whether or not the field is a required or optional field:

Field	Description
`Equipment identifier`	Required. If the device is an automated library or optical drive, this field is the `/dev/samst` entry. If the device is a disk slice, this field is the `/dev/dsk` entry. If you are using a network-attached automated library, see the information on managing vendor-specific automated libraries in the *SAM-FS and SAM-QFS Storage and Archive Management Guide*, publication SG-0008.
`Equipment ordinal`	Required. The automated libraries and all associated drives must be assigned a unique equipment ordinal. Enter a unique integer from 1 to 32757.
`Equipment type`	Required. Enter a 2- or 3-character mnemonic for the device type. Most equipment can use the generic equipment types of `od` (optical disk), `tp` (tape), and `rb` (robot). See the `mcf`(4) man page for specific equipment types.
`Family set`	Optional. If the device is associated with a family set (that is, a file system or automated library), enter the family set name for this device. If the device is a manually loaded drive, use the dash (`-`) to indicate that this field is omitted.
`Device state`	Optional. Enter a state for the device for when the file system is initialized.
`Additional parameters`	Optional. If the device is a disk slice, this field points to the `/dev/rdsk` entry. If the device is an automated library, this field is the path name to the library catalog file. The default library catalog file is `/var/opt/LSCsamfs/catalog/`*family_set_name*.

Example: The following `mcf` entries define a StorageTek 9738 automated library with two 9840 drives:

```
# Equipment           Eq   Eq    Family  Dev   Additional
# Identifier          Ord  Ty    Set     St    Parameters
#
/dev/samst/c0t3u0     50   s9    9738    on    9738
/dev/rmt/0cbn         51   sg    9738    on
/dev/rmt/1cbn         52   sg    9738    on
```

In the preceding example, the library catalog is written to `/var/opt/LSCsamfs/catalog/9738`.

For more information on this file, see the `mcf`(4) man page. There is an example `mcf` file located in `/opt/LSCsamfs/examples/mcf`.

Example SAM-FS Configuration

Assume that the following equipment is available on an example server:

- Two Seagate ST15230W 4 gigabyte disk drives used as cache
- One StorageTek 9730 30-slot automated library that contains two DLT tape drives
- One manually loaded DLT 2000 DLT drive
- One HP Model C1710T magneto optical automated library containing two HP Model C1716 magneto optical drives
- One manually loaded HP Model C1716 magneto optical drive

This equipment is connected to three SCSI buses with the following SCSI targets:

- The server's internal, single-ended, SCSI bus with the following targets:

Equipment	SCSI Target
Manually loaded magneto optical drive	2
The Solaris internal hard disk	3
Manually loaded DLT drive	4

- A differential SCSI bus connects to the HP Model C1710T automated library and cache disk with the following targets:

Equipment	SCSI target
Cache disks	0 and 1
HP C1710T automated library	2
first optical drive	5
second optical drive	6

- A differential SCSI bus connects to the StorageTek 9730 automated library and tape drives with the following targets:

Equipment	SCSI target
StorageTek 9730 automated library	0
first DLT 7000 drive	1
second DLT 7000 drive	2

Example SAM-FS Disk Cache Configuration

The Solaris `format`(1M) command reports that the disks are partitioned as follows:

```
   1. c1t0d0 <SEAGATE-ST15230W-0168 cyl 3974 alt 2 hd 19 sec 111>
      /iommu@0,10000000/sbus@0,10001000/QLGC,isp@1,10000/sd@0,0
Current partition table (original):
Total disk cylinders available: 3974 + 2 (reserved cylinders)
Part    Tag           Flag   Cylinders     Size        Blocks
0       root          wm     0-3499        3.52GB      (3500/0/0)
1       root          wm     3500-3972     487.09MB    (473/0/0)
2       backup        wu     0-3973        4.00GB      (3974/0/0)
3       unassigned    wm     0             0           (0/0/0)
4       unassigned    wm     0             0           (0/0/0)
5       unassigned    wm     0             0           (0/0/0)
6       unassigned    wm     0             0           (0/0/0)
7       unassigned    wm     0             0           (0/0/0)
   2. c1t1d0 <SEAGATE-ST15230W-0168 cyl 3974 alt 2 hd 19 sec 111>
      /iommu@0,10000000/sbus@0,10001000/QLGC,isp@1,10000/sd@1,0
Current partition table (original):
Total disk cylinders available: 3974 + 2 (reserved cylinders)
Part    Tag           Flag   Cylinders     Size        Blocks
0       root          wm     1000-3973     2.99GB      (2974/0/0)
1       unassigned    wu     0             0           (0/0/0)
2       backup        wu     0-3973        4.00GB      (3974/0/0)
3       unassigned    wm     0             0           (0/0/0)
4       unassigned    wm     0             0           (0/0/0)
5       root          wm     0-999         1.01GB      (1000/0/0)
6       unassigned    wm     0             0           (0/0/0)
7       unassigned    wm     0             0           (0/0/0)
```

One file system (`samfs1`) is placed on slice `0` of disk `c1t0d0` and slice `5` of `c1t1d0`. Another file system (`samfs2`) is created on slice `1` of disk `c1t0d0` and slice `0` of disk `c1t1d0`.

Begin writing the `mcf` file for this example configuration by defining the file system and its disk partitions, as follows:

1. Make an `ms` (for mass storage) entry for the first file system. The name of this file system (`samfs1`) is used later when writing the `/etc/vfstab` entry for the file system and making the file system.
2. Make a series of `md` (for magnetic disk) entries listing the partitions that comprise the `samfs1` file system.
3. Make similar entries for the second (`samfs2`) file system.

Figure 2-1 shows the file system entries in the `mcf` file.

NOTE

Be sure that the `/dev/dsk` and `/dev/rdsk` names on each line reference the same c*n*t*n*d*n*s*n* partition.

```
# Disk cache configuration for 2 file systems: samfs1, samfs2
#
# Equipment       Eq    Eq   Fam.  Dev.    Additional
# Identifier      Ord  Type  Set   State   Parameters
#-----------      ---   --  ------ ------  ------------------
samfs1             10   ms  samfs1
/dev/dsk/c1t0d0s0  11   md  samfs1   on    /dev/rdsk/c1t0d0s0
/dev/dsk/c1t1d0s5  12   md  samfs1   on    /dev/rdsk/c1t1d0s5
#
#
samfs2             20   ms  samfs2
/dev/dsk/c1t1d0s0  21   md  samfs2   on    /dev/rdsk/c1t1d0s0
/dev/dsk/c1t0d0s1  22   md  samfs2   on    /dev/rdsk/c1t0d0s1
```

Figure 2-1. File System Entries in an `mcf`

CAUTION

If you give the wrong partition names, you risk damaging user or system data. This is true when creating any type of file system. Make sure you specify disk partitions that are not in use on your system. Do not use overlapping partitions.

How to Identify Peripherals Using `/var/adm/messages`

When your system boots, a series of messages are written to `/var/adm/messages`. These messages identify the Solaris hardware path to each of the peripherals on your system. To display information from the latest system reboot, search backward from the end of the file.

Each peripheral has three lines, as follows (note that the third line wraps to the next line in this example):

```
Aug 23 11:52:54 baggins unix: samst2: Vendor/Product ID = HP      C1716T
Aug 23 11:52:54 baggins unix: samst2 at esp0: target 2 lun 0
Aug 23 11:52:54 baggins unix: samst2 is
/iommu@0,10000000/sbus@0,10001000/espdma@5,8400000/esp@5,8800000/samst@2,0
```

The first line displays the vendor and product information that the SCSI peripheral reported to the Solaris kernel.

The second line displays the SCSI bus, SCSI target, and LUN of the peripheral.

The third line displays the peripheral's hardware path. This path is reflected in the `/devices` directory. Symbolic links (symlinks) to the `/devices` directory are set up in the `/dev/samst` and `/dev/rmt` directories.

Matching the symbolic link to the peripheral is the key to configuring a SAM-FS or SAM-QFS environment. Use the `ls`(1) command with the `-l` option in both the `/dev/samst` and `/dev/rmt` directories to point to the path name of the peripheral.

Optionally, you can set up the device down notification script at this point. The `dev_down.sh`(4) man page contains information on setting up this script, which sends email to `root` when a device is marked `down` or `off`. For more information, see the `dev_down.sh`(4) man page.

Configuring a Manually Loaded Magneto Optical Drive

The HP Model C1716T is target 2 on the internal SCSI bus. The following information is located in the block of lines in `/var/adm/messages` associated with this device (note that the third line wraps to the next line in this example):

```
Aug 23 11:52:54 baggins unix: samst2: Vendor/Product ID = HP    C1716T

Aug 23 11:52:54 baggins unix: samst2 at esp0: target 2 lun 0
Aug 23 11:52:54 baggins unix: samst2 is
/iommu@0,10000000/sbus@0,10001000/espdma@5,8400000/esp@5,8800000/samst@2,0
```

Change directories to `/dev/samst` and use the following `ls`(1) command:

```
server# ls –l | grep “samst@2”
```

The preceding `ls`(1) command searches for a symbolic link that points to the following hardware path:

```
lrwxrwxrwx   1 root     other         88 Aug 23 12:27 c0t2u0 ->
/devices/iommu@0,10000000/sbus@0,10001000/espdma@5,8400000/esp@5,8800000/sa
mst@2,0:a,raw
```

The LSC `samst` driver uses the name `/dev/samst/c0t2u0` when referencing the device. Make the following entry in `/etc/opt/LSCsamfs/mcf`:

```
/dev/samst/c0t2u0  30  od  -  on
```

This entry contains the device name (`/dev/samst/c0t2u0`), a unique ordinal (`20`), the equipment type of the drive (`od`), a dash (`-`) to indicate that a family set name is not associated with the drive, and the device state (`on`).

Configuring a Magneto Optical Library

The HP C1710T automated library has three SCSI devices: the robotic mechanism and the two magneto optical drives that the automated library loads and unloads. Look in `/var/adm/messages` to find the messages for these devices.

```
Aug 23 11:52:56 baggins unix: samst16: Vendor/Product ID = HP      C1710T
Aug 23 11:52:56 baggins unix: samst16 at QLGC,isp0: target 2 lun 0
Aug 23 11:52:56 baggins unix: samst16 is
/iommu@0,10000000/sbus@0,10001000/QLGC,isp@1,10000/samst@2,0

Aug 23 11:52:56 baggins unix: samst19: Vendor/Product ID = HP      C1716T
Aug 23 11:52:56 baggins unix: samst19 at QLGC,isp0: target 5 lun 0
Aug 23 11:52:56 baggins unix: samst19 is
/iommu@0,10000000/sbus@0,10001000/QLGC,isp@1,10000/samst@5,0

Aug 23 11:52:56 baggins unix: samst20: Vendor/Product ID = HP      C1716T
Aug 23 11:52:56 baggins unix: samst20 at QLGC,isp0: target 6 lun 0
Aug 23 11:52:56 baggins unix: samst20 is
/iommu@0,10000000/sbus@0,10001000/QLGC,isp@1,10000/samst@6,0
```

Change directories to `/dev/samst` and use `ls`(1) commands, as follows, to search for the three symbolic links that point to the `/devices` files with the same Solaris hardware paths shown in the `/var/adm/messages` file.

```
server# ls –l | grep “samst@2”
lrwxrwxrwx   1 root     other         74 Aug 23 12:27 c1t2u0 ->
/devices/iommu@0,10000000/sbus@0,10001000/QLGC,isp@1,10000/samst@2,0:a,raw
server# ls –l | grep “samst@5”
lrwxrwxrwx   1 root     other         74 Aug 23 12:27 c1t5u0 ->
/devices/iommu@0,10000000/sbus@0,10001000/QLGC,isp@1,10000/samst@5,0:a,raw
server# ls –l | grep “samst@6”
lrwxrwxrwx   1 root     other         74 Aug 23 12:27 c1t6u0 ->
/devices/iommu@0,10000000/sbus@0,10001000/QLGC,isp@1,10000/samst@6,0:a,raw
```

Make the following entries in `/etc/opt/LSCsamfs/mcf`.

```
/dev/samst/c1t2u0  50  rb  hp30  on  /var/opt/LSCsamfs/catalog/hp30
/dev/samst/c1t5u0  51  od  hp30  on
/dev/samst/c1t6u0  52  od  hp30  on
```

The first line defines the automated library itself. It contains the `/dev/samst` name for the device (`/dev/samst/c1t2u0`) followed by a unique ordinal (`30`), the equipment identifier (`rb`, for a generic library), the family set identifier specified on all devices associated with this library (`hp30`), the device state (`on`), and the path name to the library catalog.

The two remaining lines define the drives inside the library. They are similar to the manually loaded drives defined in the previous subsection except that instead of a dash, they include the family set name of the library where they reside (`hp30`).

Configuring a Manually Loaded DLT Drive

When configuring DLT drives, make sure to add the DLT definitions to the `/kernel/drv/st.conf` file (see “Step 4: Add Tape Support to the `st.conf` File”). DLT drives are not part of the standard Solaris configuration.

The following lines from `/var/adm/messages` refer to the manual DLT drive:

```
Aug 23 11:52:54 baggins unix: samst4: Vendor/Product ID = DEC     DLT2000

Aug 23 11:52:54 baggins unix: samst4 at esp0: target 4 lun 0
Aug 23 11:52:54 baggins unix: samst4 is
/iommu@0,10000000/sbus@0,10001000/espdma@5,8400000/esp@5,8800000/samst@4,0
```

Find the matching `/dev/samst` symbolic link:

```
lrwxrwxrwx   1 root     other         88 Aug 23 12:27 c0t4u0 ->
/devices/iommu@0,10000000/sbus@0,10001000/espdma@5,8400000/esp@5,8800000/sa
mst@4,0:a,raw
```

For tape devices you can leave the additional parameters field empty. The system finds the proper `/dev/samst/*` symbolic link using the Solaris `st` driver.

NOTE

The additional parameters field is required if the equipment identifier field is not in the form `/dev/rmt/*` (the standard `st` device driver). In this case, the additional parameters field is the path to the special file (for example, `/dev/samst/cntnun`).

For a tape device, there is another symbolic link located in `/dev/rmt`. This symbolic link is the name that the Solaris `st` driver (see `st`(7)) uses when referencing the device. There are

many symbolic links in `/dev/rmt` that point to the hardware path. Each link has various combinations of the option letters `c`, `b` and `n`. When making the `mcf` entry, always use the `b` and `n` options prefixed with `c` if the drive supports compression. The symbolic link is as follows:

```
lrwxrwxrwx   1 root     other         85 Aug 15 11:37 /dev/rmt/0cbn ->
../../devices/iommu@0,10000000/sbus@0,10001000/espdma@5,8400000/esp@5,88000
00/st@4,0:cbn
```

Using this information, construct the `/etc/opt/LSCsamfs/mcf` entry:

```
/dev/rmt/0cbn  40  tp  -  on
```

The first entry on the line is the `st` driver name for the device (`/dev/rmt/0cbn`), followed by a unique ordinal (`40`), the equipment type (`tp` for a generic tape), a dash (`-`) to indicate that a family set name is not associated with the manually-mounted device, and the device state (`on`).

Configuring a DLT Library

The last piece of equipment to define is the STK 9730 automated library. This automated library has three SCSI devices: the robotic mechanism and the two DLT 7000 tape drives that the robot loads and unloads. Look in `/var/adm/messages` to find the messages for these devices. `/var/adm/messages` is as follows:

```
Aug 23 12:08:41 baggins unix: samst98: Vendor/Product ID = STK
9730
Aug 23 12:08:41 baggins unix: samst98 at QLGC,isp2:
Aug 23 12:08:41 baggins unix:  target 0 lun 0
Aug 23 12:08:41 baggins unix: samst98 is
/iommu@f,e0000000/sbus@f,e0001000/QLGC,isp@1,10000/samst@0,0
Aug 23 12:08:41 baggins unix: samst99: Vendor/Product ID = QUANTUM
DLT7000
Aug 23 12:08:41 baggins unix: samst99 at QLGC,isp2:
Aug 23 12:08:41 baggins unix:  target 1 lun 0
Aug 23 12:08:41 baggins unix: samst99 is
/iommu@f,e0000000/sbus@f,e0001000/QLGC,isp@1,10000/samst@1,0
Aug 23 12:08:41 baggins unix: samst100:    Vendor/Product ID =
QUANTUM DLT7000
Aug 23 12:08:41 baggins unix: samst100 at QLGC,isp2:
Aug 23 12:08:41 baggins unix:  target 2 lun 0
Aug 23 12:08:41 baggins unix: samst100 is
/iommu@f,e0000000/sbus@f,e0001000/QLGC,isp@1,10000/samst@2,0
```

Find the `/dev/samst` symbolic links which point to these hardware paths:

```
lrwxrwxrwx   1 root           44 Aug 23 09:09 c2t0u0 ->
/devices/iommu@f,e0000000/sbus@f,e0001000/QLGC,isp@1,10000/samst@0,0:
a,raw
lrwxrwxrwx   1 root           44 Aug 23 09:09 c2t1u0 ->
/devices/iommu@f,e0000000/sbus@f,e0001000/QLGC,isp@1,10000/samst@1,0:
a,raw
lrwxrwxrwx   1 root           44 Aug 23 09:09 c2t2u0 ->
/devices/iommu@f,e0000000/sbus@f,e0001000/QLGC,isp@1,10000/samst@2,0:
a,raw
```

A tape device is involved, so find a symbolic link in `/dev/rmt` that points to the tape devices (note that the robot does not have this additional link):

```
lrwxrwxrwx   1 root           44 Aug 23 09:09 0cbn ->
../../devices/iommu@f,e0000000/sbus@f,e0001000/QLGC,isp@1,10000/st@1,
0:cbn
lrwxrwxrwx   1 root           44 Aug 23 09:09 1cbn ->
../../devices/iommu@f,e0000000/sbus@f,e0001000/QLGC,isp@1,10000/st@2,
0:cbn
```

Again, there are multiple symbolic links in the directory that point to the same hardware path. The drive supports compression, so choose the one with the `cbn` suffix. Had it not, you would have chosen the symbolic link whose name ended with `bn`.

Make the following entries in `/etc/opt/LSCsamfs/mcf`:

```
/dev/samst/c2t0u0  60  rb  9730  on  /var/opt/LSCsamfs/catalog/9730
/dev/rmt/0cbn      61  tp  9730  on
/dev/rmt/1cbn      62  tp  9730  on
```

The first line defines the automated library, displaying the `/dev/samst` name (`/dev/samst/c2t0u0`), a unique ordinal (`50`), the equipment type (`rb`, for the generic robot equipment type), a family set name for the robot and the drive (`9730`), the device state (`on`), and the path name to the automated library's catalog (`/var/opt/LSCsamfs/catalog/9730`).

The second line defines the first DLT tape drive inside the library. These entries refer to the equipment identifier for this tape device (`/dev/rmt/0cbn`), the ordinal for the device (`51`), the equipment type (`tp`), the family set name (`9730`), and the device state (`on`).

The third line defines the second DLT tape drive inside the automated library. These entries refer to the equipment identifier for this tape device (`/dev/rmt/1cbn`), the equipment ordinal for the device (`52`), the equipment type (`tp`), the family set name (`9730`), and the device state (`on`).

Again, when configuring DLT drives, make sure that you add the DLT definitions to the `/kernel/drv/st.conf` file, as shown in "Step 4: Add Tape Support to the `st.conf` File". DLT drives are not part of the standard Solaris configuration.

Completed *mcf* File

Figure 2-2 shows the complete `mcf` file for the configuration example:

```
# Equipment         Eq    Eq    Family   Dev   Additional
# Identifier        Ord   Type  Set      Sta   Parameters
#
samfs1              10    ms    samfs1
/dev/dsk/c1t0d0s0   11    md    samfs1   on    /dev/rdsk/c1t0d0s0
/dev/dsk/c1t1d0s5   12    md    samfs1   on    /dev/rdsk/c1t1d0s5
samfs2              20    ms    samfs2
/dev/dsk/c1t1d0s0   21    md    samfs2   on    /dev/rdsk/c1t1d0s0
/dev/dsk/c1t0d0s1   22    md    samfs2   on    /dev/rdsk/c1t0d0s1
/dev/samst/c0t2u0   30    od    -        on
/dev/samst/c1t2u0   50    rb    hp30     on    /var/opt/LSCsamfs/catalog/hp30
/dev/samst/c1t5u0   51    od    hp30     on
/dev/samst/c1t6u0   52    od    hp30     on
/dev/rmt/0cbn       40    tp    -        on
/dev/samst/c2t0u0   60    rb    9730     on    /var/opt/LSCsamfs/catalog/9730
/dev/rmt/0cbn       61    tp    9730     on
/dev/rmt/1cbn       62    tp    9730     on
```

Figure 2-2. Completed Sample `mcf` File

Step 10: Set up Default Values

The `/opt/LSCsamfs/examples/defaults.conf` file contains default settings for certain parameters in the LSC environment. Read the `defaults.conf`(4) man page and examine this file to determine which, if any, of the defaults should be changed. Copy the example `defaults.conf` to `/etc/opt/LSCsamfs/defaults.conf`, then edit the file, removing comments (preceded by a # sign) from the entries to be enabled.

Step 11: Create a Volume Serial Name (VSN) Catalog (Optional)

If you have a network-attached automated library, you must perform this step.

For SCSI-attached libraries, a VSN catalog is created automatically when the SAM-FS or SAM-QFS environment is initialized. The `Additional parameters` field for the automated library entry in the `mcf` file gives the path name to the catalog.

However, for a network-attached automated library, you must create a catalog at this time. For instructions on how to build a VSN catalog, see the information on managing vendor-specific automated libraries in the *SAM-FS and SAM-QFS Storage and Archive Management Guide*, publication SG-0008.

Step 12: Create the `samfs.cmd` File (Optional)

The `/etc/opt/LSCsamfs/samfs.cmd` file can be created as the place from which mount parameters are read. Creating this file may be beneficial if you are configuring multiple LSC file systems with multiple mount parameters. Information can be provided in the `samfs.cmd` file, in the `/etc/vfstab` file, and on the `mount`(1M) command. The directive lines in the `samfs.cmd` file serve as defaults, but they can be overridden by options on the `mount`(1M) command.

For more information on the `samfs.cmd` file, see the `samfs.cmd`(4) man page or see the *LSC File System Administrator's Guide*, publication SG-0006. For more information on the `/etc/vfstab` file, see "Step 13: Create the Mount Point and Update the `/etc/vfstab` File". For more information on the `mount`(1M) command, see the `mount_samfs`(1M) man page.

Step 13: Create the Mount Point and Update the `/etc/vfstab` File

The example in this step assumes that `/sam` is the mount point of the `samfs1` file system. You can select a different name and substitute it for `/sam`, if you want.

Edit the `/etc/vfstab` file and make an entry for each LSC file system. An example entry follows:

```
samfs1  -  /sam  samfs  -  yes  high=80,low=60
```

The various fields and their content are as follows:

Field	Field Title and Content
1	Device to mount. The name of the LSC file system to mount.
2	Device to `fsck`. A dash (`-`) indicates that there are no options. This prevents the system from performing an `fsck` on an LSC file system. For more information on this process, see the `fsck`(1M) man page.
3	Mount point. For example, `/sam`.
4	File system type. Must be `samfs`.
5	`fsck`(1M) pass. A dash (`-`) indicates that there are no options.
6	Mount at boot. Specifying `yes` in this field requests that the LSC file system be automatically mounted at boot time. Specifying `no` in this field indicates that you do not want to automatically mount the file system. For information on the format of these entries, see the `mount_samfs`(1M) man page.
7	Mount parameters. A list of comma-separated parameters (with no spaces) that are used in mounting the file system. For a list of available mount options, see the `mount_samfs`(1M) man page.

Create the mount point:

```
server# mkdir /sam
```

Next, if you want, change the permissions, owner, or group owner of the `/sam` directory when it is not mounted:

```
server# chmod 555 /sam
server# chown root /sam
server# chgrp other /sam
```

NOTE

If you configured multiple mount points, repeat these steps for each mount point, using a different mount point (such as `/sam`) and family set name (such as `samfs1`) each time.

Step 14: Make the File System

Using the `sammkfs`(1M) command and the family set names that you have defined, create a file system for each family set.

For example, the following command creates a file system for family set name `samfs1`:

```
server# sammkfs samfs1
```

The output from the preceding command is as follows:

```
total data kilobytes       = 31842048
total data kilobytes free  = 31841680
```

CAUTION

Running `sammkfs`(1M) creates a new file system. It removes all data currently contained in the partition associated with the file system in the `/etc/opt/LSCsamfs/mcf` file.

Step 15: Start Up and Shut Down the File System

The `mount`(1M) command mounts an LSC file system and starts `sam-initd` if the system is at run level 3 or above. For information on run levels, see the `init`(1M) man page. For information on the `mount`(1M) command, see the `mount_samfs`(1M) man page.

`/etc/rc3.d/S95samd` starts up `sam-initd` if an `mcf` file exists and `sam-initd` is not already running.

Change the `/etc/vfstab` mount at boot parameter to `yes`. This specifies that LSC file systems be mounted by `/etc/rc2.d/S01MOUNTFSYS`. It is possible to stop `sam-initd` and leave the file systems mounted. When `sam-initd` is restarted, pending stages are reissued and archiving is resumed.

Manual Start Up and Shut Down

Several commands are used to manually start up and shut down the file system. The following examples assume that `/sam` is the mount point and `samfs1` is the file system.

Enter the following commands to perform manual startup and to set the permissions on `/sam` to allow appropriate read and write access:

```
server# mount /sam
server# chmod 755 /sam
```

Enter the following commands to perform manual shutdown:

```
server# samcmd idle eq          # see NOTE
server# samd stop
server# umount /sam
```

NOTE

The drives in your SAM-FS or SAM-QFS environment must be idled prior to issuing the **`samd stop`** command, so enter a **`samcmd idle`** *eq* command for each *eq* configured in your `mcf` file. Alternatively, you can also idle the drives by using the `samu`(1M) operator utility or by using either the `robottool`(1M) or `libmgr`(1M) Graphical User Interface (GUI) tools. For more information on the `samcmd`(1M) command, see the `samcmd`(1M) man page.

Automatic Start Up and Shut Down

To perform an automated start up, perform the following tasks:

1. Edit `/etc/vfstab` to ensure that the mount at boot parameter is `yes`.
2. Boot the system. Go to run level `3` (multiuser mode) using the `init`(1M) command with the `3` option.

If `sam-initd` is not running, stages are not queued and files are not archived until `sam-initd` is started.

Step 16: Drive Order Check Procedure

The drive order check procedure differs depending on whether or not your automated library has a front panel. The procedure for systems with a front panel appears first.

Drive Order Check Procedure – Systems With a Front Panel

1. Start the SAM-FS or SAM-QFS software by mounting the file system or by using the `samd start` command.
2. Verify the order of the drives. If your automated library contains more than one drive, the drives defined in the `mcf` file must be in the same order as the drives viewed by the library controller. The drive order that is recognized by the media changer controller can be different than the order of the SCSI targets or LUNs.
3. Verify the order in which the drives are recognized by the media changer controller. Check the SCSI target IDs displayed by the control panel of the media changer.

Drive Order Check Procedure – Systems Without a Front Panel

1. Start the SAM-FS or SAM-QFS software by mounting the file system or by using the `samd start` command.
2. Verify the order of the drives. If your automated library contains more than one drive, the drives defined in the `mcf` file must be in the same order as the drives viewed by the library controller. The drive order that is recognized by the media changer controller can be different than the order of the SCSI targets or LUNs.

   Make sure you check *each* drive in a library. Make the drive state unavailable to the LSC file system. You can do this either by using `libmgr`(1M) to select the drives and change the drive state to unavailable or by using the `samu`(1M) utility's `:unavail` command.
3. Load a cartridge into the drive using the `load`(1M) command. Two possible formats for this command are as follows:

   `server# load` *mt.vsn device_num*

   OR

   `server# load` *eq:slot device_num*

   For more information on the load command format, see the `load`(1M) man page.
4. Determine if the correct drive responds while under SAM-FS or SAM-QFS control. The procedure for this step differs depending on whether you have a tape drive or an optical drive. The procedure for tape drives is presented first.

   For tape drives, enter the following information, where *X* is the raw tape device entry in the `mcf` file:

   `server# mt -f /dev/rmt/`*X* `status`

   The following example of a status message indicates a tape is in the drive.

   ```
   server# mt -f /dev/rmt/0 status
   DLT 7000 tape drive tape drive:
      sense key(0x2)= Not Ready   residual= 0   retries= 0
      file no= 0   block no= 0
   ```

   If the tapes did not load or the drives did not return a status, the drives may not be listed in the proper order in the `mcf`. Make sure the order is correct in the `mcf` and repeat this test.

   After modifying the `mcf`, you must reinitialize the `sam-initd` daemon. Use the `samd stop` command to stop `sam-initd` and the `samd start` command to start the `sam-initd`. daemon.

   For optical drives, because they are not shared and do not return a status, you should read the SCSI target IDs displayed on the control panel for your automated library. The order in which the drive targets are reported should be the order they are configured in the `mcf` file.

   To determine whether the drives become active, you can visually inspect the drives or you can use the `samu`(1M) utility's `o` display.

Refer to your hardware maintenance manual for instructions on identifying and setting target addresses.

Step 17: Label Tapes or Optical Disks (Optional)

If you have standalone tape or optical devices, or if your automated library has no barcode reader, you must perform this step.

To prepare cartridges, use the `tplabel`(1M) command for tapes or use the `odlabel`(1M) command for optical disks. These commands create a label on the cartridge that can be used in the SAM-FS and SAM-QFS environment.

The `tplabel`(1M) command has the following format:

`tplabel –new –vsn` *new_vsn eq*`:`*slot*[`:`*partition*]

new_vsn	The new volume serial name.
eq	The equipment ordinal of the automated library or manually loaded drive being addressed as defined in the `mcf` file.
slot	The number of a storage slot in an automated library as recognized in the library catalog. This argument is not applicable for manually loaded drives.
partition	A partition on a tape. This is an optional argument. For a partitioned tape, this argument must be specified, and it must be in the range `0` ≤ *partition* ≤ `256`. For an nonpartitioned tape, this argument is `0` by default.

The `odlabel`(1M) command has the following format:

`odlabel –new –vsn` *new_vsn eq*`:`*slot*`:`*partition*

new_vsn	The new volume serial name.
eq	The equipment ordinal of the automated library or manually loaded drive being addressed as defined in the `mcf` file.
slot	The number of a storage slot in an automated library as recognized in the library catalog. This argument does not apply to manually loaded drives.
partition	A side of a magneto optical disk. The *partition* must be `1` or `2`.

The following examples show the `odlabel`(1M) and `tplabel`(1M) commands being used to label new cartridges:

```
server# tplabel –vsn TAPE01 -new 50:0
server# odlabel –vsn OPTIC01 –new 30:1:1
```

Cartridges are ready to be used after these commands are issued. For more information on these commands, see the `tplabel`(1M) and `odlabel`(1M) man pages.

Step 18: Configure the Archiver

By default, the archiver archives all files under all SAM-FS and SAM-QFS mount points. Note that the administrator is not required to take action. The archiver archives to all VSNs in all configured automated libraries.

If your site has additional requirements, you need to set up the archiver command file, `archiver.cmd`. For additional information, see the `archiver.cmd`(4) man page and see the information on the archiver in the *SAM-FS and SAM-QFS Storage and Archive Management Guide*, publication SG-0008.

Step 19: Share the File System with Client Machines

The Solaris `share`(1M) command must be run to make the file system available for mounting by remote systems. One or more `share`(1M) commands are typically placed in the `/etc/dfs/dfstab` file and are executed automatically by Solaris when entering `init`(1M) state 3.

For example, on the server, enter a line like the following:

```
server# share -F nfs -o rw=client1:client2 -d "SAM-FS" /sam
```

NOTE

If you write a `share`(1M) command like the preceding example into the `/etc/dfs/dfstab` file, Solaris shares the file system after the next system reboot. If you want to share the file system immediately, you must type the `share`(1M) command at a root shell prompt. If there are no shared file systems when Solaris boots, the NFS server is not started. You must reboot after adding the first `share` entry to this file.

Some NFS mount parameters can affect the performance of an NFS mounted LSC file system. You can set these parameters in the `/etc/vfstab` file as follows:

- `timeo =` *n*
  This value sets the NFS timeout to *n* tenths of a second. The default is 11 tenths of a second. For performance purposes, especially when staging files, LSC recommends using the default value. You can increase or decrease the value appropriately to your system.
- `rsize =` *n*
  This value sets the read buffer size to *n* bytes. In NFS 2, change the default value (8192) to 32768. In NFS 3, retain the default value of 32768.
- `wsize =` *n*
  This value sets the write buffer size to *n* bytes. In NFS 2, change the default value (8192) to 32768. In NFS 3, retain the default value of 32768.

For more information on these parameters, see the `mount_nfs`(1M) man page.

Step 20: Mount the File System on the Client Machines

On the client systems, mount the server's SAM-FS or SAM-QFS file system at a convenient mount point.

In the following example, `server:/sam` is mounted on `/sam`, and information is entered into the `/etc/vfstab` file:

```
server:/sam   -   /sam   nfs   –   yes
hard,intr,timeo=60
```

Next, on the command line, issue the `mount`(1M) command:

```
client# mount /sam
```

The automounter can also do this, if it is preferred. Follow your site procedures for adding `server:/sam` to your automounter maps.

NOTE

It is strongly recommended that clients mount the file system with the `hard` option. At times, there may be a significant delay in the SAM-FS or SAM-QFS file system's response to client requests. This can occur when a requested file resides on a cartridge that must be loaded into a DLT tape drive. If the `hard` option is not specified, the client can return an error instead of retrying the operation until it completes.

If you use the `soft` option, make sure you set the value of `retrans` to a large number such as 120 (the default is 5). This sets the number of NFS retransmissions.

Step 21: Establish Periodic Dumps Using `samfsdump(1M)`

The server should periodically create a control structure dump using `samfsdump`(1M). The `samfsdump`(1M) command supports dumping unarchived data. The `–u` option on the `samfsdump`(1M) command causes unarchived data to be interspersed with the control structure data normally contained in a `samfsdump`(1M) dump. When using the `samfsdump`(1M) command, please note the following:

- A `samfsdump`(1M) dump taken under release 3.5.0 using the `-u` option cannot be restored at earlier releases of the SAM-FS or SAM-QFS software because of new data structures needed to support data inclusion.
- A `samfsdump`(1M) dump taken using the `-u` option can be very large. The `samfsdump`(1M) command does not have any tape management or estimations as does `ufsdump`(1M). You need to weigh the tradeoffs of space and unarchived data when using the `-u` option. For more information on these commands, see the `samfsdump`(1M) and `ufsdump`(1M) man pages.

This dump does not include the data stored in your file system, but it does include information necessary to quickly locate the data on your removable media devices. This information is necessary to recover from a cache disk failure. Use `samfsrestore`(1M) to restore the control structure dump after initializing the file system if such a failure occurs.

For example, you can make an entry in root's `crontab` file so the `cron` daemon runs `samfsdump` periodically:

```
10 0 * * * (find /csd.directory/sam -type f -mtime +3 \
-print| xargs -l1 rm -f); cd /sam; \
/opt/LSCsamfs/sbin/samfsdump -f \
/csd.directory/sam/'date +\%y\%m\%d'
```

This example `crontab` entry uses a SAM-FS file system mounted on `/sam`. Replace `/csd.directory` with an existing directory of your choice. This entry causes the commands to be executed each day at midnight. First, the old dumps are renamed and a new dump is created in `/csd.directory/sam/`*yymmdd*. After that, `cron`(1M) emails the `samfsdump`(1M) output to root.

If you have multiple LSC file systems, make similar entries for each. Make sure you save each dump in a separate file.

For more information on using `samfsdump`(1M), see the `samfsdump`(1M) man page and see the information on control structures, disaster preparation, and recovery in the *SAM-FS and SAM-QFS Storage and Archive Management Guide*, publication SG-0008.

Step 22: Establish Periodic Backups of the `.inodes` File (Optional)

As an alternative to `samfsdump`(1M), you can periodically save the inode information, which is stored in file `.inodes` under the mount point. The `.inodes` file is used to recover a file system after a cache disk failure.

For example, if `/sam` is the mount point, the following `dd`(1M) command can be added to the `crontab` file:

```
0 0, 8, 16 * * * (find /csd.directory/inodes/sam \
-type f –mtime +3 –print | xargs –l1 rm –f); \
/bin/dd if=/sam/.inodes \
of=/csd.directory/inodes/sam/'date +\%y\%m\%d' bs=128k
```

After a disk failure, the backup `.inodes` file can be used as input to `sammkfs`(1M). `sammkfs`(1M) constructs the file system and restores the inodes. All the files, directories, symbolic links, and removable media files are offline. You can back up the `.inodes` file more frequently since it takes less time than running `samfsdump`(1M). Specifying the block size in integer multiples of 16 kilobytes increases the performance of the `dd`(1M) copy (for example `bs=128k` or `bs=512k`).

For more information on using the `dd`(1M) command to back up the inodes, see the `dd`(1M) man page and see the information on control structures, disaster preparation, and recovery in the *SAM-FS and SAM-QFS Storage and Archive Management Guide*, publication SG-0008.

SAM-FS and SAM-QFS Upgrade Procedure
Chapter 6

This chapter describes upgrading a server to a new release of the SAM-FS or SAM-QFS software. Use this procedure if you are upgrading your SAM-FS or SAM-QFS environment.

All steps in this chapter must be performed as superuser (root).

Step 1: Obtain the Release Files

The SAM-FS and SAM-QFS software can be obtained on a CD-ROM or by anonymous FTP. Contact your ASP or LSC for information on obtaining the software in one of these ways.

If you have a CD-ROM, run the Solaris Volume Manager, insert the CD-ROM, and change to the directory containing the SAM-FS or SAM-QFS software files using the following command:

```
server# cd /cdrom/cdrom0
```

WARNING

If you have not read the `README` file delivered with this release, please do so before continuing. The SAM-FS and SAM-QFS 3.5.0 releases include significant restructuring changes as compared to previous revisions. Failure to recognize these changes could cause dramatic changes in script behavior. The `README` file is included in the FTP instructions and is on the CD-ROM distribution. After your software is installed, it is located in `/opt/LSCsamfs/doc/README`.

Step 2: Back Up Each SAM-FS and SAM-QFS File System

If you do not have current backup files for each of your SAM-FS and SAM-QFS file systems, create them now using `samfsdump`(1M) or by copying the inodes file using `dd`(1M), as follows:

1. Back up each LSC file system using `samfsdump`(1M). The location to which you dump each system should be outside the LSC file systems.

   The following example assumes that you have a file system named `samfs1` (mounted at `/sam`) that you want to back up to `samfs1.bak`, which exists outside of the LSC file systems:

   ```
   server# cd /sam
   server# samfsdump –f /csd_dump_dir/sam.csd
   ```

   The `samfsdump` command dumps file names and inode information, not data. For more information on this, see the `samfsdump`(1M) man page.

2. If your site is archiving file system data, use the `dd`(1M) command to write this information to a file for safe keeping. The following example uses the `dd`(1M) command to write the file system at the `/sam` mount point:

   ```
   server# dd if=/sam/.inodes of=/inode_dump_dir/sam.inodes bs=128k
   ```

3. Back up any site-defined scripts. Because of the directory restructuring in the SAM-FS and SAM-QFS 3.5.0 software, any scripts stored in `/etc/fs/samfs` could be destroyed during an upgrade. Scripts in directories created by the LSC software in an earlier version could also be destroyed. After the SAM-FS or SAM-QFS 3.5.0 software is installed, you can move the scripts to a location in `/var/opt`.

You need to back up files for each file system, so repeat the preceding steps for each file system in your LSC environment.

For more information on backing up your file systems, see chapter 5, “SAM-FS and SAM-QFS Initial Installation Procedure”.

Step 3: Stop the SAM-FS or SAM-QFS File System

To stop the SAM-FS or SAM-QFS file system, enter the following command:

```
server# samcmd idle eq              # see NOTE
server# samd stop
```

NOTE

The drives in your SAM-FS or SAM-QFS environment must be idled prior to issuing the **samd stop** command, so enter a **samcmd idle** *eq* command for each *eq* configured in your mcf file. Alternatively, you can also idle the drives by using the samu(1M) operator utility or by using either the robottool(1M) or libmgr(1M) Graphical User Interface (GUI) tools. For more information on the samcmd(1M) command, see the samcmd(1M) man page.

The samd(1M) command is installed in /opt/LSCsamfs/sbin.

Step 4: Unmount the File Systems

Using the Solaris umount(1M) command, unmount each LSC file system.

If you encounter difficulty unmounting a file system, it might be because you or another user are using files or because you or another user have changed to directories in the file system. Use the fuser(1M) command to determine whether or not any processes are still busy. If any are still busy, you must terminate them by using the kill(1M) command. For example, you can enter the following command to determine whether or not processes are still running on the samfs1 file system:

```
server# fuser -uc /mountpoint
```

If you are still unable to unmount the file system, issue the Solaris unshare(1M) command on the file system as follows:

```
server # unshare pathname
```

In the preceding format, *pathname* is the path to the LSC file system that you are trying to unmount. After issuing the unshare(1M) command on the path to the LSC file system, try unmounting the file system again. For more information on this, see the unshare(1M) man page.

If all previous attempts to unmount the file system still fail, edit the /etc/vfstab file. When editing this file, change all LSC file systems from yes or delay to no. Then reboot your system.

Step 5: Remove Existing SAM-FS or SAM-QFS Software

Use the pkginfo(1) command, as follows to determine which LSC software packages are installed on your system:

```
server# pkginfo | grep LSC
```

Use the pkgrm(1M) command to remove the existing SAM-FS or SAM-QFS software. You must remove all existing SAM-FS and SAM-QFS packages before installing the new packages. If you are using any of the optional LSC packages as described at the beginning of this chapter, you should make sure that you remove these packages prior to the main LSCsamfs package. The install script prompts you to confirm several of the removal steps.

The following example removes all of the LSC packages:

```
server# pkgrm LSCibm LSCstk LSCdst LSCsony LSCgui LSCjre LSCdoc LSCsamfs
```

The `LSCsamfs` package must be the last package removed.

As part of the installation process, the existing master configuration file and the catalog files are copied to `/etc/opt/LSCsamfs/samfs.old.`*date*.

Step 6: Add the Packages

LSC software packages use the Solaris packaging utilities for adding and deleting software. As such, you must be logged in as superuser (root) to make changes to software packages. The `pkgadd`(1M) command prompts you to confirm various actions necessary to upgrade the LSC packages.

On the CD-ROM, the SAM-FS, SAM-QFS, and all optional products reside in the `/cdrom/cdrom0` directory organized by Solaris version.

To satisfy product dependencies, you must upgrade the `sampkg` first. Run the `pkgadd`(1M) command to upgrade all packages, answering `yes` to each question:

```
server# pkgadd -d sampkg          (must be first)
```

If your SAM-FS or SAM-QFS environment includes certain network-attached automated libraries, such as certain models from StorageTek, Ampex, IBM, or Sony, you may need to install one or more vendor-specific media changer packages. These packages are supplied by LSC. For information on whether or not you need to install a vendor-specific package, see the information on managing vendor-specific automated libraries in the *SAM-FS and SAM-QFS Storage and Archive Management Guide*, publication SG-0008.

To install one or more of these packages, install them using `pkgadd`(1M), as follows:

```
server# pkgadd -d samstk          (optional StorageTek package)
server# pkgadd -d samdst          (optional Ampex package)
server# pkgadd -d samibm          (optional IBM package)
server# pkgadd -d samsony         (optional Sony package)
```

If you want to use the GUI tools included with the SAM-FS and SAM-QFS software package, install them now. The GUI tools require the presence of a Java runtime environment. Add the Java runtime environment and the GUI tool package as follows:

```
server# pkgadd -d samjre          (optional)
server# pkgadd -d samgui          (optional)
```

If you want to install LSC documentation, install it now. Manuals are available in PDF format. Add this package as follows:

```
server# pkgadd -d samdoc          (optional)
```

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.

Step 7: Restore File Changes (`inquiry.conf` and `samst.conf`)

LSC does not guarantee correct operation with peripherals other than those included in the `/opt/LSCsamfs/examples/inquiry.conf` file supplied with the release. The installation script compares this file with an existing one, if any, in `/etc/opt/LSCsamfs`. If these files differ, the following message is issued:

```
inquiry.conf has been updated.
/opt/LSCsamfs/examples/inquiry.conf is the latest version;
please add your changes and copy this file to
/etc/opt/LSCsamfs/inquiry.conf.
```

If you have modified `/kernel/drv/samst.conf`, you need to merge any changes to it that might be needed for your configuration. The installation script compares this file with an existing one, if any, in `/kernel/dev/samst.conf`. If these files differ, the following message is issued:

```
samst.conf has been updated.
/opt/LSCsamfs/examples/samst.conf is the latest version;
please add your changes and copy it to
/kernel/drv/samst.conf.  When you have done this, you may
need to run /usr/sbin/add_drv samst and
/opt/LSCsamfs/sbin/samdev again.
```

Step 8: Update the License Keys

You must update the license keys for the SAM-FS and SAM-QFS 3.5.0 release. If you are upgrading from an LSC release prior to 3.5.0, you need to place a new license key in the following file:

`/etc/opt/LSCsamfs/LICENSE.3.5`

To obtain new license keys, contact your ASP or LSC.

For more information see the licensing information in chapter 5, “SAM-FS and SAM-QFS Initial Installation Procedure”.

Step 9: Verify the New Master Configuration File

The topology of the equipment managed by the SAM-FS or SAM-QFS file system is defined in the master configuration file, `/etc/opt/LSCsamfs/mcf`. This file specifies the devices, automated libraries, and file systems included in the environment. Each piece of equipment is assigned a unique equipment identifier in the `mcf` file.

Verify that a new `mcf` file exists in `/etc/opt/LSCsamfs/mcf`.

NOTE

For information on file system design considerations, see the *LSC File System Administrator’s Guide*, publication SG-0006.

Step 10: Modify the `/etc/vfstab` File (Optional)

If you modified the `/etc/vfstab` file in "Step 4: Unmount the File Systems", edit this file again and change all LSC file systems from `no` to `yes` or `delay`.

Step 11: Reboot the System

You must reboot the system at this time using the `reboot`(1M) command.

Rebooting is particularly important if you are upgrading from a SAM-FS or SAM-QFS 3.3.1 release on Solaris 2.7, which is a 32-bit release, and are now upgrading to a 64-bit release. The reboot is necessary to build the 64-bit kernel.

Step 12: Mount the File System(s) (Optional)

You must perform this step if you have not modified the `/etc/vfstab` file to have `yes` or `delay`.

Use the `mount`(1M) command to mount the file systems and continue operation with the upgraded LSC software.

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

```
server# mount samfs1
```

Step 13: Relink API-dependent Applications (Optional)

If you are running applications that use the LSC application programmer interface (API) and you are using static linking, you should relink these applications at this time.

LSC Product Support
Appendix A

This appendix includes the following topics:

- LSC software support
- How to report a problem
- What LSC does when your Authorized Service Provider (ASP) reports a problem
- LSC support contacts

LSC Software Support

The following subsections relate to problems or questions regarding LSC software products, documentation, or support

ASPs

LSC sells and supports its products through ASPs. Your ASP is generally a specialist within your country or industry market that provides support for LSC products. The ASPs provide help desk assistance and have LSC-trained service representatives. The ASPs provide primary support on the product including taking the initial software support call and providing immediate problem and question resolution whenever possible.

LSC Support Center

When an ASP cannot provide a resolution, the ASP escalates the problem to the LSC support center located in Minnesota. These secondary support calls require a higher level of expertise for problems that cannot be resolved by the Level-1 ASPs. If you have an ASP, the escalation of a problem to the LSC support center must be done through the ASP. Do not report a problem directly to LSC. You must use your ASP.

How to Report a Problem

This subsection describes the steps LSC suggests to report your problem to your ASP. If your ASP has a different procedure, please follow the ASP's procedure instead.

What to Do Before You Call

The first step to take when you encounter a problem or a technical question is to review the product documentation. It is possible that a solution or answer is provided in the documentation. If the documentation does not provides a solution, take the following steps before you call your support ASP.

Step 1: Identify the Severity Level of the Problem

You must determine how critical the software problem is, based on the severity level descriptions in this subsection.

The severity levels range from A to D, with severity level A being the most critical. The severity levels only apply to processing software problem incidents. All problems should be reported by email if possible to avoid errors. We can help you in the most efficient way if you have emailed a description of the problem and have sent the output of the `info.sh` script prior by FTP prior to telephoning. In the definitions that follow, a *software problem* refers to both software and documentation problems.

The problem severity levels are:

- Severity Level A - The software product is non-operational, resulting in a critical system condition requiring immediate resolution. Support personnel may require continuous access to your resources until a workaround or resolution is provided. When reporting a Severity A incident, a telephone call after sending materials by email is preferred. Email without a call is acceptable, but it may delay an ASP or LSC response. LSC requires that any support calls at Severity Level A to LSC include availability of the customer system administrators to LSC.
- Severity Level B - The software product is operational, but it is severely restricted in functionality or presents a system degradation. When reporting a Severity B incident, a telephone call after sending materials by email is preferred, although email alone is acceptable.
- Severity Level C - The software product is operational, but functional limitations or restrictions that are not critical to the overall system operations are present. When reporting a Severity C incident, email is preferred.
- Severity Level D - Problems that have little, or no, impact on system operations are present. Severity D incidents should be reported only via email.

Step 2: Record Your Company Information

You will be asked to provide the following information:

- Your company name and customer number. For example, Company X, L0666.
- Your name and telephone number. Also provide the name and number for an alternate contact, if possible. For Severity A or B, a pager number is also requested.
- Your email address. For example, `jjohnson@amcorp.com`.
- Details of the software problem or technical question.
- Severity level of the software problem or a specific time and date by which you require a response to a technical question. For more information, see the previous step, “Step 1:

Identify the Severity Level of the Problem". You will be given an incident number to track this support call.

Step 3: Record Your Site and Configuration Information

You should have the following information accessible:

- The name of the software product, including the release level. For example, SAM-FS 3.5.0. This can be obtained by entering the following command:

```
server# pkginfo -l LSCsamfs
```

- The names and releases of your system software, such as the operating systems or any other appropriate software. For example, Solaris 2.7.

Step 4: Detail the Problem

Use the LSC Problem Identification Checklist (Table A-1) to help you collect details about the software or documentation problem. You may make copies of the checklist. Collect this information for each problem or question.

Keep a record of your checklist responses in a convenient place for reference. Your ASP and the LSC software support center may request an answer to some or all of the questions.

Step 5: Gather Diagnostic Output

During problem resolution, your ASP and the LSC support center may request that you provide specific diagnostic material. The output of the `info.sh`(1M) command provides us with a current snapshot of your system configuration as it relates to your SAM-FS or SAM-QFS environment. Only limited log information is captured by this script, so make sure you run `info.sh` when the problem is occurring or as soon a possible after it occurs.

Submit a separate copy of the `info.sh`(1M) output for each problem you report. The output should be sent by FTP to your ASP. LSC may ask you to send information to the LSC site, but unless otherwise directed, you should always work through your ASP. The following guidelines apply when sending diagnostic information:

- Do not send SAM reports as attachments to email. If your ASP has directed you to send a SAM report to LSC, send it to the LSC FTP site, which is `ftp.lsci.com`.
- Do not send any other files or core dumps unless you have been specifically requested to do so by staff at the LSC support center.
- Do not compress the ASCII files unless you use the Solaris `compress`(1) utility. Please do not zip these files on a PC using Microsoft Windows software.

Occasionally a problem is reported many hours or even days after the problem first occurred. Because the SAM-FS and SAM-QFS environments generate a lot of log messages, a review of the log files during the problem period is important. The `info.sh`(1M) command only gathers the last 1000 log entries. If many log entries are generated after a problem occurs, a snapshot of the relevant time period may be needed for diagnosis.

For more information on the `info.sh`(1M) command, see the `info.sh`(1M) man page.

Step 6: Contact Support

When you have completed all steps described in this subsection, "What To Do Before You Call", it is time to contact your ASP. Before contacting your ASP, make sure that you have collected all of the information on the Problem Identification Checklist.

The Problem Identification Checklist

Table A-1 is the LSC problem identification checklist. It summarizes the information that you need to gather prior to calling your ASP to report a problem.

Table A-1. LSC Problem Identification Checklist

For software problems, provide the following information:

- Severity Level (see page A-2)
- Company name and customer number (see page A-2)
- Site and configuration information (see page A-3)
- What statement or command are you using?
- What are you expecting to happen, versus what is actually happening?
- What, if any, error messages are you receiving?
- When did you first notice the problem?
- Have you attempted this activity before? Was it successful?
- What has changed since the activity last operated correctly? For instance, was the software upgraded or have you changed the configuration?
- Is the problem reproducible? If so, under what conditions?
- Has the problem occurred before?
- If the problem does not occur consistently, describe the conditions under which the problem does and does not occur.
- What other information can you provide concerning this problem?

For documentation problems, provide the following information:

- Severity level
- Company name and customer number
- Site and configuration information
- The document name, document number, and date of the publication.
- The number of the page that contains the problem.
- A description of the documentation problem. Please be specific.
- Any other information that you can provide concerning this problem.

What LSC Does When Your ASP Reports a Problem

The LSC support center answers problems regarding our released software products. As problems are reported and analyzed, we work to clarify our documentation, fix our software, and implement design requests. The following process describes flow from reporting a problem to generating a fix.

Step 1: Log the Incident

When LSC receives a call or an email, an LSC support analyst assigns it an incident number (for example, `W711030018`). The incident number is to be used for any communications regarding this specific problem. Multiple problems usually receive multiple incident numbers. Be sure that when you are responding to LSC emails that you include the appropriate incident number in the email subject line.

Step 2: Assign a Support Analyst to the Incident

The incident is assigned to one of the support analysts in the LSC support center. This analyst works with your ASP to understand, analyze, and close out the problem. Not all incidents are necessarily answered immediately. If LSC cannot answer a problem right away, LSC tells your ASP why and keeps your ASP posted as analysis progresses.

Step 3: Analyze the Problem Incident

Further analysis of the incident may be required. If so, the support analyst works with the proper LSC staff members to try and resolve the problem.

Step 4: Request Additional Information

During problem resolution, the support analyst may request additional information from you through your ASP. The analyst will refer to the problem using the assigned incident number. You should remember to use this number in all communications.

Step 5: Close Out the Incident Report

When the problem is resolved, LSC closes the incident with a response to you through your ASP. An incident is closed when one of the following occurs:

- A question is answered
- A problem that you encountered is fixed in a release that may require you to upgrade your software
- LSC has analyzed the problem and determined that there is a problem in our software that needs to be fixed. In this case, LSC closes the incident but opens a software problem report as described in the next step.

Step 6: LSC Opens a Software Problem Report

If an incident occurred because of an error in our software, the LSC support analyst opens an internal software problem report. Software problem reports are tracked in an LSC internal database and are assigned to software developers for further analysis and fixing.

Step 7: Take Corrective Action

The software developer works to fix the problem. Although LSC works to close all software problem reports in a timely manner, no guarantees are made as to when these problems might be resolved.

Step 8: Integrate and Test

The software fix is integrated into an internal software release and tested before it is released. Sometimes LSC requests that a customer help in the testing process by running a fix at their site. This is done in situations in which a unique set of circumstances exists for the problem only at the customer site.

Step 9: Identify a Release in Which to Package the Software Fix

Finally, the software fix is integrated into one or more releases of the software product. LSC's software fixes are packaged in releases indicated by the last digit in the release number. For example, SAM-FS 3.5.0-9 is the ninth bugfix edition of 3.5.0.

LSC Support Contacts

If your support contact is directly with LSC, then contact the LSC support center. The following table shows the telephone numbers and email addresses to use for LSC service. Before contacting LSC, please read the "What To Do Before You Call" subsection, which appeared previously in this chapter.

The LSC contact information is as follows:

Communication method	Contact information
Telephone, domestic	1 (800) 650-2337
Telephone, international	+1 (612) 482-5683
Email	`support@lsci.com`
Fax	+1 (651) 554-1540
Regular mail	LSC, Inc. Attention: Software Support 1270 Eagan Industrial Road, Suite 160 Eagan, MN 55121-1231 USA

The LSC support center hours of operations are Monday through Friday, 09:00 - 18:00, central standard time. This does not include LSC holidays.

Glossary

addressable storage

The storage space encompassing online, nearline, and offline storage that is user referenced through an LSC file system.

archiver

The archive program that automatically controls the copying of files to removable cartridges.

archive storage

Copies of file data that have been created on removable cartridges for long-term offline storage.

audit (full)

The process of reading the VSNs from each cartridge in an automated library. For non-tape 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 robot that moves cartridges to and from the storage slots and the drives.

backup storage

A snapshot of a collection of files for the express purpose of preventing inadvertent loss. A backup includes both the file's attributes and associated data.

block allocation map

A bit map representing each available block of storage on a disk and indicating whether the block is in use or free.

cartridge

The 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.

data device

For a file system, a device or group of devices upon which file data is stored.

data space

The portion of a collection of files that is the actual data information.

DAU (Disk Allocation Unit)

The basic unit of online storage.

The SAM-FS file system uses several sizes. The small DAU is 4 kilobytes (2^{17} or 4096 bytes). The large DAU is 16, 32, or 64 kilobytes. The available DAU size pairs are 4/16, 4/32, and 4/64.

The QFS and SAM-QFS file systems support a fully adjustable DAU, sized from 16 kilobytes through 65528 kilobytes. The DAU you specify must be multiple of 8 kilobytes.

device logging

A feature that provides device-specific error information used to analyze device problems.

device scanner

Software within the LSC file system that periodically monitors the presence of all manually mounted removable devices and detects the presence of mounted cartridges that may be requested by a user or other process.

devicetool

A SAM-FS and SAM-QFS administrative tool with a graphical user interface for viewing information about and managing individual devices.

direct I/O

An attribute used for large block-aligned sequential I/O. The `setfa`(1) command's `-D` 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.

disk allocation unit

See DAU.

disk cache family set

The definition for the devices that make up a family set. The name of the disk cache family set is found in the equipment identifier field of the Master Configuration File (`mcf` file). This is sometimes referred to as a *metadevice* in industry literature. Also see family set.

disk striping

The process of recording a file across several disks, thereby improving access performance and increasing overall storage capacity.

direct access

A file attribute (stage never) designating that a nearline file can be accessed directly from the archive cartridges and need not be staged for online access.

directory

A file data structure that points to other files and directories within the file system.

disk space thresholds

User-defined disk space thresholds that define 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 the pre-defined disk space thresholds.

drive

A mechanism for transferring data to and from a volume.

extent array

The array within a file's inode that defines where each data block assigned to the file is located on the disk.

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 mounted within an automated library.

Also see disk cache family set.

FDDI

Fiber Distributed Data Interface. FDDI is a 100 megabytes-per-second fiber optic LAN.

file system-specific directives

Directives that follow global directives 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.

file system

A hierarchical collection of files and directories.

FTP

File Transfer Protocol. An internet protocol for transferring files between two hosts over a TCP/IP network.

global commands

Commands that apply to all file systems and appear before the first "`fs =` " line.

indirect block

A disk block that contains a list of storage blocks. The LSC 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.

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 LSC inodes are 512 bytes long. The inode file is a metadata file, which is separated from file data in the QFS and SAM-QFS file systems.

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.

LAN

Local Area Network.

library catalog

See catalog.

LUN

Logical Unit Number.

mcf

Master Configuration File. The file that is read at initialization time that defines the device topology within a QFS, SAM-FS, and SAM-QFS environment.

media

Tape or optical disk cartridges.

media recycling

The process of recycling or reusing archive cartridges with low use (that is, archive cartridges with few active files).

metadata

Data about data. The index information needed to locate the exact data position of a file on a disk. Metadata contains information pertaining to the directory, symbolic link, removable media, segmented file index, and `.inode`s.

metadata device

A separate device (for example a solid-state disk or mirrored device) upon which QFS and SAM-QFS file system metadata is stored. Separating file data from metadata can increase performance. In the `mcf` file, a metadata device is declared as an `mm` device within an `ma` file system.

mirror writing

The process of maintaining two copies of a file on disjoint sets of disks to prevent loss from a single disk failure. It is often referred to as shadowing.

mount point

The path to a directory where a file system is mounted.

name space

The portion of a collection of files that identifies the file, its attributes, and its storage locations.

nearline storage

Removable 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 network-attached automated library, such as those from StorageTek, ADIC/Grau, IBM, or Sony, is controlled using a software package supplied by the vendor. The SAM-FS and SAM-QFS file systems interface with the vendor software using an LSC media changer daemon specifically designed for the automated library.

NFS

Network File System. A standard protocol that allows a UNIX file system to be remotely mounted via a network.

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).

partition

A portion of a device.

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 only be performed on zero-sized files. That is, the `setfa -l` command can only be specified for a file that is size zero. For more information, see the `setfa`(1) man page.

prioritizing preview requests

A method of assigning priority to archive and stage requests that cannot be immediately satisfied.

RAID

Redundant Array of Inexpensive/Independent Disks. A disk technology that uses several inexpensive disks to reliably store files. It may protect against data loss from a single disk failure, may provide a fault-tolerant disk environment, and may provide higher throughput than individual disks.

recycler

A SAM-FS and SAM-QFS component that reclaims space on cartridges that is occupied by unused 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 SAM-FS and SAM-QFS 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.

robot

The portion of an automated library that moves cartridges between storage slots and drives.

robottool

A SAM-FS and SAM-QFS administrative tool with a graphical user interface (GUI) for viewing and managing automated libraries.

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, LSC file systems implement striped data access unless striped groups are present. Files are round robined 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 striping.

RPC

Remote Procedure Calls. The underlying data exchange mechanism used by NFS to implement custom network data servers.

SAM-FS

The LSC Storage and Archive Manager File System. The SAM-FS software controls the access to all files stored and all devices configured in the Master Configuration File (`mcf`).

SAM-QFS

The SAM-QFS software combines the LSC Storage and Archive Manager with the QFS file system. 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 SAM-FS command set as well as standard UNIX file system commands.

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 copy data.

samfsrestore

A program that restores a control structure dump.

samtool

A SAM-FS and SAM-QFS administrative tool with a GUI for invoking `robottool`, `devicetool`, and `previewtool`.

SCSI

Small Computer System Interface. An electrical communication specification commonly used for peripheral devices such as disk and tape drives and automated libraries.

SCSI-attached Library

An automated library connected directly to a server using the SCSI interface. These libraries are controlled directly by the SAM-FS or SAM-QFS software by using the SCSI standard for automated libraries.

shared writer/shared reader

The QFS shared reader/shared writer capability allows you to specify a file system that can be shared by multiple servers. Multiple hosts can read the file system while only one host can write to the file system. Shared readers are specified with the `-o shared_reader` option on the `mount`(1M) command. The one-writer host is specified with the `-o shared_writer` option on the `mount`(1M) command. For more information on the `mount`(1M) command, see the `mount_samfs`(1M) man page.

small computer system interface

See SCSI.

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. The contents of the storage slots are kept in the automated library's catalog.

stripe size

The number of disk allocation units (DAUs) to allocate before moving to the next device of a stripe. If `stripe=0`, the file system uses round-robin access, not striped access.

striped group

A collection of devices within a QFS or SAM-QFS file system and defined in the `mcf` file as two or more `g`*XXX* 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.

striping

A data access method in which files are simultaneously written to logical disks in an interlaced fashion.

All LSC file systems allow you to declare either striped or round robin access for each individual file system. The QFS and SAM-QFS file systems allow you to declare striped groups within each file system.

Also see the glossary entry for round robin.

super block

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.

tar

Tape Archive. A standard file/data recording format used by the SAM-FS and SAM-QFS 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.

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

Allows 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. A logical identifier for magnetic tape and optical disk that is written in the volume label.

WORM

Write Once Read Many. A storage classification for media that can be written only once but read many times.

Index