

Quantum[®]

Installation Guide

StorNext 5 and StorNext FX 5



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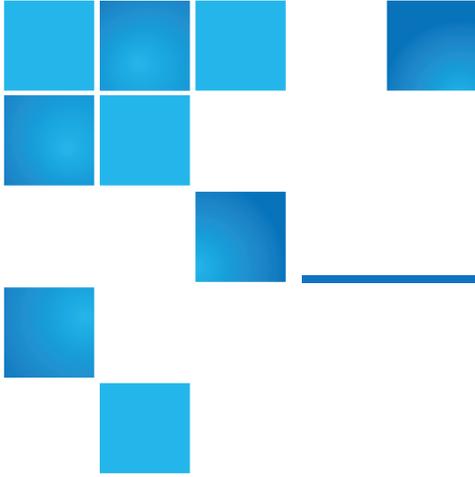
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Preface

This manual introduces the Quantum StorNext 5 and StorNext FX 5 (**FX** stands for **F**ile **S**ystem for **X**san) and contains the following chapters:

- [Chapter 1: Begin Here](#)
- [Chapter 2: StorNext Linux MDC Installation/Configuration](#)
- [Chapter 3: Linux SNFS-Only MDC Installation/Configuration](#)
- [Chapter 4: Windows SNFS-Only MDC Installation/Configuration](#)
- [Chapter 5: StorNext and StorNext FX Client Installation/Configuration](#)
- [Chapter 6: Configuring LAN Clients and Gateway Servers](#)
- [Appendix A: Uninstalling StorNext](#)
- [Appendix B: Administration Tasks](#)
- [Appendix C: StorNext Files](#)
- [Appendix D: Quality of Service Feature](#)

Audience

This manual is written for StorNext 5 and StorNext FX 5 operators, system administrators, and field service engineers.

Notational Conventions

This manual uses the following conventions:

Convention	Example
User input is shown in bold monospace font.	./DARTinstall
Computer output and command line examples are shown in monospace font.	./DARTinstall
User input variables are enclosed in angle brackets.	http://<ip_address>/cgi-bin/stats
For UNIX and Linux commands, the command prompt is implied.	./DARTinstall is the same as # ./DARTinstall
File and directory names, menu commands, button names, and window names are shown in bold font.	/data/upload
Menu names separated by arrows indicate a sequence of menus to be navigated.	Utilities > Firmware

The following formats indicate important information:

 **Note:** Note emphasizes important information related to the main topic.

 **Caution:** Caution indicates potential hazards to equipment or data.

 **WARNING:** Warning indicates potential hazards to personal safety.

- Right side of the system - Refers to the right side as you face the component being described.
- Left side of the system - Refers to the left side as you face the component being described.
- Data sizes are reported in base 1000 rather than base 1024. For example:
 - 1 MB = 1,000,000 bytes
 - 1 GB = 1,000,000,000 bytes
 - 1 TB = 1,000,000,000,000 bytes

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For the most up to date information on StorNext 5 and StorNext FX 5, see:

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Chapter 1: Begin Here

This chapter contains the following topics:

Begin Here	1
Audience	2
Installation Scenarios	2

Begin Here

StorNext provides high performance data sharing and intelligent archiving that is compatible with an industry-leading range of operating systems, server platforms, and storage devices.

StorNext includes two main components:

- StorNext File System (SNFS) is high performance data sharing software that lets applications on multiple operating systems access a single data set.
- StorNext Storage Manager (SNSM) is an intelligent, policy-based data mover that automatically moves and locates data across multiple storage tiers.

In addition, StorNext and StorNext FX client software allows client operating systems to mount and work with StorNext and Xsan file systems.

Audience

This document is intended for service professionals and system administrators who install StorNext software. The installer should have strong familiarity with the operating system on which StorNext is installed.

Only service professionals, experienced StorNext users, or individuals who have successfully completed StorNext training should configure StorNext. Attempting to configure StorNext without proper experience or training can affect system performance and may result in data loss.

Installation Scenarios

The intent of this section is to help you better use this guide by providing a few of installation scenarios. These scenarios will help you navigate to the procedures that are appropriate to your environment.

Metadata Controller Installations

Install a RedHat Linux MDC with Windows and Clients

[StorNext Linux MDC Installation/Configuration](#) provides system requirements, pre-installation information, and instructions for installing and configuring StorNext File System and Storage Manger on a Linux server, called the Metadata Controller (MDC).

[StorNext and StorNext FX Client Installation/Configuration](#) provides system requirements, pre-installation information, and instructions for installing the StorNext and StorNext FX client software on Linux and Windows machines.

Install a SNFS-only Windows MDC

[Windows SNFS-Only MDC Installation/Configuration](#) provides system requirements, pre-installation information, and instructions for installing and configuring StorNext File System on Windows servers.

Install a SNFS-only Linux MDC

[Linux SNFS-Only MDC Installation/Configuration](#) provides system requirements, pre-installation information, and instructions for installing and configuring RPM-only installations on Linux servers.

⚠ Caution: As the File System Manager (FSM) supports over 1000 clients (with more than 1000 file requests per client), the resource limits of your MDC may be exhausted with additional load from other processes. Exceeding the file descriptor limit will cause errors to your system. Quantum recommends you **not** run additional applications on the MDC.

Additional Resources

[Configuring LAN Clients and Gateway Servers](#) describes how to configure a distributed LAN client or server for both single-server and high-availability (HA) systems.

[Uninstalling StorNext](#) describes how to remove StorNext software from a server or client system.

[Administration Tasks](#) describes how to perform file system tasks that do not apply to a typical StorNext setup, including Connecting Xsan Clients to StorNext MDCs.

[StorNext Files](#) describes the files used and modified to configure a file system, the cluster-wide control feature, and the file used to configure the cluster-wide security controls.

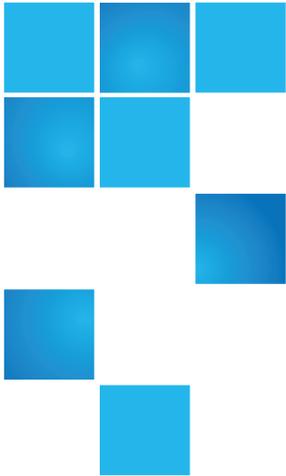
[Quality of Service Feature](#) describes how to configure and use the StorNext File System (SNFS) Quality of Service (QOS) feature.

DVD Directories

Files on the StorNext installation DVD are located in the following locations, depending on whether a media kit DVD or a user-created DVD from an .iso image for a web-release download is used:

Directory Location	Directory	Contents
Media Kit DVD	/fs_only	This contains the installation binaries for supported platforms for StorNext Filesystem-only and Filesystem-only clients and clients plus Distributed Data Mover (DDM), which are located in the _plus_mover directory. This also contains the StorNext and StorNext FX client installation binaries for supported platforms.
	/stornext_full	This contains the installation binaries for supported platforms for full installation of StorNext, including both the File System and Storage Manager..
	/stornext_full/clients	This contains the StorNext and StorNext FX client installation binaries for supported platforms.
	/documentation	This contains the current set of StorNext documentation and the documentation front end, which provides a way to navigate to the documents.
	/offlinenotification	This contains the installation binaries for supported platforms for StorNext offline notification installations.

Directory Location	Directory	Contents
Web Release DVD	/fs_only	This contains the installation binaries for supported platforms for StorNext Filesystem-only and Filesystem-only clients and clients plus Distributed Data Mover (DDM), which are located in the _plus_ mover directory. This also contains the StorNext and StorNext FX client installation binaries for supported platforms.
	/stornext_full	This contains the installation binaries for supported platforms for full installation of StorNext, including both the File System and Storage Manager.
	/stornext_full/clients	This contains the StorNext and StorNext FX client installation binaries for supported platforms.
	/offlinenotification	This contains the installation binaries for supported platforms for StorNext offline notification installations.



Chapter 2: StorNext Linux MDC Installation/Configuration

This chapter contains the following topics:

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Configuring StorNext Using the StorNext GUI	38
Linux Device Mapper Multipath Support	41

StorNext Linux MDC Installation/Configuration

This topic describes how to install StorNext File System (SNFS) and StorNext Storage Manager (SNSM) together as a complete package on a Linux Metadata Controller (MDC). Install both SNFS and SNSM for storage systems that require policy-based data movement (for example, systems that use the Replication feature or include tape drives or libraries or to use the StorNext Linux GUI).

Quantum recommends performing a full StorNext install on a Linux MDC, with the StorNext web GUI and StorNext Storage Manager. This provides a user-friendly interface, and the ability to use archiving.

If you do not need Storage Manager components or the StorNext Linux GUI, you can perform an RPM-only installation (see [Linux SNFS-Only MDC Installation/Configuration](#)).

The Storage Manager component of StorNext can only be installed on Linux systems. For Windows installation, see [Windows SNFS-Only MDC Installation/Configuration](#).

Once the StorNext File System is installed, you can configure it using the StorNext Configuration Wizard. To configure StorNext, you will enter license information and create one or more file systems. In addition, on Metadata Controllers (MDCs) running StorNext Storage Manager, you can add storage devices and media, create storage policies, and set up e-mail notifications. To access the Configuration Wizard, use the Web-based GUI to access StorNext running on an MDC.

To ensure successful operation, do the following tasks before installing StorNext:

- Make sure the MDC meets all operating system and hardware requirements (see [System Requirements below](#)).
- Make sure all storage devices are correctly configured and are visible to the MDC (see [Getting Ready to Install on page 13](#))
- (Optional) Run the pre-installation script to check for available disk space and view recommended locations for support directories (see [Running the Pre-Installation Script on page 14](#)).

When you are ready to install StorNext File System and Storage Manager on the MDC, run the installation script (see [Running the StorNext Installation Script on page 18](#)).

This topic covers:

- [System Requirements below](#)
- [Getting Ready to Install on page 13](#)
- [Running the Pre-Installation Script on page 14](#)
- [Running the StorNext Installation Script on page 18](#)
- [Post-Installation Steps on page 22](#)
- [Enabling and Installing Licenses on page 23](#)
- [Converting to HA on page 32](#)
- [Configuring StorNext Using the StorNext GUI on page 38](#)
- [Linux Device Mapper Multipath Support on page 41](#)

System Requirements

To run StorNext, the Metadata Controller must meet all operating system, hardware, and LAN requirements.

i Note: The performance of the storage holding the Storage Manager database and metadumps has an impact on overall StorNext file system performance. Quantum recommends that the Storage Manager database and metadata dumps are stored on high performance storage devices, such as a RAID array. Storing the Storage Manager database on slower storage devices, including local disks, can result in poor performance or time-outs.

i Note: The UIDs for the **quantumdb** and **tdlm** users and the **adic** group must be identical on both nodes of an HA pair. If the UIDs are not identical, the MySQL database will not start (due to file permission errors), which in turn prevents storage manager from fully starting up. Quantum recommends creating the UIDs for the **quantumdb** and **tdlm** users along with the **adic** group on both nodes prior to running **install.stornext**.

Operating System Requirements

The operating systems, kernel versions, rpm package dependencies, and hardware platforms supported by StorNext File System are listed in the *StorNext Compatibility Guide* posted here:

<http://www.quantum.com/sn5docs>

Make sure the system meets the operating system and platform requirements outlined in the guide, and, if necessary, update to a supported release or kernel version before installing StorNext.

Modifying the grub.conf File to Disable the Intel Sleep State

Newer versions of Linux include a driver that controls CPU C-states. It is strongly recommended that this driver be adjusted so that deep sleep states are disabled. Making this change may result in increased power consumption but improves stability and performance. This change should be applied to systems running RHEL 6.x and newer, SLES11 and newer, and all supported versions of Debian and Ubuntu:

1. Prior to installation, append the following text to the "kernel" line in the boot loader configuration file:

```
intel_idle.max_cstate=0 processor.max_cstate=1
```

i Note: Consult your distribution's documentation on how to modify the kernel boot loader.

- For **RHEL 6.x** and **Debian** systems update `/boot/grub/grub.conf`.
- For **RHEL 7.x** update `/boot/grub2/grub.cfg`.
- For **SLES** systems use `/sbin/yast` to change the boot loader options under **System > Boot Loader**. Save the configuration and verify that `/boot/grub/menu.lst` was updated.
- For **Ubuntu** systems update the `GRUB_CMDLINE_LINUX_DEFAULT` string in `/etc/default/grub` to include the above text, and then execute **update-grub**. Afterwards verify that `/boot/grub/grub.cfg` was updated.

2. Reboot the system for the change to take effect.

i Note: Disabling C-States in the system BIOS has no effect on Linux.

In some cases, performance can also be improved by adjusting the idle kernel parameter. However, care should be taken when using certain values. For example, `idle=po11` maximizes performance but is incompatible with hyperthreading (HT) and will lead to very high power consumption. For additional information, refer to the documentation for your version of Linux.

Installing StorNext from a DVD

Installation and upgrade media is shipped on DVDs. Both software and documentation are now stored on a single DVD, eliminating multiple discs for different operating systems. If you plan to install from media, you must have a DVD ROM drive to perform the installation or upgrade.

Refer to the following procedures:

- [Installing StorNext and StorNext FX Client Software on Linux or Unix on page 135.](#)
- [Installing StorNext and StorNext FX Client Software on Windows on page 147.](#)

Downloading a StorNext Media Kit (Creating an ISO Image)

Another way to obtain a StorNext media kit is by downloading the software. This process consists of obtaining a download authorization certificate, creating a download account (or signing on if you already have an account), downloading a software ISO image onto DVD, and then installing the software as described in the following procedures.

Refer to the following procedures:

- [Installing StorNext and StorNext FX Client Software on Linux or Unix on page 135.](#)
- [Installing StorNext and StorNext FX Client Software on Windows on page 147.](#)

If you have problems or questions with this process, contact your Quantum StorNext support representative.

Installing StorNext from a Web Download

A third StorNext delivery method is downloading from the Web. With this method you will download an executable program that will require you to accept the StorNext end user license agreement and will then extract the StorNext installer.

As part of the installation from a Web download, the software files are extracted into the `/tmp/stornext` directory by default. The software, when extracted, requires approximately 400 MB of space. Make sure there is enough free space in the default directory to extract the files. If there is not sufficient space, you may need to specify an alternative directory with the `-d` option.

To specify an alternate location before beginning the installation, enter the following command:

```
# ./<installation file> -d <dir>
```

where *<installation file>* is the name of the installation file, and *<dir>* is the directory into which you want to extract the installation files.

Refer to the following procedures:

- [Installing StorNext and StorNext FX Client Software on Linux or Unix on page 135](#)
- [Installing StorNext and StorNext FX Client Software on Windows on page 147](#).

Hardware Requirements

RAM and hard disk space requirements to run the StorNext File System are listed in the *StorNext Compatibility Guide* posted online at <http://www.quantum.com/sn5docs>.

Make sure the MDC meets the hardware requirements outlined in the guide, and, if necessary, update the MDC before installing StorNext.

For improved performance and stability, it is strongly recommended that CPU C-States be disabled in the BIOS if they are supported by your system. Refer to system vendor documentation for additional information.

Partitioning Local Hard Disks

StorNext can be installed on any local file system (including the root file system) on the MDC. However, for optimal performance, as well as to aid disaster recovery, follow these recommendations:

- Avoid installing StorNext on the root file system.
- Partition local hard disks so that the MDC has four available local file systems (other than the root file system) located on four separate hard drives. This is so you can install the support directories in four separate locations (for more information, see [Support Directories on page 14](#)).

i Note: You can run the pre-installation script to help determine the estimated size of and optimal location for StorNext support directories. For more information, see [Running the Pre-Installation Script on page 14](#).

Additional Memory and Disk Requirements for Deduplication and Replication

Additional requirements that must be met in order to use the data deduplication and replication features on the StorNext MDC are listed in the “*StorNext MDC Additional RAM and Disk Requirements for Deduplication and Replication*” section of the *StorNext Compatibility Guide* posted here:

<http://www.quantum.com/sn5docs>

Make sure the MDC meets the requirements outlined in the guide, and, if necessary, update the MDC before installing StorNext.

LAN Requirements

StorNext LAN requirements are listed in the “*StorNext MDC Network Requirements*” section of the *StorNext Compatibility Guide* posted here:

<http://www.quantum.com/sn5docs>

Make sure the MDC meets the network requirements outlined in the guide, and, if necessary, update the MDC before installing StorNext.

Other Requirements

Additional requirements that must be met for the StorNext system are listed in the “*Additional StorNext MDC and StorNext Client Requirements*” section of the *StorNext Compatibility Guide* posted here:

<http://www.quantum.com/sn5docs>

Make sure the system meets the additional requirements outlined in the guide, and, if necessary, update the system before installing StorNext.

System Clock Synchronization

Quantum recommends that system clocks are synchronized using NTP for easier debugging. For HA installations, the system clocks must be synchronized for proper operation.

Nobody User and Group ID Values

The default UID/GID values for the "Nobody" user differ across platforms. Please ensure that your environment is set up with a common value for the Nobody user and group to ensure proper file access. Also note the default values for nobody when files are generate by Windows clients, as defined in each file system's configuration.

Windows Recycle Bin Requirements

If you are using the StorNext client software with Windows Server 2003, Windows Server 2008, Windows XP, Windows Vista or Windows 7, turn off the Recycle Bin in the StorNext file systems mapped on the Windows machine. You must disable the Recycle Bin for the drive on which a StorNext file system is mounted. Also, each occurrence of file system remapping (unmounting/mounting) will require disabling the Recycle Bin. For example, if you mount a file

system on E: (and disable the Recycle Bin for that drive) and then remap the file system to F:, you must then disable the Recycle Bin on the F: drive.

As of release 3.5, StorNext supports mounting file systems to a directory. For Windows Server 2003 and Windows XP you must disable the Recycle Bin for the root drive letter of the directory-mounted file system. (For example: for **C:\MOUNT\File_System** you would disable the Recycle Bin for the **C:** drive.)

For Windows Server 2003 or Windows XP:

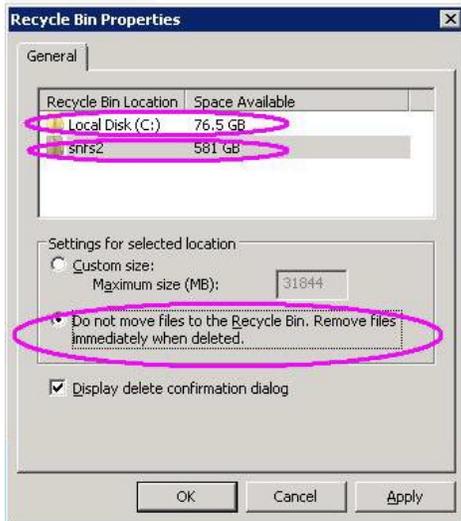
1. On the Windows client machine, right-click the **Recycle Bin** icon on the desktop and then click **Properties**.
2. Click **Global**.
3. Click **Configure drives independently**.
4. Click the **Local Disk** tab that corresponds to the mapped or directory-mounted file system.
5. Click the checkbox **Do not move files to the Recycle Bin. Remove files immediately when deleted**.
6. Click **Apply**, and then click **OK**.

For Windows Server 2008, Windows Vista and Windows 7 systems, you must disable the Recycle Bin on C: and the File system name:

1. On the Windows client machine, right-click the **Recycle Bin** icon on the desktop and then click **Properties**.
2. Click the **General** tab.
3. Select the mapped drive that corresponds to the StorNext mapped file system. For directory-mounted file systems, select the file system from the list.
4. Choose the option **Do not move files to the Recycle Bin. Remove files immediately when deleted**.
5. Click **Apply**.
6. Repeat steps 3-5 for each remaining directory-mounted file system.
7. When finished, click **OK**.

(See [Windows Recycle Bin Settings Example below](#))

Figure 1: Windows Recycle Bin Settings Example



Getting Ready to Install

Before installing StorNext SNFS and SNSM, complete the following tasks to ensure successful installation:

- Correctly configure all storage devices (see [Configuring Storage Devices below](#)).
- If using LUNs larger than 1 TB, decide on a label type and install any necessary operating system patches (see [Planning for LUNs Larger than 1 TB on page 47](#)).
- Review and install any package dependencies (see [Package Dependencies on the next page](#)).

Configuring Storage Devices

Before installing StorNext SNFS and SNSM, make sure that all LUNs are visible to the MDC. (A LUN, or logical unit number, is a logical device that corresponds to one or more disks, drives, or storage devices.)

If there are any connection issues, resolve them before installing StorNext. For assistance in configuring storage devices, refer to the documentation that came with the storage device, or contact the manufacturer.

i Note: LUNs that you plan to use in the same stripe group must be the same size. Consider this when configuring storage devices. (For more information about stripe groups, see the *StorNext User's Guide*.)

! Caution: StorNext does not support the connection of multiple devices through fibre channel hubs. Multiple devices must be connected using fibre channel switches.

⚠ Caution: Quantum recommends that only the storage devices required for an environment are visible to each system. Unnecessary disk visibility will affect system start-up performance and increase the risk of inadvertent reuse of resources.

⚠ Caution: Additionally, it is recommended that sites never perform operating (OS) installations while hardware is attached to a StorNext storage network. Numerous instances of OS installations accidentally overwriting StorNext volumes have been observed in the past.

Package Dependencies

- For management servers running Red Hat Enterprise Linux version 6 or 7, before installing SNFS and SNSM you must first install the kernel header files (shipped as the kernel-devel or kernel-devel-smp RPM, depending on your Linux distribution).
- For servers running SUSE Linux Enterprise Server, you must install the first kernel source code (shipped as the kernel-source RPM). StorNext will not operate correctly if these packages are not installed. You can install the kernel header files or kernel source RPMs by using the installation disks for your operating system.
- In addition, for MDC installs on Linux the PERL package is required.
- For customer supplied metadata-controllers and hardware, install the `fuse-libs` package on the system before installing the `stornext_full` or `snfs_client_plus_mover` packages.

Verifying Hostname Length

The maximum hostname length for a StorNext server is limited to 255 characters. Before you begin the installation, verify that the destination hostname is not longer than 255 characters.

Running the Pre-Installation Script

The StorNext pre-installation script (**snPreInstall**) is included on the StorNext installation DVD. When you run **snPreInstall**, you are prompted for information about your system. The pre-installation script uses this information to estimate the amount of local disk space required for SNFS and SNSM support directories. In addition, the script recommends the optimal locations for support directories.

Support Directories

StorNext uses four support directories to store application support information. These directories are stored locally on the Metadata Controller.

The StorNext support directories are described in [Table 1 below](#).

Table 1: StorNext Support Directories

Support Directory*	Description
Database /usr/adic/mysql/db	Records information about where and how data files are stored.
Journal /usr/adic/mysql/journal	Records changes made to the database.
Mapping /usr/adic/TSM/internal/mapping_dir	Contains index information that enables quick searches on the file system.
Metadata /usr/adic/database/metadumps	Stores metadata dumps (backups of file metadata).

* Depending on file system configuration, the support directory locations may be different. However, symbolic links in **/usr/adic/** will always point to the support directories.

Before You Begin

Before running the pre-installation script, be prepared to answer the following questions:

- Is this an upgrade installation?
- What local file systems can be used to store support information?
- Which version of StorNext will be installed?
- What is the maximum number of directories expected (in millions)?
- What is the maximum number of files expected (in millions)?
- How many copies will be stored for each file?
- How many versions will be retained for each file?

i Note: Keep in mind that storage needs typically grow rapidly. Consider increasing the maximum number of expected directories and files by a factor of 2.5x to ensure room for future growth.

i Note: The pre-installation script ignores unmounted file systems. Before running **snPreInstall**, be sure to mount all local file systems that will hold StorNext support information.

Running snPreInstall

To run the pre-installation script, use the StorNext installation DVD.

1. Log on to the MDC as root.
2. Mount the StorNext installation DVD and change to the DVD root directory.

When a CD-ROM is mounted on Linux systems, it may have `noexec` (non-executable) permissions.

If you encounter this condition, the workaround to this Linux security issue (not StorNext) is to remount the CD-ROM with an executable option, as follows:

- a. At command prompt, enter: `mount -t iso9660`. The system responds with:

```
/dev/cdrom on /mnt/cdrom type iso9660 (ro,noexec,nosuid,nodev)
```

- b. Use this information to mount the cdrom:

```
mount -o remount,exec /mnt/cdrom
```

3. List the installation directories on the DVD. At the command prompt, type:

```
ls -l
```

4. Change to the **stornext_full** directory.

i Note: Make sure you are in the **stornext_full** directory and not the **fs_only** directory. The **fs_only** directory installs the StorNext File System only.

5. List the directories in the **stornext_full** directory. At the command prompt, type:

```
ls -l
```

6. Identify the correct installation directory for your operating system and hardware platform, and then change to that directory.

For example, for Red Hat Linux 5 running on an x86 64-bit platform, change to the **RedHat50AS_26x86_64** directory.

7. Run the script. At the command prompt, type the following:

```
./snPreInstall
```

The pre-installation script runs ([Figure 2 on the next page](#)).

Figure 2: Pre-Installation Script

```
-----  
This script will determine the disk space requirements for  
performing a StorNext install/upgrade. It will then report  
whether or not the local system has the required disk space  
for the operation. Output will be one of these four types:  
  
RECOMMEND: A recommendation of how to set up the  
StorNext directories on your system.  
NOTE:      An advisory message indicating that the system  
            can run with the given configuration, at the  
            desired capacity, but the configuration  
            is not optimal.  
SPACE:     Due to space issues the system cannot be  
            configured to run at the desired capacity  
            without adding more disk space.  
Aborting:  An error has occurred, or invalid input has been  
            provided, and no further analysis can be done.  
  
The script will exit with one of these values:  
0 - disk space fine, ok to proceed with install/upgrade  
1 - disk space available, but not optimal file system layout  
2 - disk space not available for install/upgrade  
3 - invalid args etc. kept script from completing normally  
  
-----  
Are you upgrading ?? [y/<n>]:
```

8. Follow the onscreen instructions, and answer each question when prompted.

The script outputs results based on the information you entered.

Interpreting snPreInstall Output

After you enter all requested information, the pre-installation script outputs the following results:

- Estimated disk space required for each support directory.
- Recommended file system location for each support directory.

There are three types of directory recommendations, as indicated by the text preceding the recommendation. The three types of recommendations are described in [Table 2 below](#).

Table 2: Pre-Installation Script Recommendation Types

Type	Description
RECOMMEND	The suggested directory locations will result in optimal system performance.
NOTE	The suggested directory locations are valid but system performance will not be optimal.
SPACE	Additional hard disk space is required to store the required support directories.

The pre-installation script bases directory location recommendations on the following criteria:

- To aid disaster recovery, the **Database** and **Journal** directories should be located on different file systems.

- For optimal performance, each support directory should be located on its own local file system, and each local file system should reside on a separate physical hard disk in the MDC.

i Note: These recommendations apply to non-HA systems only.

i Note: Do not change the location of support directories manually. Instead, use the installation script to specify the location for support directories. For more information, see [Running the StorNext Installation Script below](#).

Running the StorNext Installation Script

When you are ready to install StorNext, use the StorNext installation script to install StorNext File System and Storage Manager on the Metadata Controller. The installation script also installs the client software on the MDC.

The installation script runs dependency checks to ensure the server has all the required RPM packages pre-installed. Refer to the *StorNext and StorNext FX 5 Compatibility Guide* for a list of required RPM packages for the operating system you are using.

Upgrading From a StorNext File System-Only Configuration

If you have StorNext File System only and are adding StorNext Storage Manager, some components remain from the File System installation and the new installation could fail. To prevent installation failure, you should first remove the old components.

The following procedure describes how to remove the old components before starting the new StorNext installation. Follow the steps below *only* if you are upgrading from a StorNext File System-only configuration to StorNext File System and Storage Manager.

1. Log on to the MDC as **root**.
2. Save **/etc/fstab** and **/usr/cvfs/config**
3. Remove the existing StorNext File System rpms.
4. Install StorNext as described in [Launching the StorNext Installation Script below](#).
5. Restore **/etc/fstab** and **/usr/cvfs/config**

Launching the StorNext Installation Script

The StorNext installation script lets you choose installation configuration options and install StorNext. To launch the script, you will need to use the correct file on the StorNext installation DVD for your operating

system.

i Note: localhost cannot map to multiple IP addresses. Before running the StorNext installation script, make sure localhost in the /etc/hosts file is mapped to a single IPv4 address, and not an IPv6 address.

1. Log on to the MDC as **root**.
2. Mount the StorNext installation DVD and change to the DVD root directory.

i Note: When you mount a DVD in a Red Hat 5 or 6 system, DVDs are mounted by default with a noexec (non-executable) option which prevents you from proceeding with the installation.

For Red Hat users only, before proceeding you must remount the DVD by typing **mount -o remount, exec ...**

3. List the installation directories on the DVD. At the command prompt, type:

```
ls -l
```

4. Change to the **stornext_full** directory.

i Note: Make sure you are in the **stornext_full** directory and not the **fs_only** directory. The **fs_only** directory installs the StorNext File System only.

5. List the directories in the **stornext_full** directory. At the command prompt, type:

```
ls -l
```

6. Identify the correct installation directory for your operating system and hardware platform, and then change to that directory.

For example, for Red Hat Linux 5 running on an x86 64-bit platform, change to the **RedHat50AS_26x86_64** directory.

7. Run the script. For new StorNext installations, at the command line, type:

```
./install.stornext
```

Running the installation script displays:

```
Stornext Install 5.0.0 MAIN MENU
1) Installation Configuration
2) Install stornext
3) Show Status
4) Quit
Enter your choice <2>:
```

The **install.stornext** by default uses **snPreInstall** to automatically detect the available free space on the system for installing StorNext components. Components favor the location **/usr/adic**,

however if there are file systems available that have more space, it will chose those file systems for installing components, creating symbolic links in `/usr/adic` to the installation location of the installed component as needed. Newly installed components may be changed interactively at install time (See [Changing Installation Configuration Options below](#)). You may also chose to override the locations chosen by `snPreInstall` by passing in the `-installdir` and `-dbjrn1` to `install.stornext`.

To specify the location to install StorNext components, execute the command:

```
./install.stornext -installdir <dir>
```

This will cause `install.stornext` to install components at `<dir>/adic`, and will create symbolic links in `/usr/adic/<component>` pointing to `<dir>/adic/<component>`.

i Note: Once elements for a component have been installed the location of the component may not be changed by `install.stornext`.

8. Type the number corresponding to a menu option and press **Enter**. Installation menu options are described in [Table 1 below](#).

Table 1: StorNext Installation Main Menu Options

Menu Option	Description
1	Change installation options, including the location of application directories and the default media type (see Changing Installation Configuration Options below).
2	Install StorNext using the installation options specified on the Configuration Menu (see Performing an Installation Operation on page 22).
3	View the status of an installation operation that is currently in progress.
4	Exit the StorNext installation script.

Changing Installation Configuration Options

Use the Configuration Menu to change StorNext installation options. You can specify the location of application and support directories and change the default media type for storage devices.

On the Main Menu, type **1** and press **<Enter>**. The Configuration Menu appears ([Figure 3 on the next page](#)).

Figure 3: Configuration Menu

```
Stornext 5.0.0(38610) Configuration Menu
[U.S. Pat. No. 5,990,810]

  VALUE                               DESCRIPTION
  -----                               -
1) /usr/adic/perl                     Perl installation directory
2) /usr/adic/docs                      Docs installation directory
3) /adic/mysql                        Mysql installation directory
4) /usr/adic/database                 Dbm installation directory
5) /usr/adic/SRVCLLOG                 Srvcllog installation directory
6) /usr/adic/PSE                      Pse installation directory
7) /usr/adic/MSM                      Media Manager installation directory
8) /usr/adic/TSM                      Tertiary Manager installation directory
9) /usr/adic/java                     Java5 installation directory
10) /usr/adic/tomcat                  Tomcat installation directory
11) /usr/adic/gui                     Sngui installation directory
    /usr/cvifs                         Disk Manager installation directory
13) /adic/database_meta               Metadumps directory
14) /adic/mapping_dir                 TSM mapping directory
15) /adic/mysql_jnl                   MySQL journal directory
16) LTO                               Default media type

Enter number to modify or hit <RETURN> to continue: 
```

Changing Application Directory Locations

When you first enter the Configuration Menu, it displays recommended locations for StorNext application directories based on the available file systems detected by the installation script. To accept the recommended directory locations and return to the Main Menu, press **<Enter>**.

Alternately, customize the installation by specifying the file systems where application and support files are stored.

1. On the Configuration Menu, type the number that corresponds to the directory location you want to customize (**1–16**), and then press **<Enter>**.

A list of available local file systems is shown.

2. To change the file system where the directory is located, type the name of the file system and press **<Enter>**.
3. To confirm the change, type **yes** and press **<Enter>**.

To customize additional directory locations, repeat steps 1–3.

4. When you are done customizing the installation, press **<Enter>** to return to the Main Menu.

i Note: To help determine the optimal location for StorNext support directories, use the StorNext pre-installation script. For more information, see [Running the Pre-Installation Script on page 14](#).

Changing the Default Media Type

If you do not specify a different media type, the StorNext installation script selects LTO as the default media type for storage devices. If storage devices in your system use a different media type, change the default media type before installing StorNext.

1. On the Configuration Menu, type **16** and press **<Enter>**.

A list of valid default media types is shown. The valid media types are: SDISK, LTO, LTOW, 3590, 3592, 9840, 9940, AITW, AIT, DLT4, T10, and LATTUS.

2. Type the correct default media type for storage devices in your system and press **<Enter>**.
3. To confirm the change, type **yes** and press **<Enter>**.
4. When you are done customizing the installation, press **<Enter>** to return to the Main Menu.

Performing an Installation Operation

- i Note:** Storage Manager requires that the **rpcbind** service is running. Make sure that the **rpcbind** service is installed and running before installing StorNext or starting Storage Manager. Consult your distribution's documentation for more information on how to install and start the **rpcbind** service.

To install StorNext using the options specified on the Configuration Menu, perform an installation operation.

1. On the Main Menu, type **2** and press **<Enter>**.

The StorNext installation script runs. The script displays the current progress of the installation.

2. When the installation is complete, press **<Enter>** to return to the Main Menu.
3. To exit the installation script, type **4** and press **<Enter>**.

- i Note:** The script displays the URL at which the MDC can be accessed. Make a note of this information.

4. After running the installer, source the profile on the MDC by running this command:

```
. /usr/adic/.profile
```

You can now access StorNext File System and Storage Manager, and run the Configuration Wizard. For more information, see [Configuring StorNext Using the StorNext GUI on page 38](#).

Post-Installation Steps

After StorNext is installed, you are ready to configure your system. Quantum recommends using the StorNext Configuration Wizard, which walks you through the steps of configuring your system for the first time. For more information about logging in to StorNext and using the Configuration Wizard, see [Using the StorNext Configuration Wizard on page 40](#).

Logging In to StorNext

For instructions, see [Accessing the StorNext GUI on page 38](#).

SSL Certificate Exception

When you log into StorNext for the first time, you might see a message warning you about a security certificate.

For a permanent workaround to this issue, see the Quantum Knowledge Base article titled *StorNext GUI: Installing a SSL Certificate from a Certificate Authority* available online at <http://qsupport.quantum.com/kb/node/4489>

For a temporary solution, create a certificate exception that will allow you to log into StorNext without seeing the warning message during subsequent logins.

Starting StorNext Components

When you log in to StorNext for the first time, the **System Control** page appears. On this screen you can start StorNext File System and Storage Manager by clicking **Start**.

Enabling and Installing Licenses

Some StorNext licenses come pre-enabled on your system, and others must be purchased and then enabled by installing a license key file on your system. You must do this to obtain your correct maintenance expiration date. If your system is using a 30-day an auto-generated license, you should enter permanent licenses as soon as it is convenient. The following are the steps you need to take to obtain and install your StorNext licenses.

Obtaining Licenses

If you need license keys to enable StorNext or StorNext features, www.quantum.com/ServiceandSupport.enter the required information about your system on-line at:

<http://www.quantum.com/ServiceandSupport/License/StorNext/Index.aspx>

i Note: If you cannot access the web page or need additional help filling out the form, contact Quantum support at <http://www.quantum.com/ServiceandSupport>.

i Note: The web page requires the **StorNext system serial number** in order to generate StorNext licenses.

In a new installation, the serial number and download instructions are delivered via email.

System serial numbers are alpha-numeric (example: CX1234CKD5678).

If you are adding to an existing StorNext installation and cannot locate the original software package, locate the license.dat file. The license.dat file can be found on the Metadata Controller at `/usr/cvfs/config/license.dat` for UNIX systems, and `c:\Program Files\StorNext\config\license.dat` for Windows systems.

Open the license.dat file and locate the serial number.

1. **Existing software features licensed:** You will need to have a list of StorNext features already licensed and enabled on your system.
2. **New software features licensed:** You will need to have a list of purchased StorNext add-on features for which you wish to enable licenses.

After the Quantum Technical Assistance Center receives the above information, a representative will send you a license.dat file (which contains license keys for the products/features you specified) within one business day. Save the file to a temporary location to apply to the system.

-
- i Note:** You can determine the current license limits on SAN client, LAN client, DDM, and Storage Manager licenses in the StorNext GUI on the Configuration > License screen.

Installing StorNext Licenses on a Windows MDC

See the help files installed with StorNext. The help files are located in the Start menu at **All Programs > StorNext File System > StorNext Help**.

Installing StorNext Licenses from the GUI for non-HA Installations

-
- i Note:** Use these steps to install the license keys on a single-node system, or one that has not yet been configured as HA. For HA systems, see [Installing StorNext Licenses from the GUI for HA Installations on page 26](#).

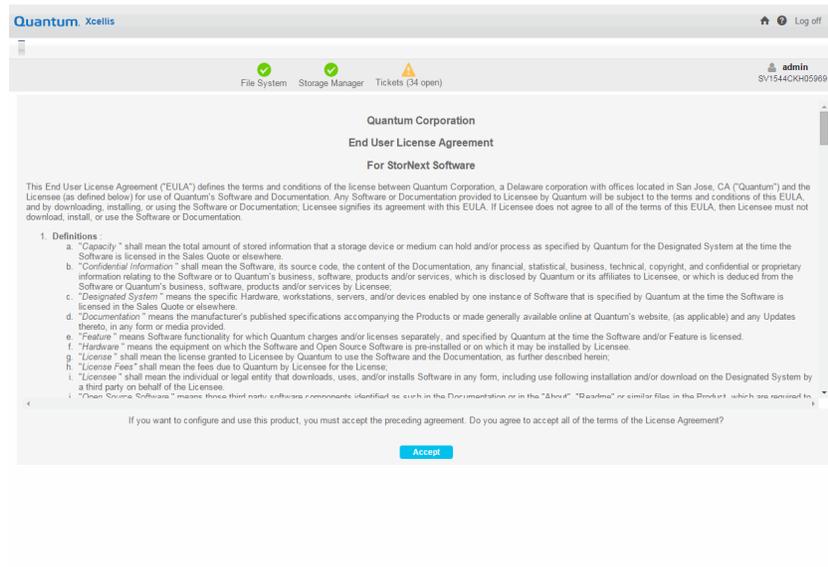
To install the license keys on a single-node system, or one that has not yet been configured as HA.

Do one of the following, depending on how you are applying the StorNext license:

If you are logging into StorNext for the first time:

1. Read the end-user license agreement carefully, and then click Accept. The Configuration > Licenses Entry page appears. Continue to [Step 3](#).

Figure 4: Configuration > Licenses > Agreement Page



Updating Licenses

You will need to update a license if the license expires or if your configuration changes (for example, if you add additional clients or increase capacity).

To update a license, select the desired product/feature and then click Enter/Update. When the Configuration > Licenses > Enter/Update page appears, copy the license string you received from Quantum into the [License/Feature Name] License field, and then click Apply.

If you are updating StorNext licenses:

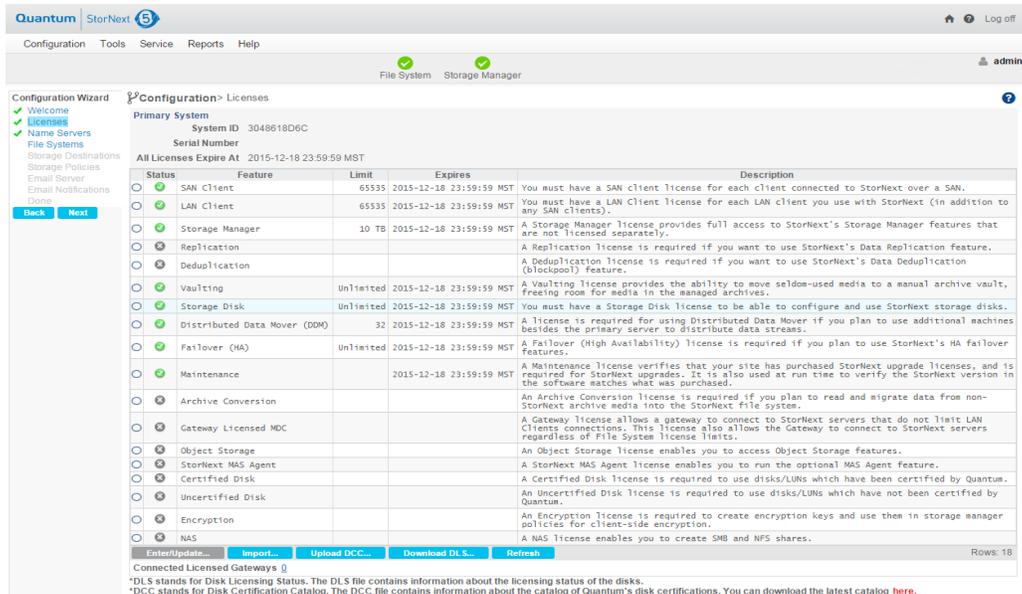
1. Stop StorNext services by navigating to Tools > System Control option.

Caution: You can update SAN Client licenses, LAN Client licenses, and Disk licenses (Certified and Uncertified) without restarting the StorNext services. All other license types will require a restart of the StorNext services.

2. Navigate to Configuration > Licenses > Enter/Update.

Continue the installation

Figure 5: Configuration > Licenses Page



3. To import the license key from a text file, click Import. When the Import License File window appears, click Browse and navigate to the file's location. Click Close to continue.

A message at the top of the screen informs you whether the information was successfully imported and copied from the file into the StorNext license file. The status indicator changes to enabled (a green check mark icon and you are now ready to activate your licenses.

4. After you install your licenses, you should restart StorNext services by using the Tools > System Control option. StorNext may not recognize some feature licenses until you restart services.

Installing StorNext Licenses from the GUI for HA Installations

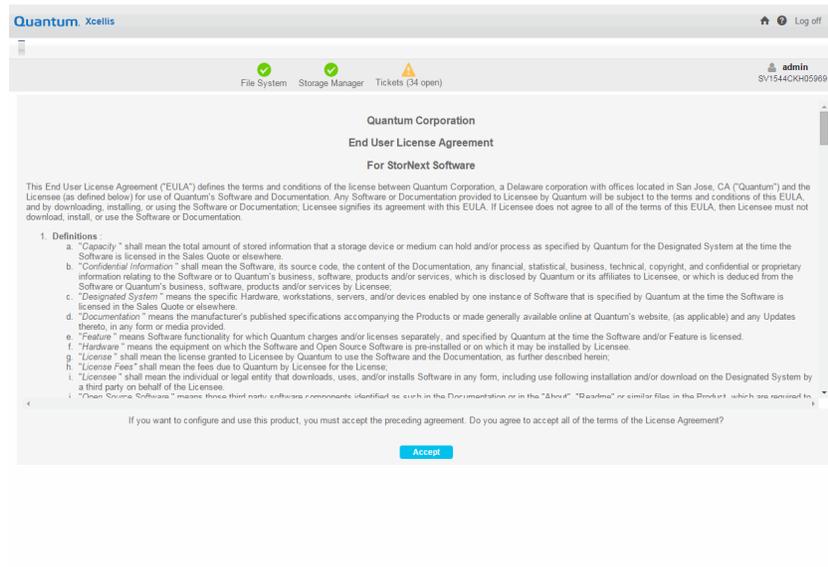
- Note:** Use these steps to install the license keys on an MDC configured for HA. For non-HA systems, see [Installing StorNext Licenses from the GUI for non-HA Installations on page 24](#).

Do one of the following, depending on how you are applying the StorNext license:

If you are logging into StorNext for the first time:

1. Read the end-user license agreement carefully, and then click Accept. The Configuration > Licenses Entry page appears. Continue to [Step 5](#).

Figure 6: Configuration > Licenses > Agreement Page



Updating Licenses

You will need to update a license if the license expires or if your configuration changes (for example, if you add additional clients or increase capacity).

To update a license, select the desired product/feature and then click Enter/Update. When the Configuration > Licenses > Enter/Update page appears, copy the license string you received from Quantum into the [License/Feature Name] License field, and then click Apply.

If you are updating StorNext licenses:

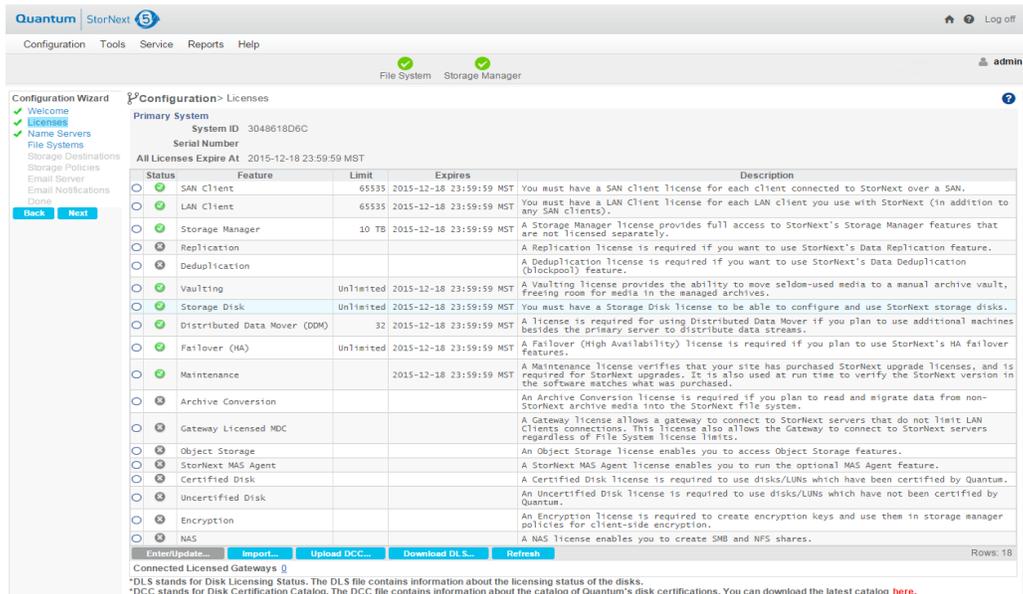
1. Place the system into config mode by navigating to Tools > High Availability > Manage.
2. Select Enter Config Mode button.

This will pop up a confirmation to attempt to lock the HA cluster configuration.

Caution: You can update SAN Client licenses, LAN Client licenses, and Disk licenses (Certified and Uncertified) without restarting the StorNext services. All other license types will require a restart of the StorNext services.

3. Choose “yes” when prompted.
See [High Availability Systems](#) in the StorNext 5 User’s Guide for further information about HA systems.
4. Navigate to Configuration > Licenses > Enter/Update.

Figure 7: Configuration > Licenses Page



- To import the license key from a text file, click Import. When the Import License File window appears, click Browse and navigate to the file's location. Click Close to continue.

A message at the top of the screen informs you whether the information was successfully validated and copied into the StorNext license file. The status indicator changes to enabled (a green check mark icon) and you are now ready to activate your licenses.

- Navigate back to Tools > High Availability > Manage and press Exit Config Mode. You will be prompted for confirmation that you want to unlock the cluster. Click Yes to exit config mode.

Obtain and Install StorNext Licenses

StorNext and some StorNext feature licenses are pre-installed on your system, and others must be purchased and then enabled by installing a license.dat file on the system. If your system is using a 30-day auto-generated license, you should upload a license file containing permanent licenses as soon as it is convenient, so that the maintenance expiration date for the licenses is set correctly on the system. (You can determine the current license limits for many StorNext features, such as SAN clients, LAN clients, DDM, and Storage Manager licenses, on the **Configuration > Licenses** page of the StorNext GUI.)

Obtain StorNext Licenses

If you need license keys to enable additional StorNext features or capacity enter the required information about your system at: <http://www.quantum.com/ServiceandSupport/License/StorNext/Index.aspx>

Note: If you cannot access the web page or need additional help filling out the form, contact Quantum Support at <http://www.quantum.com/ServiceandSupport>.

In order to receive a license.dat file, you will need the following:

- The System Serial Number. (Use this in the "Product Information, Serial Number of the Original Media" section of the form.)

System serial numbers are alpha-numeric (example: SV1728CKH02059).

- You could also use the StorNext Serial Number instead. (Use this in the "Product Information, Serial Number of the Original Media" section of the form.) For new installations, the serial number is delivered via email. You can also find the StorNext Serial Number in the license.dat file. The license.dat file can be found on the server node at /usr/cvfs/config/license.dat for UNIX systems, and c:\Program Files\StorNext\config\license.dat for Windows systems. Open the license.dat file and locate the **Serial Number**.

Example:

```
# Serial Number: Q8675309
```

- The cvfsid string for each server node.

Example:

```
ECF4BCEECC0E linux 0 xcellis13
```

- A list of StorNext features already licensed and enabled on your system.
- A list of purchased StorNext add-on features for which you wish to enable licenses.

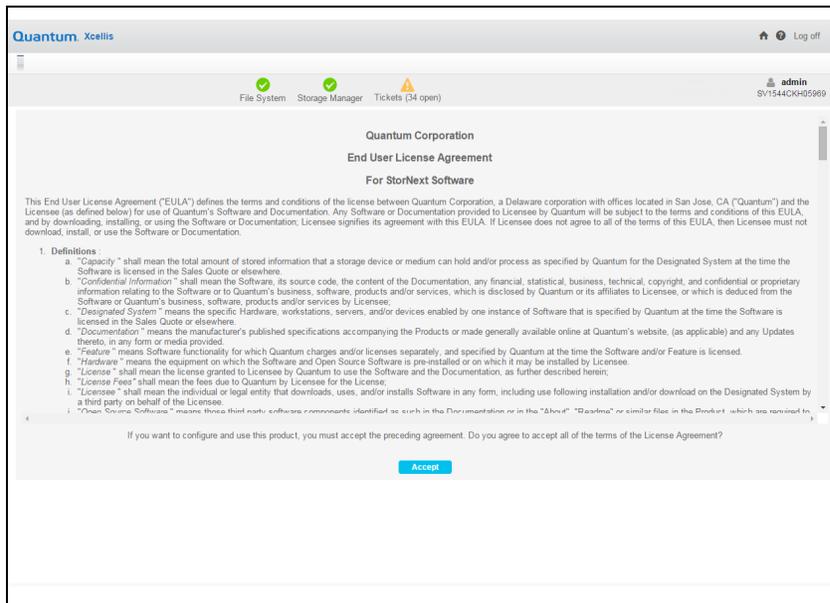
After will send a new license.dat file, which will contain licenses for the new StorNext features purchased, within one business day. Save the file to a temporary location on your computer. You will upload this file on the Licenses page of the StorNext GUI. Continue to the next step to **Install the License**. Use the **Install a StorNext License from the GUI for non-HA Installations** procedure if you have a single-node StorNext MDC. Use the **Install/Update Licenses from the GUI for HA Installations** procedure if you have a High Availability (HA) StorNext MDC pair.

Install/Update Licenses from the GUI for HA Installations

 **Caution:** At the end of this procedure, exiting Config Mode will restart StorNext services on both server nodes. This will cause a disruption in client operations. Quantum strongly recommends halting I/O operations for connected StorNext clients before beginning the process.

1. If you are logging into StorNext for the first time, read the end-user license agreement (EULA) carefully, and then click **Accept** (you will not see the EULA page if you have previously logged into StorNext).

Figure 8: EULA (Configuration > Licenses > Agreement) Page



2. For new installations, the **Configuration > Licenses Entry** screen appears. Skip to step 4.
For operational systems, place the system into config mode by navigating to **Tools > High Availability > Manage** to halt StorNext client I/O operations.
3. Click **Enter Config Mode**. This will pop up a confirmation to lock the HA cluster configuration. Click **Yes**.
(See the **High Availability Systems** section in the appendix of the current *StorNext User's Guide* for further information about HA systems.)
4. Select **Configuration > Licenses > Import**. Use this option to install new StorNext licenses and update existing ones.

Note: As of StorNext 5.4, the option to upload a single license key from an ASCII text file using the **Configuration > Licenses > Enter/Update** option on the StorNext Licenses page has been removed. For StorNext releases prior to 5.4, this option is still available.

If you choose to update licenses this way, copy the license string(s) you received from Quantum into the field(s), and click **Apply**.

Licenses for HA systems must be applied to both server nodes. Enter the appropriate license string in the appropriate field for both the Primary and Secondary server nodes.

5. Click **Choose File**, select the **license.dat** file provided for your system from the temporary location where you downloaded it, and click **Open**.

You will know that the licenses have been applied to your system when you see the confirmation **“License file license.dat imported successfully.”** appear at the top of the page. The status indicator for the licensed features is displayed as a green check mark icon.

6. If the system is in config mode, navigate to **Tools > High Availability > Manage** and click **Exit Config Mode**. You will be prompted for confirmation that you want to unlock the cluster. Click **Yes** to exit config mode.

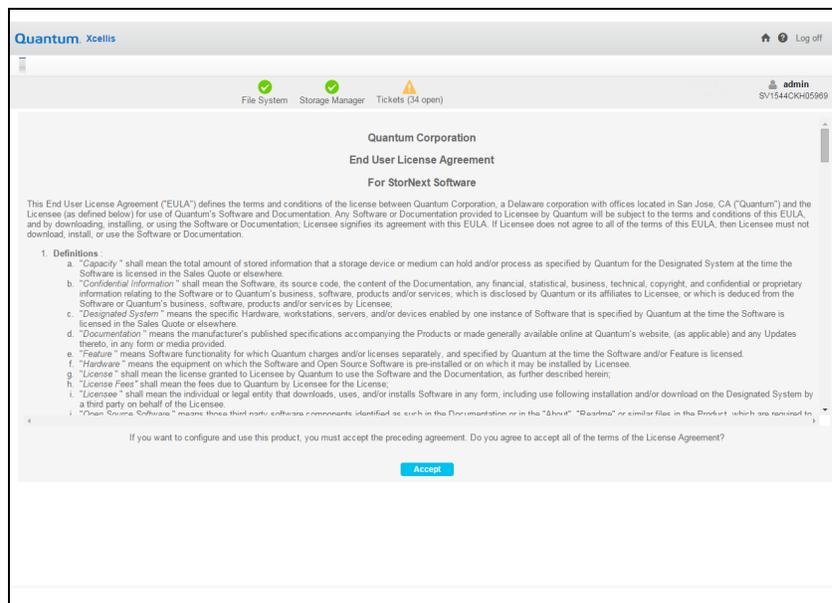
The procedure is complete.

Install StorNext Licenses from the GUI for non-HA Installations

Note: Use these steps to install the license keys on a single-node system, or one that has not been configured as HA. For HA systems, see [Obtain and Install StorNext Licenses](#).

1. If you are logging into StorNext for the first time, read the end-user license agreement (EULA) carefully, and then click **Accept** (you will not see the EULA page if you have previously logged into StorNext).

Figure 9: Configuration > Licenses > Agreement Screen



2. For new installations, the **Configuration > Licenses Entry** page appears. Skip to step 5.
For operational systems, halt StorNext client I/O operations.
3. Stop the StorNext filesystem by navigating to **Tools > System Control**, and selecting **Stop** in the **File System** section of the page.
4. Navigate to **Configuration > Licenses**.
5. Click **Import**, click **Choose File**, select the `license.dat` file provided for your system, and click **Open**.

Caution: Importing a license file overwrites the existing license file and all existing licenses. Licenses not present in the imported license file are removed from StorNext.

Note: As of StorNext 5.4, the option to upload a single license key from an ASCII text file using the

-
- i** **Configuration > Licenses > Enter/Update** option on the StorNext Licenses page has been removed. For StorNext releases prior to 5.4, this option is still available.

If you choose to update licenses this way, copy the license string(s) you received from Quantum into the field(s), and click **Apply**.

- You will know that the licenses have been applied to your system when you see the confirmation “**License file license.dat imported successfully.**” appears at the top of the page. The status indicator changes to enabled (a green check mark icon).
- After you install your licenses, restart the StorNext filesystem by navigating to **Tools > System Control**, and selecting **Start** in the **File System** section of the page. StorNext may not recognize some feature licenses until you restart services.

The procedure is complete.

Install a StorNext License on a Windows MDC

For help installing Windows MDC licenses, refer to the StorNext help, which can be found at: **Windows Start menu > All Programs > StorNext File System > StorNext Help**.

Installing Optional StorNext Add-on Software Features and Clients from the StorNext GUI

Download client software installers and optional add-on software features from the StorNext GUI on the **Tools > Client Download** page.

Converting to HA

- i** **Note:** The HA conversion process is required for initial installations.

- i** **Note:** If you are upgrading to StorNext 5 or later from StorNext 4.7 or later, and have previously converted your system to HA configuration, the conversion process is unnecessary. Previously-converted systems will not be taken out of HA configuration, so the option to convert to HA is unavailable. However, for StorNext releases prior to 4.7, an HA conversion is necessary after StorNext software upgrades.

This section describes the configuration steps necessary to convert two StorNext MDC nodes into a High Availability MDC pair connected to a shared file system. Converting to HA consists of selecting the dedicated unmanaged StorNext file system for use as the controlling shared file system, and then instructing StorNext to convert each MDC node to operate as one MDC node of the HA pair. The following note and bullet items apply only to customer-supplied MDCs.

i Note: The **Convert** menu option will be unavailable (grayed out) on the **Tools** menu if you have not specified a secondary system. If you have not already done so, specify a secondary system by using the Name Servers function. For more information, see [Name Servers on page 60](#).

Following are some other things you should be aware of concerning the HA conversion process:

- The HA shared file system **MUST** be configured as an unmanaged file system. The file system should not have quotas enabled. Enabling quotas on this file system can interfere with the proper functionality of Storage Manager and the HA infrastructure.
- The conversion process converts one MDC node at a time. The second MDC should be converted as soon as possible after the first node.
- StorNext operating files will be moved to the HaShared file system, and this move cannot easily be reversed.
- Following conversion, the primary MDC is identified by the vIP for Replication/Deduplication.
- Replication/Deduplication policies must be changed to use the vIP:
 - The global policy for each file system must use it as the “Address for Replication and Deduplication”
 - Replication policies must use it as the Target for Replication Schedules
 - If multilink is configured, the vIP address should be used.

The following bullet item applies to all MDCs used in an HA configuration, including StorNext Metadata Appliances:

- The UIDs for the **quantumdb** and **tdlm** users and the **adic** group **must** be identical on both MDC nodes of an HA pair. If the UIDs are not identical, the MySQL database will not start (due to file permission errors), which in turn prevents storage manager from fully starting up. Quantum recommends creating the UIDs for the **quantumdb** and **tdlm** users along with the **adic** group on both nodes prior to running **install.stornext**.

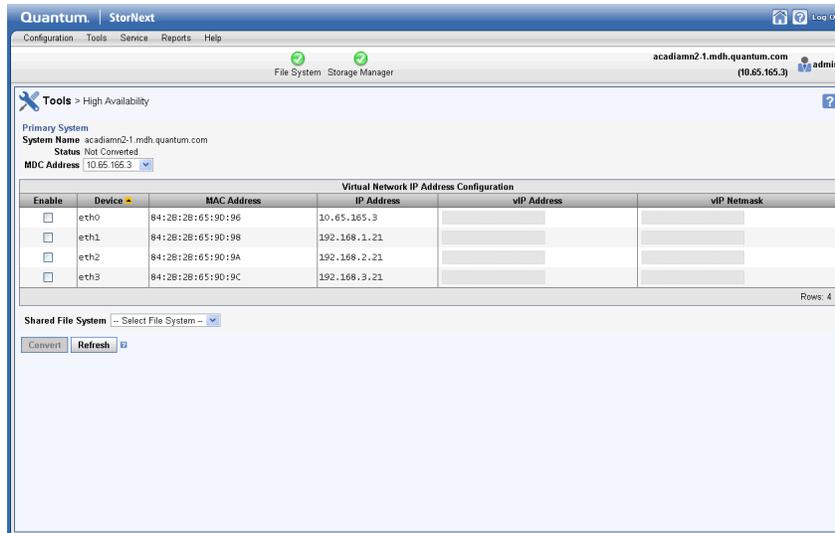
HA Conversion Procedure

Follow these steps to configure HA:

1. Choose **Tools > High Availability > Convert**. If the system has previously been converted to HA mode, continue to [Step 4](#).

The **High Availability** page appears.

Figure 10: Tools > HA > Page



Caution: Once you convert a file system to HA you cannot undo the operation, so choose carefully when selecting the file system.

Note: The file system should not have quotas enabled. Enabling quotas on the file system can interfere with the proper functionality of Storage Manager and the HA infrastructure.

Caution: **Tools > High Availability** page, it is critical that you assign the Metadata network IP address in the **MDCAddress** field and NOT the Management network IP address.

2. **For non-Lattus systems ONLY:** If your HA cluster also runs the blockpool, select **Enable** and then enter the virtual IP address and virtual netmask. (Ask your network administrator for the VIP address and netmask.)
3. Click **Convert** to convert the primary MDC node to HA.

Note: Once the primary MDC node has been converted, **Status** will change to **“Converted”**.

4. Enter the IP address of the secondary MDC node on the same LAN as the primary MDC node.
5. Click **Scan Host**. The system should resolve the secondary MDC node - the MDC Address will auto-fill with a value. If you do not already have licenses for the secondary system in the license file, you will be required to switch to the license page to import them before continuing. (The information comes from the individual `license.dat` files on both MDC nodes. StorNext merges the two into one file before converting the secondary.)

Note: Until you have performed the scan, you cannot import the license file for the secondary system using the StorNext import function. After you have performed the scan you can import licenses for the secondary. Following the conversion to HA, the license file will contain both primary and secondary licenses and will be present on both servers.

6. Click **Convert** to convert the secondary MDC node.
7. Storage Manager may need to be started following the HA conversion if the system was in config mode at the time that HA conversion was initiated. To restart the Storage Manager components, click the **Start** button in the Storage Manager panel of the **Tools > System Control** page.

GUI Feedback During HA Conversion

There are some indications within the GUI that the system is being upgraded. Here are some notes about this visual feedback:

- After the StorNext upgrade has completed, and the HA configuration has been done, the GUI for the secondary MDC node provides a message stating it is not the primary MDC node and a link to launch the primary MDC node.

⚠ Caution: Do not login to the GUI of the secondary MDC node at any point during the upgrade/HA conversion process. System configuration for the system could be compromised.

- When you are able to log into the primary system/node, after accepting the EULA, the system will automatically display the **Tools > System Control** page. Click the **Start** button to restart the Storage Manager components.
- Wait until the system icons for both MDC nodes of the system as well as File System and Storage Manager are green, which indicates normal operation.

Post-Conversion Steps

If you are using the DDM feature, do the following:

- If you use the secondary MDC node as a DDM mover, make sure the file systems are mounted.
- Edit **fs_sysparm** or **fs_sysparm_override** to use your preferred DDM mode: All or Threshold. Use the command **adic_control** restart TSM to put this change into effect.

Verifying HA Failover

After an initial conversion of your system to HA, you may want to verify HA failover. To initiate the failover of a system that has just been converted to HA:

1. Open an SSH connection to the MDC node operating as the **primary**.
2. Login to the command line of the **primary** MDC node.
User: **stornext**
Password: (the customer should have the password for the stornext account)
3. Type **sudo rootsh** to gain root user access. Enter the password again.
4. Confirm that the MDC node is operating as the primary by entering the following at the command prompt:

```
snhamgr -m status
```

5. Verify the output is (bold used for clarification):

```
:default:primary:default:running:
```

6. Initiate an HA failover on the **primary** MDC node to the **secondary** MDC node.

⚠ Caution: Only use the `snhamgr force smith` or `cvadmin -e hamon smith` commands to initiate a system failover the first time the system is converted to HA and should only be done when the system is operating in a non-production environment. These commands cause a HARD RESET of the MDC node, and will impact StorNext operations. For initiating a failover any other time, see [Initiate a Graceful System Failover on the next page](#) for the graceful HA failover procedure.

- a. Issue the following command to stop StorNext services on the primary MDC node:

```
adic_control stop
```

- b. Then, issue the following command to initiate the failover:

```
snhamgr force smith
```

i Note: Restarting StorNext more than once every three minutes can trigger a startup delay of three minutes. The delay slows down looping HA resets so that an administrator can correct any configuration problems that are causing the resets.

7. Wait 3 minutes until the MDC node previously operating as the **secondary** becomes the **primary**.
8. Open an SSH connection to the MDC node now operating as the **primary**.
9. Login to the command line of the **primary** MDC node.
10. Confirm that the MDC node is operating as the **primary** by entering the following at the command prompt:

```
snhamgr -m status
```

11. Verify the output is:

```
:default:primary:default:running:
```

12. Repeat if desired to fail over to the original system operating as the **primary**.

i Note: When the command `force smith` is used on an MDC node, the system will reboot, and it may take a significant amount of time for the MDC node to come back online, so plan for this additional delay. Wait until the MDC node reboot has completed before initiating another fail over to the MDC node originally operating as the **primary**.

13. Once the failover has completed, restart SNFS services on any clients that were stopped earlier.
14. Mount the SNFS file systems on each client machine, if needed.

15. Verify that all clients have full access.
16. Verify access to all file systems and move files to/from disk and tape.

Initiate a Graceful System Failover

During the upgrade of the node originally operating as the primary, the node originally operating as the secondary node becomes the primary. After the database updates are complete and the upgrade of the original primary completes, a failover of the node currently operating as the primary should be triggered so it once again is operating as the secondary, and to reinstate the original primary node to operate as primary again.

To initiate the graceful failover of an HA pair:

1. Open an SSH connection to the node operating as the **primary**.
2. Login to the command line of the **primary** node as root.
3. Confirm that the node is operating as the **primary** by entering the following at the command line:

```
snhamgr -m status
```

4. Verify the output is (bold used for clarification):

```
:default:primary:default:running:
```

5. On the node operating as the **primary**, initiate an HA failover to the node operating as the **secondary**.

```
service cvfs stop
```

6. Wait until the **secondary** node becomes the **primary**, and leave your SSH connection to this node open. (Time may vary.)
7. Open an SSH connection to the node now operating as the **primary**.
8. Login to the command line of the **primary** node as root and enter the following:
9. Confirm that the node is operating as the **primary** by entering the following at the command line:

```
snhamgr -m status
```

10. Verify the output is:

```
:default:primary:default:stopped:
```

11. From the SSH connection to the node now operating as the **secondary**, enter the following:

```
service cvfs start
```

12. Confirm that the node is operating as the **secondary** by entering the following at the command line:

```
snhamgr -m status
```

13. Verify the output is:

```
:default:running:default:primary:
```

14. Repeat if desired to fail over to the original system operating as the **primary**.

15. Verify that all clients have full access.

16. Test access to all file systems.

Configuring StorNext Using the StorNext GUI

The StorNext GUI provides access to StorNext features and displays system status information. Use the StorNext GUI to create and work with file systems. In addition, on Metadata Controllers running Storage Manager, you can use the StorNext GUI to configure storage devices and media, and to set up storage policies.

Accessing the StorNext GUI

The StorNext GUI is browser-based and can be remotely accessed from any machine with access to the StorNext server.

Use this procedure to access the StorNext GUI.

1. Open a Web browser.

i Note: For a list of browsers that have been tested to work with StorNext, refer to the *StorNext Compatibility Guide* posted here:

<http://www.quantum.com/sn5docs>

In the browser's **Address** field, type the full address of the machine, and then press **Enter**.

For example: `https://<machine name>:<port number>`. Use the name of the machine you copied when you installed the StorNext software.

i Note: Typically, the port number is 443. If port 443 is in use, use the next unused port number. (I.e., 444, 445, etc.)

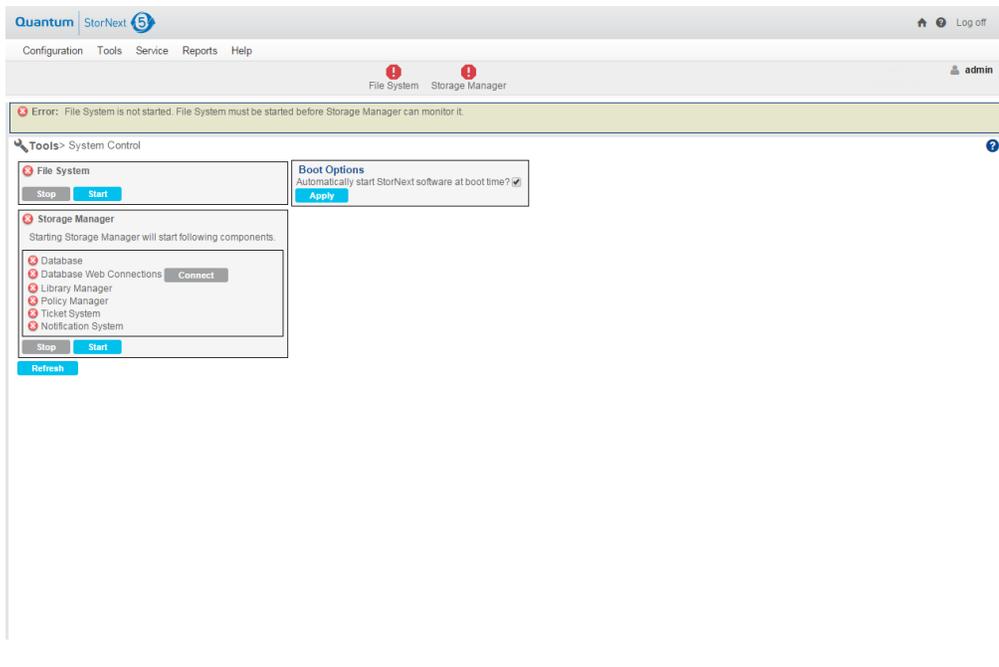
After you enter the machine name and port number, the following window appears:

Figure 11: StorNext Login Window



2. In the **User ID** field, type admin.
3. In the **Password** field, type password.
4. Click **Login**. The initial StorNext **System Control** page appears.

Figure 12: System Control



- On this screen you can determine if the StorNext File System and Storage Manager components are currently started. If not, click **Start** for each component to start them. (If you are logging in for the first time, it is likely that Storage Manager will be stopped and require starting.)
- Click the home (house) icon in the upper right corner to go to the StorNext Home Page.

Note: When you log into StorNext for the first time, you might see a message warning you about a security certificate. Either click the option that allows you to “continue to this site,” or, for a temporary solution, create a certificate exception that will allow you to log into StorNext without seeing the warning message during subsequent logins.

Using the StorNext Configuration Wizard

The first time you log onto the StorNext GUI, the Configuration Wizard appears. The wizard guides you step-by-step through the process of configuring StorNext.

Note: Using the Configuration Wizard to configure StorNext is optional. All configuration tasks can be accessed at any time using the StorNext Setup menu.

The Configuration Wizard is shown in [Figure 13 below](#).

Figure 13: StorNext Configuration Wizard: Storage Manager

The screenshot shows the StorNext Configuration Wizard interface. The top navigation bar includes 'Quantum StorNext 5' and 'Log off'. Below the navigation bar, there are status indicators for 'File System' and 'Storage Manager', both showing green checkmarks. The main content area is titled 'Configuration Wizard' and 'Configuration > Welcome'. It displays a list of 'Disks/LUNs' and 'Libraries and Tape Drives'.

Serial Number	Type	Label	Size	Status	Used	File System
600A0B8000293F1C0000071F47F243BA	GENERIC_1931458527	CvFs_SN70601237_0_1	920.99 GB	up	false	
600A0B8000293F1C0000072147F2430E	GENERIC_37730271	CvFs_SN70601237_1_2	17.99 GB	up	false	
600A0B8000293F1C0000072247F243F4	GENERIC_1931458527	CvFs_SN70601237_2_3	920.99 GB	up	false	
600A0B8000293F1C0000072347F24414	GENERIC_1931458527	CvFs_SN70601237_3_4	920.99 GB	up	false	
600A0B8000293F1C0000072547F24438	GENERIC_37730271	CvFs_SN70601237_4_5	17.99 GB	up	false	
600A0B8000293F1C0000072647F24450	GENERIC_1931458527	CvFs_SN70601237_5_6	920.99 GB	up	false	

Serial Number	Product ID	Device Type	Device Path
0000000091_Defau	Scalar 1000	Tape Library	/dev/sg7
AD1C000092	ULTRIUM-TD2	Tape Drive	/dev/sg3
AD1C000093	ULTRIUM-TD2	Tape Drive	/dev/sg4
AD1C000094	ULTRIUM-TD2	Tape Drive	/dev/sg5
AD1C000095	ULTRIUM-TD2	Tape Drive	/dev/sg6

The Configuration Wizard consists of multiple steps. The wizard lets you navigate between steps and tracks your progress as you complete each step.

- To go to the next step, click **Next**.
- To return to a previous step, click **Back** (or click the step in the list).

These are the steps you'll complete in the Configuration Wizard:

- **Welcome:** View disks and libraries currently available for StorNext usage.
- **Licenses:** Enter StorNext License Information.
- **System:** Set up the networking configuration for StorNext Metadata Appliances (M660, M440 and M330). This step only appears on the Configuration Wizard of StorNext Metadata Appliances.
- **Name Servers:** Specify and order the machines acting as StorNext name servers.
- **File Systems:** Add a StorNext file system.
- **Storage Destinations:** Add a library, storage disks, and other storage destinations.
- **Storage Policies:** Add a Storage Manager or replication storage policy.
- **Email Server:** Specify an email server to handle StorNext notifications.
- **Email Notification:** Add e-mail notification recipients.
- **Done:** Signify that you are finished using the Configuration Wizard. You can also convert to a high availability (HA) system.

To see more detailed instructions for completing Configuration Wizard tasks, refer to "[The Configuration Wizard](#)" in the *StorNext User's Guide*.

Linux Device Mapper Multipath Support

StorNext 5 supports the Linux Device Mapper (DM) Multipath driver. This driver provides redundancy and improved I/O performance by taking advantage of multiple paths to storage. If you plan to use the Linux DM Multipath support with StorNext, be aware of the following:

- The StorNext File System does not currently support disks managed through the Linux Device Mapper tools other than those which are managed through **multipathd**. Disk paths showing up under the `/dev/mapper` path that are not **multipathd** devices will not be usable by StorNext due to Device Mapper taking exclusive control of the disk devices. See the Linux **dmsetup** documentation for details.

Device Mapper will release exclusive control of a disk device if all of the Device Mapper partition entries are removed. Some customers have successfully used Device Mapper devices by using **dmsetup** to remove the partition entries for a particular device before attempting to mount StorNext File Systems. See the Linux **dmsetup** documentation for details.

-
- **Note:** Device Mapper control on specific devices may need to be removed after each reboot or after a device is first presented to a system.
 - Not all RAID configurations work with the DM Multipath Driver. Check with your storage vendor for compatibility.
 - For detailed instructions on installing and configuring the DM Multipath Driver, refer to the Red Hat, SUSE, Debian, or Ubuntu documentation provided with your version of Linux.
 - For StorNext to use Linux Device Mapper Multipath devices, you must make two changes to the `/etc/multipath.conf` file.

- a. Set `user_friendly_names` to `yes`.
- b. Add the following entry to the `multipath.conf` blacklist section to prevent **multipathd** from managing the SNFS volume devices:

```
devnode "cvfsctl*"
```

In addition, the use of the `alias` attribute in a `multipath` subsection of the `multipath.conf` file is not currently supported for devices used by StorNext. Its use can lead to mount failures.

- Using the `cvpaths` file and `udev` rules configuration files is typically unnecessary with Linux Device-Mapper with StorNext.
- Current versions of the Linux DM Multipath driver assign a default value of 1000 for `rr_min_io` which is too high for most configurations having multiple active paths to storage. Using a smaller value such as 32 will typically result in significantly improved performance. Refer to the Red Hat, SUSE, Debian, or Ubuntu documentation provided with your version of Linux for details on how to apply this setting.

i Note: Experimentation may be required to determine the optimal value.

- **On SUSE Linux Systems:** In order to use Linux Device Mapper Multipath with StorNext, `/etc/multipath.conf` must be used because SUSE Linux does not install a `multipath.conf`, and Novell recommends against using it. Although SUSE Linux does not install a `multipath.conf` file by default, an example file, located at:

```
/usr/share/doc/packages/multipath-tools/ multipath.conf.synthetic
```

can be copied to:

```
/etc/multipath.conf
```

- **On Ubuntu Linux Systems,** there is no `multipath.conf` file installed by default. However, an example file, located at:

```
/usr/share/doc/multipath-tools/examples/multipath.conf.synthetic
```

can be copied to:

```
/etc/multipath.conf
```

- **On Debian Linux Systems,** there is no `multipath.conf` file installed by default and no example file is provided. Therefore, the `multipath.conf` file must be hand-crafted. Refer to your Debian documentation for additional information.
- **On Red Hat Linux Systems:** Red Hat does install a `multipath.conf` file. By default, Red Hat **multipath.conf** file blacklists all multipath-capable targets. This means:

```
blacklist { devnode "*" }
```

must be commented out.

i Note: After installing and/or updating the `/etc/multipath.conf` file, **multipath** services must be restarted for changes to take effect. For details, refer the documentation for your version of Linux.

Third-Party Multipath Support

If you are using a third-party multipath driver, you may need to use a `cvpaths` file. The `cvpaths` file directs StorNext to the multipath devices for the entire lun.

By default, here are the devices StorNext uses:

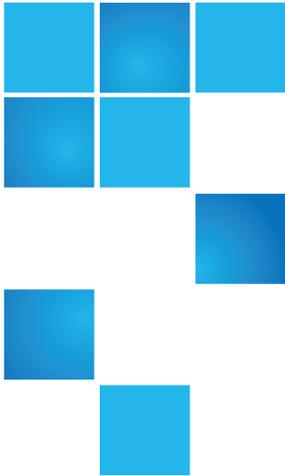
- linux - `/dev/sd*`
- aix - `/dev/rhdisk*`
- solaris - `/dev/rdisk*`

For example, the EMC Powerpath driver creates devices named `/dev/emcpower*` on Linux. If you do not tell StorNext to use the `/dev/emcpower*` devices, it will instead use the `/dev/sd*` devices. So in this example a `cvpaths` file must be created to specify the following:

```
wildcard=/dev/emcpower*[^1-9]
```

Other third-party multipath devices may use other path names. If you run the `cvlabel -l` command, the output will show which devices are being used by StorNext.

For additional information on configuring the `cvpaths` file, refer to the `cvpaths` man page from the command line, or the `cvpaths` entry in the MAN Pages Reference Guide.



Chapter 3: Linux SNFS-Only MDC Installation/Configuration

This chapter contains the following topics:

Linux SNFS-Only MDC Installation/Configuration	44
File System Requirements	45
Getting Ready to Install	46
Installing StorNext File System-Only from RPMs	49
Configuring StorNext RPM Servers Using the Command Line	51
Obtain and Install StorNext Licenses	55
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Linux SNFS-Only MDC Installation/Configuration

The RPM installation includes only StorNext File System (not StorNext Storage Manager) and does not include a GUI or components required to use the StorNext Replication feature. This topic describes how to install and configure File System-only on Linux MDCs. It also describes how to configure an RPM high-availability (HA) system.

This topic covers:

- [File System Requirements on the next page](#)

- [Getting Ready to Install on the next page](#)
- [Installing StorNext File System-Only from RPMs on page 49](#)
- [Configuring StorNext RPM Servers Using the Command Line on page 51](#)
- [Configuring Licenses for RPM Installations on page 62](#)

For further information not covered in this topic, refer to the man pages that reside in the directory **/usr/cvfs/man**.

File System Requirements

To run StorNext File System, the machine onto which you are installing SNFS must meet all operating system, hardware, and LAN requirements.

Operating System Requirements

The operating systems, kernel versions, rpm package dependencies, and hardware platforms supported by StorNext File System are listed in the *StorNext Compatibility Guide* posted here:

<http://www.quantum.com/sn5docs>

Make sure the system meets the operating system and platform requirements outlined in the guide, and, if necessary, update to a supported release or kernel version before installing StorNext.

LTFS Runtime Requirements

StorNext 5 Storage Manager supports the open LTFS format. You can use the GUI to configure what format you want a copy to use when writing to tape (ANTF or LTFS) on a per policy and per copy basis. The following LTFS runtime RPM packages are required:

- RHEL6 and SUSE11:
 - libuuid, available from the DVD ISO
 - libic, available from the DVD ISO
- RHEL5:
 - e2fsprogs-libs, available from the DVD ISO
 - libicu, available from the DVD ISO

Hardware Requirements

RAM and hard disk space requirements to run the StorNext File System are listed in the *StorNext Compatibility Guide* posted here:

<http://www.quantum.com/sn5docs>

Make sure the MDC meets the hardware requirements outlined in the guide, and, if necessary, update the MDC before installing StorNext.

For improved performance and stability, it is strongly recommended that CPU C-States be disabled in the BIOS if they are supported by your system. Refer to system vendor documentation for additional information.

LAN Requirements

StorNext LAN requirements are listed in the “*StorNext MDC Network Requirements*” section of the *StorNext Compatibility Guide* posted here:

<http://www.quantum.com/sn5docs>

Make sure the MDC meets the network requirements outlined in the guide, and, if necessary, update the MDC before installing StorNext.

Other Requirements

Additional requirements that must be met for the StorNext system are listed in the “*Additional StorNext MDC and StorNext Client Requirements*” section of the *StorNext Compatibility Guide* posted here:

<http://www.quantum.com/sn5docs>

Make sure the system meets the additional requirements outlined in the guide, and, if necessary, update the system before installing StorNext.

Getting Ready to Install

Before installing StorNext File System, complete the following tasks to ensure successful installation:

- Make sure the Metadata Controller (MDC) meets all operating system and hardware requirements (see [File System Requirements on the previous page](#)).
- Make sure all storage devices are correctly configured and are visible to the MDC (see [Configuring Storage Devices on the next page](#)).

- If using LUNs larger than 1 TB, decide on a label type and install any necessary operating system patches (see [Planning for LUNs Larger than 1 TB below](#)).
- Review and install any package dependencies (see [Getting Ready to Install on the previous page](#)).

Configuring Storage Devices

Before installing StorNext File System, make sure that all LUNs are visible to the MDC. (A LUN, or logical unit number, is a logical device that corresponds to one or more disks, drives, or storage devices.)

If there are any connection issues, resolve them before installing StorNext. For assistance in configuring storage devices, refer to the documentation that came with the storage device, or contact the manufacturer.

i Note: LUNs that you plan to use in the same stripe group must be the same size. Consider this when configuring storage devices. (For more information about stripe groups, see the *StorNext User's Guide*.)

! Caution: StorNext does not support the connection of multiple devices through fibre channel hubs. Multiple devices must be connected using fibre channel switches.

Planning for LUNs Larger than 1 TB

StorNext supports LUNs greater than 1 TB in size if they are allowed by the operating system. To enable support for 1 TB or larger LUNs, all StorNext LUNs must be correctly labeled according to the requirements of the operating system running on the MDC as well as the operating system running on all connected clients. Disk LUNs can have one of three labels: VTOC, EFI, or sVTOC (short VTOC). Before installing StorNext, decide what label type will be used.

Required disk LUN label settings based on operating system and LUN size are presented in [Table 1 below](#). Before installing StorNext, install any required operating system patches or updates (for both MDC and client) as indicated in the notes for [Table 1 below](#).

i Note: After labeling a disk LUN, you must reboot systems running Solaris before they can access the disk LUN.

Table 1: Required Disk LUN Labels

Operating System	Label for LUNs < 1 TB	Label for LUNs 1–2 TB	Label for LUNs > 2 TB
Windows ^a	VTOC, EFI	VTOC, EFI	EFI, sVTOC
Linux 2.6 Kernel	VTOC, EFI	VTOC, EFI	EFI, sVTOC
Solaris 10 ^b	VTOC, EFI	EFI	EFI
HP-UX ^c	VTOC, EFI	VTOC, EFI	EFI, sVTOC

Operating System	Label for LUNs < 1 TB	Label for LUNs 1–2 TB	Label for LUNs > 2 TB
IBM AIX ^d	VTOC, EFI	VTOC, EFI	EFI, sVTOC
SGI IRIX ^e	VTOC	VTOC	Not supported
Apple Xsan 2.1.1 (MacOS X 10.5 Leopard)	VTOC, EFI	VTOC, EFI	EFI, sVTOC
Apple Xsan 2.2 (MacOS X 10.6 Snow Leopard)	VTOC, EFI	VTOC, EFI	EFI, sVTOC

- For Windows XP 32-bit systems only, support for LUNs larger than 2 TB is limited to the first 2 TB. All other supported Windows platforms (including Windows XP 64-bit) support LUNs greater than 2 TB.
- Support for 2 TB or larger LUNs requires Solaris 10 Update 2 (06/06).
- Supports only the first 2 TB of LUNs larger than 2 TB.
- Supports only LUNs of 2.2 TB or less.
- IRIX is not supported starting with StorNext 4.0. However, StorNext 3.5 IRIX clients can be used with StorNext 5 MDCs.

i Note: For best results, Quantum recommends using persistent binding for disk LUNs. For more information, contact the vendor of your HBA (host bus adapter).

Package Dependencies

- For management servers running Red Hat Enterprise Linux version 6 or 7, before installing SNFS and SNSM you must first install the kernel header files (shipped as the kernel-devel or kernel-devel-smp RPM, depending on your Linux distribution).
- For servers running SUSE Linux Enterprise Server, you must install the first kernel source code (shipped as the kernel-source RPM). StorNext will not operate correctly if these packages are not installed. You can install the kernel header files or kernel source RPMs by using the installation disks for your operating system.
- In addition, for MDC installs on Linux the PERL package is required.
- For customer supplied metadata-controllers and hardware, install the `fuse-libs` package on the system before installing the `stornext_full` or `snfs_client_plus_mover` packages.

Verifying Hostname Length

The maximum hostname length for a StorNext server is limited to 255 characters. Before you begin the installation, verify that the destination hostname is not longer than 255 characters.

Ensuring You Have Enough Space to Extract the Installation Software

The installation software files are extracted into the `/tmp/stornext` directory by default. The software, when extracted, requires approximately 40 MB of space. Make sure there is enough free space in the default directory to extract the files. If there is not sufficient space, you may need to specify an alternative directory with the `-d` option.

To specify an alternate location before beginning the installation, enter the following command:

```
# ./<snfs_full.bin> -d <dir>
```

where `<snfs_full.bin>` is the name of the Linux RPM installation file, and `<dir>` is the directory into which you want to extract the installation files.

Installing StorNext File System-Only from RPMs

This section describes how to install StorNext 5 using an RPM-only installation. To perform the install, you will need to use the correct file on the StorNext installation DVD or download for your operating system.

1. Log on to the MDC as **root**. For DVD installations, continue to next step. For installations from downloaded files, change to the directory containing the `.bin` file and continue to [Step 7](#). If you only have the rpm files, continue to [Step 10](#).
2. Mount the StorNext installation DVD and change to the DVD root directory.

Note: When you mount a DVD in a Red Hat 5 or 6 system, DVDs are mounted by default with a `noexec` (non-executable) option which prevents you from proceeding with the installation.

For Red Hat users only, before proceeding you must remount the DVD by typing:

```
mount -o remount, exec ...
```

Note:

3. List the installation directories on the DVD. At the command prompt, type:

```
ls -l
```

4. Change to the **fs_only** directory.

Note: Make sure you are in the **fs_only** directory and not the **stornext_full** directory. The **fs_only** directory installs the StorNext File System only.

5. List the directories in the **fs_only** directory. At the command prompt, type:

```
ls -l
```

6. Identify the correct .bin file for your operating system and hardware platform.

For example, for Red Hat Linux 5 running on an x86 64-bit platform, the file you will use is **snfs_full_RedHat50AS_26x86_64.bin**.

7. Launch the install script. At the command prompt, type:

```
./<file>
```

where <file> is the name of the .bin file for your installation.

The End User License Agreement (EULA) displays.

8. Read the EULA. When finished you are asked if you accept.
9. Type **y** to accept the EULA and continue.

After you accept the EULA, the client software is extracted to **/tmp/stornext** (or to another directory if you specified an alternate location; see [Ensuring You Have Enough Space to Extract the Installation Software on the previous page](#)).

i Note: If the directory into which the files are being extracted does already exist or does not have enough space, the installation will fail and you will receive an error message. You will need to identify an alternate location into which to extract the files by entering the following command:

```
# ./<snfs_full.bin> -d <dir>
```

i Note:

where <snfs_full.bin> is the name of the Linux server installation .bin file, and <dir> is the directory into which you want to extract the installation files.

It is NOT recommended that you force using an existing directory (by using the **-f** command) because this could lead to additional problems installing the .rpm files.

10. Change to the directory into which the files were extracted. The following command uses the default extract location for the files prompt, type:

```
cd /tmp/stornext
```

11. Display a list of the installed files. At the prompt, type:

```
ls -l
```

12. Install the required .rpm files in the following order. Use the command **rpm -ivh** before each package. For example, **rpm -ivh quantum_jansson-<version>.rpm**. The files are installed in the directory: **/usr/cvfs**.

- a. quantum_jansson-<version>.rpm
- b. quantum_protobuf-<version>.rpm
- c. quantum_zeromq-<version>.rpm
- d. snfs-common-<version>.rpm
- e. snfs-extapi-<version>.rpm
- f. snfs-client-<version>.rpm
- g. snupdate-<version>.rpm

Configuring StorNext RPM Servers Using the Command Line

This section describes how to set up a StorNext 5 server in an RPM-only installation. This section covers:

- [Editing the /etc/hosts file in HA Configurations below](#)
- [Configuring a Single StorNext 4.x .RPM Server or the Primary Server in an HA Configuration below](#)
- [Configuring the Secondary StorNext 4.x .RPM Server in an HA Configuration on page 53](#)

i Note: For RPM installations (specifically, when there is no “HA shared” file system), the ha manager program `/usr/cvfs/bin/snhamgr` is not functional.

Editing the /etc/hosts file in HA Configurations

SUSE Linux distributions automatically associate the FQDN of the local machine with the address 127.0.0.2 in the `/etc/hosts` file. There is no benefit from doing this when the machine is connected to a network that can resolve its name to an IP address. However, the existence of this entry can sometimes cause a failure of configuration synchronization within and between the server computers in an HA configuration. For this reason, the 127.0.0.2 entry should be deleted from the `/etc/hosts` file.

Configuring a Single StorNext 4.x .RPM Server or the Primary Server in an HA Configuration

The steps for setting up a single server or the primary server in an HA configuration are nearly identical. The HA configuration requires a few extra steps, which are noted in the procedure below. If you do not have an HA configuration, ignore the steps marked “HA Only.”

Run the following commands on the **Primary** node if installing an HA system:

1. Install RPMs using the procedure outlined in [Installing StorNext File System-Only from RPMs on page 49](#).
2. Obtain and install licenses.
3. Populate the `fsnameservers` file with the IP addresses of the `fsnameserver` systems by running this command:

```
# vi /usr/cvfs/config/fsnameservers
```

(For more information see the `fsnameservers` man page.)

i Note: If you add the host name instead of the IP address, the conversion to HA could fail. Use **only** the IP address when populating the `fsnameservers` file.

4. **HA Only:** Create the `ha_peer` file by running the command below. This file should contain the IP address of the **Secondary** in the HA pair.

```
# vi /usr/cvfs/config/ha_peer
```

(For more information, see the `ha_peer` man page.)

5. Start up the `fsmppm` by running this command:

```
# /etc/init.d/cvfs start
```

6. Create the `.cfgx` file by running this command:

```
# /usr/cvfs/bin/sncfgedit -n snfs1
```

(For more information, see the `snfs.cfgx` and `sncfgedit` man pages.)

After creating the file, do the following:

- a. Delete first two lines at top that start with `****`
- b. **HA Only:** Change the `haFsType` entry to `HaUnmanaged`. That is, change this:

```
<haFsType>HaUnmonitored</haFsType>
```

to this:

```
<haFsType>HaUnmanaged</haFsType>
```

- c. Fix the `<diskTypes>` and `<stripeGroups>` sections at the bottom.

7. Make the file system by running this command:

```
# /usr/cvfs/bin/cvmkfs snfs1
```

8. Create the mount point by running this command:

```
# mkdir /stornext/snfs1
```

9. Edit the file `/usr/cvfs/config/fsmlist` and add your file system name(s) that the file system services will start. To do this:

a. Open the file by running this command:

```
# vi /usr/cvfs/config/fsmlist
```

b. Add the name of your file system to launch:

```
snfs1
```

10. Configure the file system to automatically mount after reboot by doing the following:

a. Edit the `/etc/fstab` file by running this command:

```
# vi /etc/fstab
```

b. Add the file system name and mount options to the end of the list:

```
snfs1 /stornext/snfs1 cvfs rw 0 0
```

i Note: There are six fields in the `fstab` file. Spaces are used between the entries to delineate one field from the other. The fields are:
First field: Name of the file system to be mounted.
Second field: Mount point for the file system.
Third field: Type of file system.
Fourth field: Mount options.
Fifth field: Flag that tells Linux if this file system need to be dumped.
Sixth field: Determines the order in which file system checks are done.

11. Start and mount the file system by running this command:

```
# /usr/cvfs/bin/cvadmin -e 'start snfs1'  
# mount /stornext/snfs1
```

Configuring the Secondary StorNext 4.x .RPM Server in an HA Configuration

Perform this procedure only if you have an HA configuration. Run the following commands on the **Secondary** node:

1. Install RPMs using the procedure outlined in [Installing StorNext File System-Only from RPMs on page 49](#).
2. Create the `fsnameservers` file that contains the IP address of the system acting as the name servers by doing the following:

- a. Open the file by running this command:

```
# vi /usr/cvfs/config/fsnameservers
```

- b. Add the IP address of the name servers.

i Note: The `fsnameservers` file on the secondary must be the same as the `fsnameservers` file on the primary.

Remember, if you add the host name instead of the IP address, the conversion to HA could fail. Use **only** the IP address when populating the `fsnameservers` file.

3. Create the `ha_peer` file and add the IP address of the **Primary** in the HA pair by doing the following:

- a. Open the file by running this command:

```
# vi /usr/cvfs/config/ha_peer
```

- b. Add the IP address of the **Primary**:

4. Start up the `fsmpm` by running this command:

```
# /etc/init.d/cvfs start
```

5. Copy the `.cfgx` file from the Primary to the `/usr/cvfs/config` directory on the Secondary.

6. Edit the file `/usr/cvfs/config/fsmlist` and add your file system name(s) that the file system services will start by doing the following:

- a. Run this command:

```
# vi /usr/cvfs/config/fsmlist
```

- b. Add the name of your file system to launch:

```
snfs1
```

7. Configure the file system to automatically mount after reboot by doing the following:

- a. Edit the `/etc/fstab` file by running this command:

```
# vi /etc/fstab
```

- b. Add the file system name and mount options to the end of the list:

```
snfs1 /stornext/snfs1 cvfs rw 0 0
```

8. Start and mount the file system by running this command:

```
# /usr/cvfs/bin/cvadmin -e 'start snfs1'  
# mount /stornext/snfs1
```

Obtain and Install StorNext Licenses

StorNext and some StorNext feature licenses are pre-installed on your system, and others must be purchased and then enabled by installing a license.dat file on the system. If your system is using a 30-day auto-generated license, you should upload a license file containing permanent licenses as soon as it is convenient, so that the maintenance expiration date for the licenses is set correctly on the system. (You can determine the current license limits for many StorNext features, such as SAN clients, LAN clients, DDM, and Storage Manager licenses, on the **Configuration > Licenses** page of the StorNext GUI.)

Obtain StorNext Licenses

If you need license keys to enable additional StorNext features or capacity enter the required information about your system at: <http://www.quantum.com/ServiceandSupport/License/StorNext/Index.aspx>

i Note: If you cannot access the web page or need additional help filling out the form, contact Quantum Support at <http://www.quantum.com/ServiceandSupport>.

In order to receive a license.dat file, you will need the following:

- The System Serial Number. (Use this in the "Product Information, Serial Number of the Original Media" section of the form.)

System serial numbers are alpha-numeric (example: SV1728CKH02059).

- You could also use the StorNext Serial Number instead. (Use this in the "Product Information, Serial Number of the Original Media" section of the form.) For new installations, the serial number is delivered via email. You can also find the StorNext Serial Number in the license.dat file. The license.dat file can be found on the server node at /usr/cvfs/config/license.dat for UNIX systems, and c:\Program Files\StorNext\config\license.dat for Windows systems. Open the license.dat file and locate the **Serial Number**.

Example:

```
# Serial Number: Q8675309
```

- The cvfsid string for each server node.

Example:

```
ECF4BCEECC0E linux 0 xcellis13
```

- A list of StorNext features already licensed and enabled on your system.
- A list of purchased StorNext add-on features for which you wish to enable licenses.

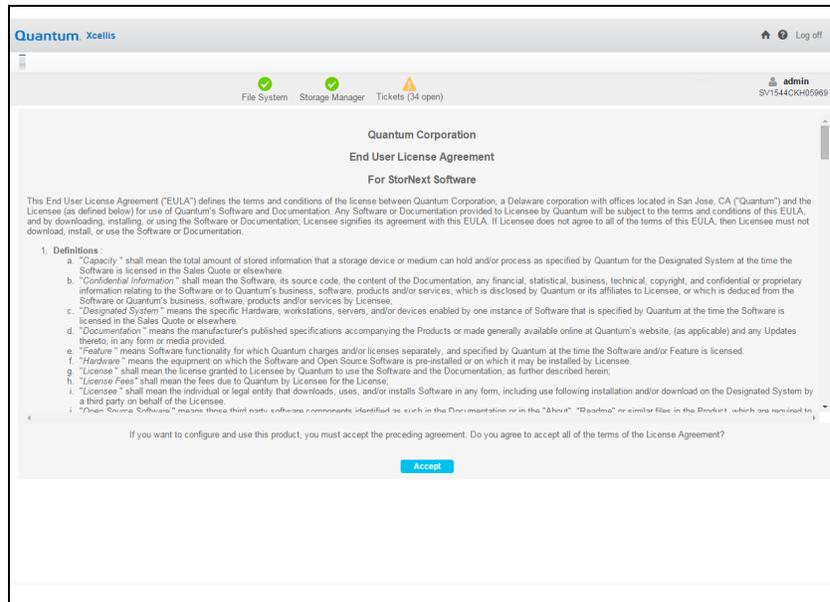
After will send a new license.dat file, which will contain licenses for the new StorNext features purchased, within one business day. Save the file to a temporary location on your computer. You will upload this file on the Licenses page of the StorNext GUI. Continue to the next step to **Install the License**. Use the **Install a StorNext License from the GUI for non-HA Installations** procedure if you have a single-node StorNext MDC. Use the **Install/Update Licenses from the GUI for HA Installations** procedure if you have a High Availability (HA) StorNext MDC pair.

Install/Update Licenses from the GUI for HA Installations

⚠ Caution: At the end of this procedure, exiting Config Mode will restart StorNext services on both server nodes. This will cause a disruption in client operations. Quantum strongly recommends halting I/O operations for connected StorNext clients before beginning the process.

1. If you are logging into StorNext for the first time, read the end-user license agreement (EULA) carefully, and then click **Accept** (you will not see the EULA page if you have previously logged into StorNext).

Figure 14: EULA (Configuration > Licenses > Agreement) Page



2. For new installations, the **Configuration > Licenses Entry** screen appears. Skip to step 4.
For operational systems, place the system into config mode by navigating to **Tools > High Availability > Manage** to halt StorNext client I/O operations.
3. Click **Enter Config Mode**. This will pop up a confirmation to lock the HA cluster configuration. Click **Yes**.
(See the **High Availability Systems** section in the appendix of the current *StorNext User's Guide* for further information about HA systems.)
4. Select **Configuration > Licenses > Import**. Use this option to install new StorNext licenses and update existing ones.

i Note: As of StorNext 5.4, the option to upload a single license key from an ASCII text file using the **Configuration > Licenses > Enter/Update** option on the StorNext Licenses page has been removed. For StorNext releases prior to 5.4, this option is still available.

If you choose to update licenses this way, copy the license string(s) you received from Quantum into

the field(s), and click **Apply**.

Licenses for HA systems must be applied to both server nodes. Enter the appropriate license string in the appropriate field for both the Primary and Secondary server nodes.

5. Click **Choose File**, select the **license.dat** file provided for your system from the temporary location where you downloaded it, and click **Open**.

You will know that the licenses have been applied to your system when you see the confirmation “**License file license.dat imported successfully.**” appear at the top of the page. The status indicator for the licensed features is displayed as a green check mark icon.

6. If the system is in config mode, navigate to **Tools > High Availability > Manage** and click **Exit Config Mode**. You will be prompted for confirmation that you want to unlock the cluster. Click **Yes** to exit config mode.

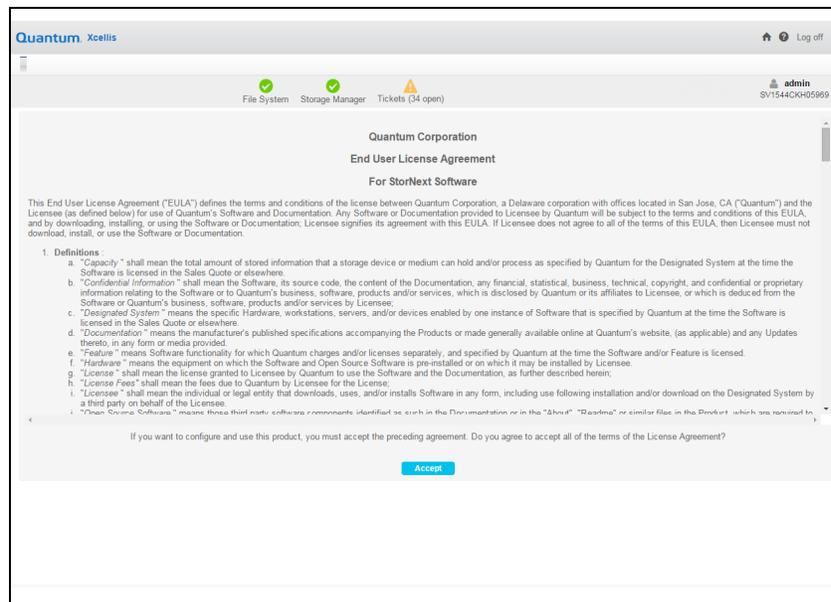
The procedure is complete.

Install StorNext Licenses from the GUI for non-HA Installations

i Note: Use these steps to install the license keys on a single-node system, or one that has not been configured as HA. For HA systems, see [Obtain and Install StorNext Licenses](#).

1. If you are logging into StorNext for the first time, read the end-user license agreement (EULA) carefully, and then click **Accept** (you will not see the EULA page if you have previously logged into StorNext).

Figure 15: Configuration > Licenses > Agreement Screen



2. For new installations, the **Configuration > Licenses Entry** page appears. Skip to step 5. For operational systems, halt StorNext client I/O operations.

3. Stop the StorNext filesystem by navigating to **Tools > System Control**, and selecting **Stop** in the **File System** section of the page.
4. Navigate to **Configuration > Licenses**.
5. Click **Import**, click **Choose File**, select the `license.dat` file provided for your system, and click **Open**.

 **Caution:** Importing a license file overwrites the existing license file and all existing licenses. Licenses not present in the imported license file are removed from StorNext.

 **Note:** As of StorNext 5.4, the option to upload a single license key from an ASCII text file using the **Configuration > Licenses > Enter/Update** option on the StorNext Licenses page has been removed. For StorNext releases prior to 5.4, this option is still available.

If you choose to update licenses this way, copy the license string(s) you received from Quantum into the field(s), and click **Apply**.

6. You will know that the licenses have been applied to your system when you see the confirmation “**License file license.dat imported successfully.**” appears at the top of the page. The status indicator changes to enabled (a green check mark icon).
7. After you install your licenses, restart the StorNext filesystem by navigating to **Tools > System Control**, and selecting **Start** in the **File System** section of the page. StorNext may not recognize some feature licenses until you restart services.

The procedure is complete.

Install a StorNext License on a Windows MDC

For help installing Windows MDC licenses, refer to the StorNext help, which can be found at: **Windows Start menu > All Programs > StorNext File System > StorNext Help**.

Obtaining Licenses for RPM Installations

Obtain and Install StorNext Licenses

StorNext and some StorNext feature licenses are pre-installed on your system, and others must be purchased and then enabled by installing a `license.dat` file on the system. If your system is using a 30-day auto-generated license, you should upload a license file containing permanent licenses as soon as it is convenient, so that the maintenance expiration date for the licenses is set correctly on the system. (You can determine the current license limits for many StorNext features, such as SAN clients, LAN clients, DDM, and Storage Manager licenses, on the **Configuration > Licenses** page of the StorNext GUI.)

Obtain StorNext Licenses

If you need license keys to enable additional StorNext features or capacity enter the required information

about your system at: <http://www.quantum.com/ServiceandSupport/License/StorNext/Index.aspx>

Note: If you cannot access the web page or need additional help filling out the form, contact Quantum Support at <http://www.quantum.com/ServiceandSupport>.

In order to receive a license.dat file, you will need the following:

- The System Serial Number. (Use this in the "Product Information, Serial Number of the Original Media" section of the form.)

System serial numbers are alpha-numeric (example: SV1728CKH02059).

- You could also use the StorNext Serial Number instead. (Use this in the "Product Information, Serial Number of the Original Media" section of the form.) For new installations, the serial number is delivered via email. You can also find the StorNext Serial Number in the license.dat file. The license.dat file can be found on the server node at /usr/cvfs/config/license.dat for UNIX systems, and c:\Program Files\StorNext\config\license.dat for Windows systems. Open the license.dat file and locate the **Serial Number**.

Example:

```
# Serial Number: Q8675309
```

- The cvfsid string for each server node.

Example:

```
ECF4BCECC0E linux 0 xcellis13
```

- A list of StorNext features already licensed and enabled on your system.
- A list of purchased StorNext add-on features for which you wish to enable licenses.

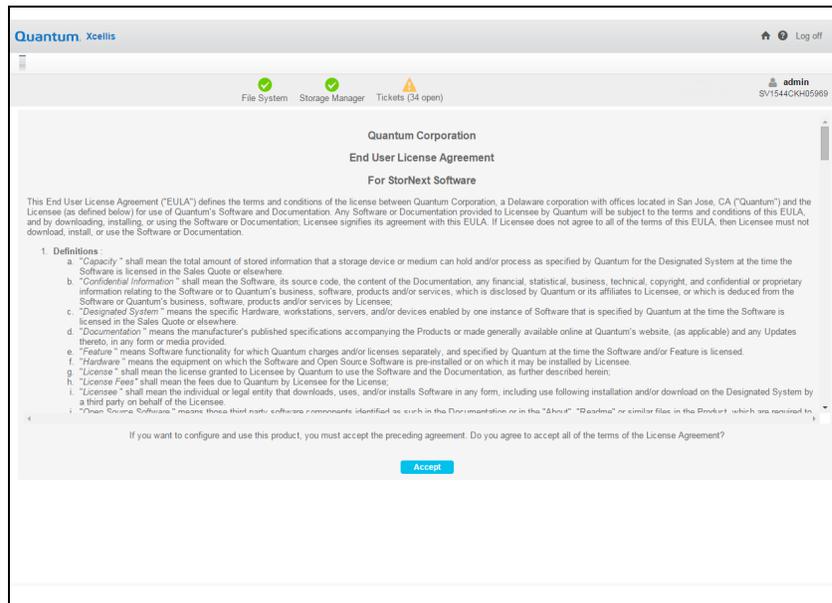
After will send a new license.dat file, which will contain licenses for the new StorNext features purchased, within one business day. Save the file to a temporary location on your computer. You will upload this file on the Licenses page of the StorNext GUI. Continue to the next step to **Install the License**. Use the **Install a StorNext License from the GUI for non-HA Installations** procedure if you have a single-node StorNext MDC. Use the **Install/Update Licenses from the GUI for HA Installations** procedure if you have a High Availability (HA) StorNext MDC pair.

Install/Update Licenses from the GUI for HA Installations

Caution: At the end of this procedure, exiting Config Mode will restart StorNext services on both server nodes. This will cause a disruption in client operations. Quantum strongly recommends halting I/O operations for connected StorNext clients before beginning the process.

1. If you are logging into StorNext for the first time, read the end-user license agreement (EULA) carefully, and then click **Accept** (you will not see the EULA page if you have previously logged into StorNext).

Figure 16: EULA (Configuration > Licenses > Agreement) Page



2. For new installations, the **Configuration > Licenses Entry** screen appears. Skip to step 4.
For operational systems, place the system into config mode by navigating to **Tools > High Availability > Manage** to halt StorNext client I/O operations.
3. Click **Enter Config Mode**. This will pop up a confirmation to lock the HA cluster configuration. Click **Yes**.
(See the **High Availability Systems** section in the appendix of the current *StorNext User's Guide* for further information about HA systems.)
4. Select **Configuration > Licenses > Import**. Use this option to install new StorNext licenses and update existing ones.

Note: As of StorNext 5.4, the option to upload a single license key from an ASCII text file using the **Configuration > Licenses > Enter/Update** option on the StorNext Licenses page has been removed. For StorNext releases prior to 5.4, this option is still available.

If you choose to update licenses this way, copy the license string(s) you received from Quantum into the field(s), and click **Apply**.

Licenses for HA systems must be applied to both server nodes. Enter the appropriate license string in the appropriate field for both the Primary and Secondary server nodes.

5. Click **Choose File**, select the **license.dat** file provided for your system from the temporary location where you downloaded it, and click **Open**.

You will know that the licenses have been applied to your system when you see the confirmation **“License file license.dat imported successfully.”** appear at the top of the page. The status indicator for the licensed features is displayed as a green check mark icon.

6. If the system is in config mode, navigate to **Tools > High Availability > Manage** and click **Exit Config Mode**. You will be prompted for confirmation that you want to unlock the cluster. Click **Yes** to exit config mode.

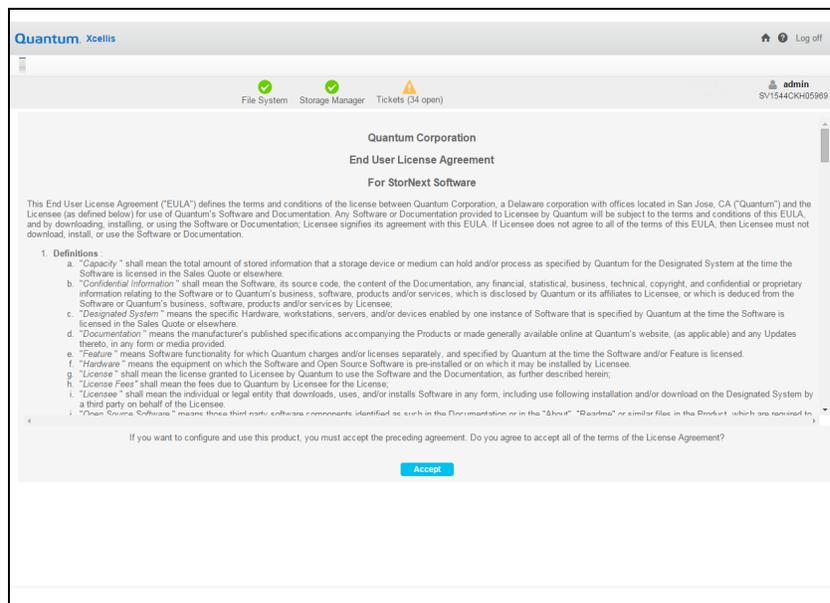
The procedure is complete.

Install StorNext Licenses from the GUI for non-HA Installations

Note: Use these steps to install the license keys on a single-node system, or one that has not been configured as HA. For HA systems, see [Obtain and Install StorNext Licenses](#).

1. If you are logging into StorNext for the first time, read the end-user license agreement (EULA) carefully, and then click **Accept** (you will not see the EULA page if you have previously logged into StorNext).

Figure 17: Configuration > Licenses > Agreement Screen



2. For new installations, the **Configuration > Licenses Entry** page appears. Skip to step 5.
For operational systems, halt StorNext client I/O operations.
3. Stop the StorNext filesystem by navigating to **Tools > System Control**, and selecting **Stop** in the **File System** section of the page.
4. Navigate to **Configuration > Licenses**.
5. Click **Import**, click **Choose File**, select the `license.dat` file provided for your system, and click **Open**.

Caution: Importing a license file overwrites the existing license file and all existing licenses. Licenses not present in the imported license file are removed from StorNext.

Note: As of StorNext 5.4, the option to upload a single license key from an ASCII text file using the

-
- i** **Configuration > Licenses > Enter/Update** option on the StorNext Licenses page has been removed. For StorNext releases prior to 5.4, this option is still available.

If you choose to update licenses this way, copy the license string(s) you received from Quantum into the field(s), and click **Apply**.

6. You will know that the licenses have been applied to your system when you see the confirmation “**License file license.dat imported successfully.**” appears at the top of the page. The status indicator changes to enabled (a green check mark icon).
7. After you install your licenses, restart the StorNext filesystem by navigating to **Tools > System Control**, and selecting **Start** in the **File System** section of the page. StorNext may not recognize some feature licenses until you restart services.

The procedure is complete.

Install a StorNext License on a Windows MDC

For help installing Windows MDC licenses, refer to the StorNext help, which can be found at: **Windows Start menu > All Programs > StorNext File System > StorNext Help**.

Configuring Licenses for RPM Installations

Installing StorNext MDC Licenses from the Command Line for RPM-only Installations

For File System installations, or in instances where there is no available StorNext GUI, StorNext license keys for the system can be installed manually. This section describes how to install licenses from the command line in those situations.

Licenses for purchased StorNext components (such as File System) and features are listed in the *StorNext Licensing Guide* which can be found here:

<http://www.quantum.com/sn5docs>

-
- i** **Note:** Licenses must be installed “by hand” on RPM-only installations because there is no GUI to lead you through the steps.

Before installing a **license.dat** file ensure that exactly one key is present in the file for each licensed feature, and that a Maintenance license key is present. The new license file must be complete before proceeding to the next steps. If you are updating a license file, ensure that old keys are removed so that they do not interfere with the updated license keys.

If you are installing a license file for HA MDCs, make sure that the keys for both MDCs are present in the **license.dat** file before proceeding.

Obtaining Licenses

1. Obtain licenses for all purchased StorNext components and features from Quantum according to the previous section. You will receive an e-mail with a **license.dat** file containing license keys for the desired components.
2. Copy the new **license.dat** file to a temporary location.
3. Install StorNext (see [Installing StorNext File System-Only from RPMs on page 49](#)).
4. If the **/usr/cvfs/config/license.dat** file exists on the MDC, make a backup copy.

Installation Steps

Installation Steps

Depending on the configuration of the system you are updating, you will use a different set of installation steps to install the license keys for StorNext and components for RPM installations from the command line. Here are the possible installation scenarios:

- [Installing StorNext License Keys on a Single-Node MDC below](#)
- [Installing StorNext License Keys on HA Systems \(with a Shared File System\) below](#)
- [Installing StorNext License Keys on a Failover System \(without a Shared File System\) on the next page](#)

Installing StorNext License Keys on a Single-Node MDC

1. From the command line of the MDC, type the following command:

```
service cvfs stop
```

 **Caution:** The command **service cvfs stop** will stop all StorNext services on the MDC.

2. Navigate to the temporary location where you stored the new **license.dat** file.
3. Copy the **license.dat** file to the **/usr/cvfs/config/** directory on the MDC.
4. Type the following command on the MDC:

```
service cvfs start
```

Installing StorNext License Keys on HA Systems (with a Shared File System)

 **Note:** Stop the StorNext service on the **secondary** node of the HA system **before** stopping the StorNext service on the **primary** node.

1. From the command line of the **secondary** node of an HA MDC (both File System and Storage Manager), type:

```
service cvfs stop
```

 **Caution:** The command `service cvfs stop` will stop all StorNext services on the MDC.

2. From the command line of the **primary** node of an HA MDC, type:

```
service cvfs stop
```

 **Caution:** The command `service cvfs stop` will stop all StorNext services on the MDC.

3. Navigate to the temporary location where you stored the new **license.dat** file.
4. Copy the **license.dat** file to the `/usr/cvfs/config/` directory on the **primary** node of the MDC.

 **Note:** Start the StorNext service on the **primary** node of the HA system **before** starting the StorNext service on the **secondary** node.

5. From the command line of the **primary** node of an HA MDC, type:

```
service cvfs start
```

6. From the command line of the **secondary** node of an HA MDC, type:

```
service cvfs start
```

 **Note:** Wait up to 2 minutes for the **license.dat** file to propagate to the secondary node of the MDC. After 2 minutes, display the file and verify the license has been propagated on the secondary node.

Installing StorNext License Keys on a Failover System (without a Shared File System)

 **Note:** Stop the StorNext service on the **secondary** node of the HA system **before** stopping the StorNext service on the **primary** node.

1. From the command line of the **secondary** node of an HA MDC, type:

```
service cvfs stop
```

 **Caution:** The command `service cvfs stop` will stop all StorNext services on the MDC.

2. From the command line of the **primary** node of an HA MDC, type:

```
service cvfs stop
```

 **Caution:** The command `service cvfs stop` will stop all StorNext services on the MDC.

3. Navigate to the temporary location where you stored the new **license.dat** file.
4. Copy the **license.dat** file to the `/usr/cvfs/config/` directory on the **primary** node of the MDC.
5. Copy the **license.dat** file to the `/usr/cvfs/config/` directory on the **secondary** node of the MDC.

i Note: Start the StorNext service on the **primary** node of the HA system **before** starting the StorNext service on the **secondary** node.

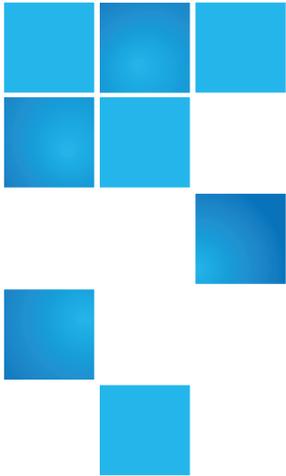
6. From the command line of the **primary** node of an HA MDC, type:

```
service cvfs start
```

7. From the command line of the **secondary** node of an HA MDC, type:

```
service cvfs start
```

Installing StorNext License Keys on a Windows MDC



Chapter 4: Windows SNFS-Only MDC Installation/Configuration

This chapter contains the following topics:

Windows SNFS-Only MDC Installation/Configuration	66
File System Requirements	67
Getting Ready to Install	68
Installing StorNext File System on Windows MDCs	69
Configuring StorNext File System on Windows	75
Configuring a High Availability System on Windows	122
Adding or Removing StorNext Components	124
Restoring a Previous Client Configuration	126
Upgrading or Reinstalling StorNext on a Windows Server	126

Windows SNFS-Only MDC Installation/Configuration

This topic describes how to install and configure StorNext File System (SNFS) on a Windows Metadata Controller (MDC). Since Windows systems do not support StorNext Storage Manager, the Windows installation does not include procedures for installing the StorNext Storage Manager.

Once StorNext File System is installed, you can configure it using the Windows-based configuration utilities to set up server and client features. To configure StorNext, you enter license information and create one or more file systems.

This topic covers:

- [File System Requirements below](#)
- [Getting Ready to Install on the next page](#)
- [Installing StorNext File System on Windows MDCs on page 69](#)
- [Configuring StorNext File System on Windows on page 75](#)
- [Configuring a High Availability System on Windows on page 122](#)
- [Adding or Removing StorNext Components on page 124](#)
- [Restoring a Previous Client Configuration on page 126](#)
- [Upgrading or Reinstalling StorNext on a Windows Server on page 126](#)

File System Requirements

To run StorNext File System, the machine onto which you are installing SNFS must meet all operating system, hardware, and LAN requirements

Operating System Requirements

The operating systems, kernel versions, rpm package dependencies, and hardware platforms supported by StorNext File System are listed in the *StorNext Compatibility Guide* posted here:

<http://www.quantum.com/sn5docs>

Make sure the system meets the operating system and platform requirements outlined in the guide, and, if necessary, update to a supported release or kernel version before installing StorNext.

Hardware Requirements

RAM and hard disk space requirements to run the StorNext File System are listed in the *StorNext Compatibility Guide* posted here:

<http://www.quantum.com/sn5docs>

Make sure the MDC meets the hardware requirements outlined in the guide, and, if necessary, update the MDC before installing StorNext.

For improved performance and stability, it is strongly recommended that CPU C-States be disabled in the BIOS if they are supported by your system. Refer to system vendor documentation for additional information.

Windows Server 2012 SAN Disk Requirements

Windows disks on a Storage Area Network that will be used for StorNext, must be initialized before a StorNext volume label be written to the device. This involves writing a master boot record (MBR) to the disk according to the following:

[http://technet.microsoft.com/en-us/library/cc782513\(v=ws.10\).aspx](http://technet.microsoft.com/en-us/library/cc782513(v=ws.10).aspx)

This only needs to be done the first time new devices are connected to Windows.

LAN Requirements

StorNext LAN requirements are listed in the “*StorNext MDC Network Requirements*” section of the *StorNext Compatibility Guide* posted here:

<http://www.quantum.com/sn5docs>

Make sure the MDC meets the network requirements outlined in the guide, and, if necessary, update the MDC before installing StorNext.

Other Requirements

Additional requirements that must be met for the StorNext system are listed in the “*Additional StorNext MDC and StorNext Client Requirements*” section of the *StorNext Compatibility Guide* posted here:

<http://www.quantum.com/sn5docs>

Make sure the system meets the additional requirements outlined in the guide, and, if necessary, update the system before installing StorNext.

Getting Ready to Install

Before installing StorNext File System, complete the following tasks to ensure successful installation:

- Make sure the Metadata Controller (MDC) meets all operating system and hardware requirements (see [File System Requirements on the previous page](#)).
- Make sure you understand changes in licensing procedures. If you are using LUNs larger than 1 TB, decide on a label type and install any necessary operating system patches (see [Planning for LUNs Larger than 1 TB on page 47](#)).

- Make sure all storage devices are correctly configured and are visible to the MDC (see [Configuring Storage Devices below](#)).
- If using LUNs larger than 1 TB, decide on a label type and install any necessary operating system patches (see [Planning for LUNs Larger than 1 TB on page 47](#)).

Configuring Storage Devices

Before installing StorNext File System, make sure that all LUNs are visible to the MDC. (A LUN, or logical unit number, is a logical device that corresponds to one or more disks, drives, or storage devices.)

If there are any connection issues, resolve them before installing StorNext. For assistance in configuring storage devices, refer to the documentation that came with the storage device, or contact the manufacturer.

i Note: LUNs that you plan to use in the same stripe group must be the same size. Consider this when configuring storage devices. (For more information about stripe groups, see the *StorNext User's Guide*.)

! Caution: StorNext does not support the connection of multiple devices through fibre channel hubs. Multiple devices must be connected using fibre channel switches.

Installing StorNext File System on Windows MDCs

The StorNext setup wizard guides you through the process of installing the StorNext File System on Windows machines.

When you are ready, use the setup wizard to install StorNext (see [Installing StorNext File System on the next page](#)).

If you did not install all StorNext components when you initially installed StorNext or wish to remove them later, you can add or remove components at any time (see [Adding or Removing StorNext Components on page 124](#)).

(Optional) After installation, restore the previous client configuration (see [Restoring a Previous Client Configuration on page 126](#)). This is only necessary if you have performed a complete removal of StorNext. The StorNext client configurations are fully maintained on upgrades from version 3.0 and later.

As new versions of StorNext are released, you can upgrade to a new version or reinstall (see [Upgrading or Reinstalling StorNext on a Windows Server on page 126](#)).

i Note: You must log on as an Administrator to install StorNext.

If you are installing on Windows Vista, answer Yes to any messages asking if you want to run the installation process with administrative privileges.

Installing StorNext File System

1. Copy the file named **/fs_only/snfs_full_Windows_x86_64.zip** from the installation DVD and place it on the system onto which you want to install it. For the SNFS-only installation, be sure to select the file from the **fs_only** directory and not the **stornext_full** directory.
2. Unzip the file.
3. Double-click the file named **Snfssetup.exe** to launch the installer.

The **StorNext Installation** window appears ([Figure 18 below](#)).

i Note: For existing installations, do not use this procedure. Refer to the StorNext Upgrade guide for upgrading existing StorNext

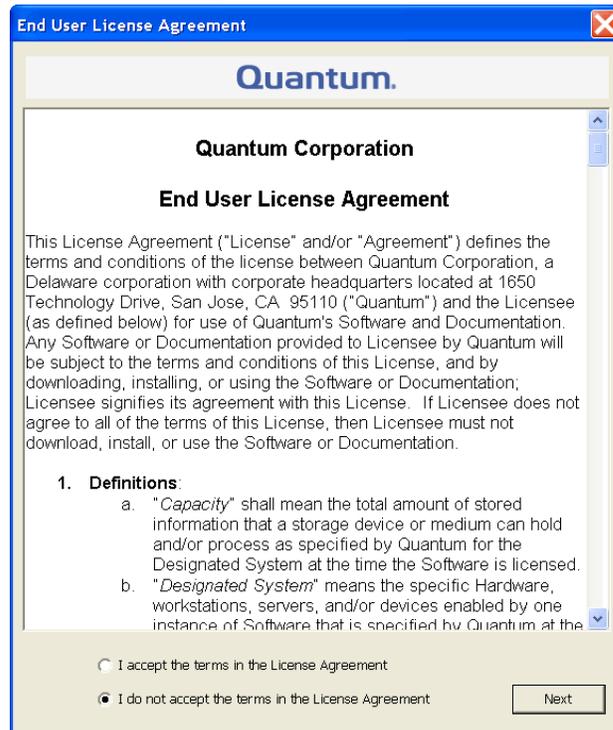
Figure 18: StorNext Installation Window: Install StorNext



4. Click **Install StorNext** to begin installation.

The **StorNext File System License Agreement** window appears ([Figure 19 on the next page](#)).

Figure 19: SNFS Setup: End-User License Agreement



5. Read the license. If you agree to the terms, select "I accept the terms in the License Agreement" and click **Next** to continue the install.

The StorNext setup wizard launches ([Figure 20 below](#)).

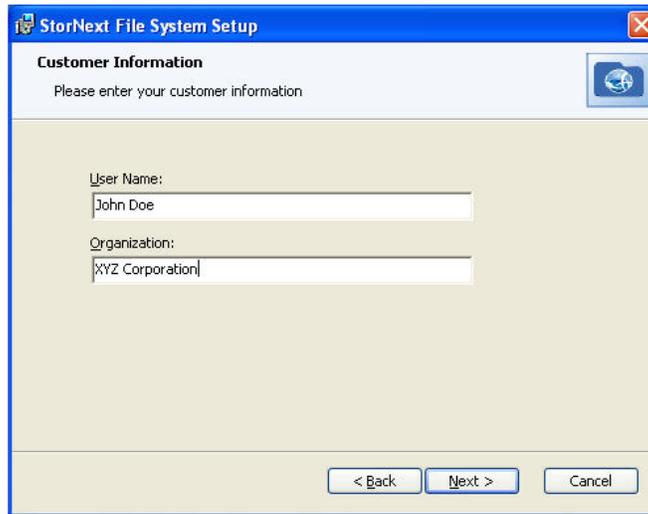
Figure 20: SNFS Setup: Welcome



6. Click **Next** to continue.

The **Customer Information** window appears ([Figure 21 on the next page](#)).

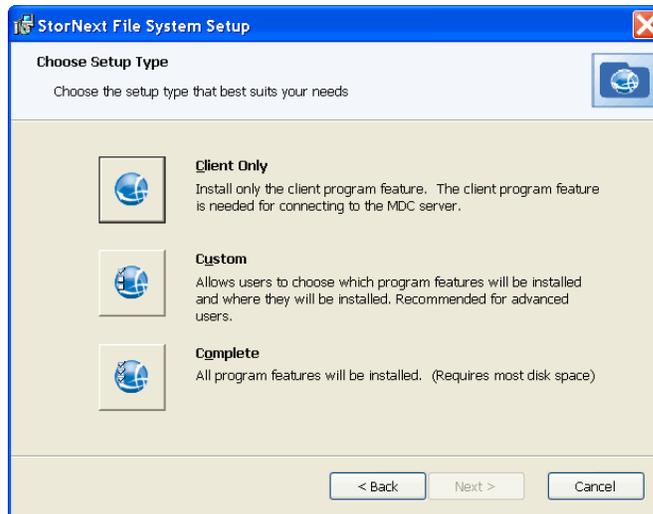
Figure 21: SNFS Setup: Customer Information



7. Type your name and the name of your company or organization in the boxes, and then click **Next** to continue.

The **Choose Setup Type** window appears, ([Figure 22 below](#)).

Figure 22: SNFS Setup: Choose Setup Type



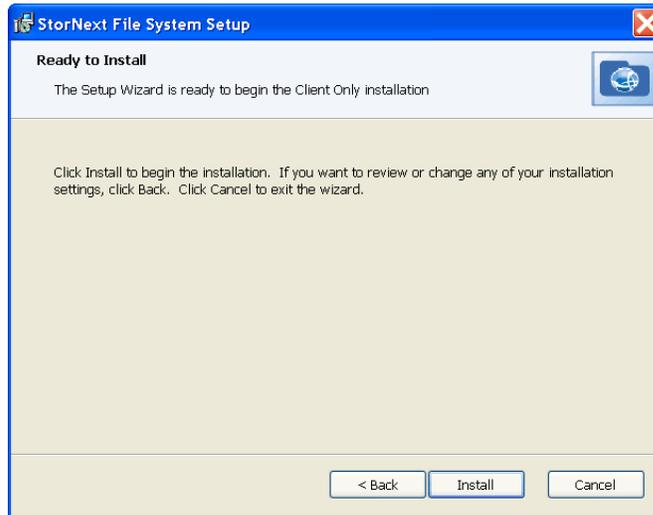
8. Click one of the following installation options (to install StorNext File System you would click **Custom** or **Complete**):

- **Client Only:** Installs only the StorNext client software and help files in the default location (**C:\Program Files\StorNext**).
- **Custom:** Lets you choose which components to install and specify an installation location. When ready, click **Next**.

- **Complete:** All installable components will be installed in the default location (**C:\Program Files\StorNext**). If the system is capable of running the StorNext server, the StorNext server will also be installed.

The **Ready to Install** window appears ([Figure 23 below](#)).

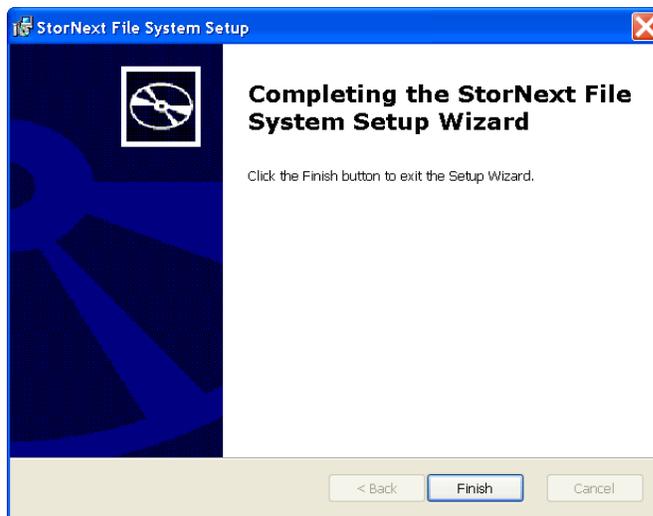
Figure 23: SNFS Setup: Ready to Install



9. Click **Install** to continue.

Wait while the setup wizard installs StorNext. When installation is complete, the **Finish** window appears ([Figure 24 below](#)). (It make take several minutes for the installation to finish.)

Figure 24: SNFS Setup: Finish

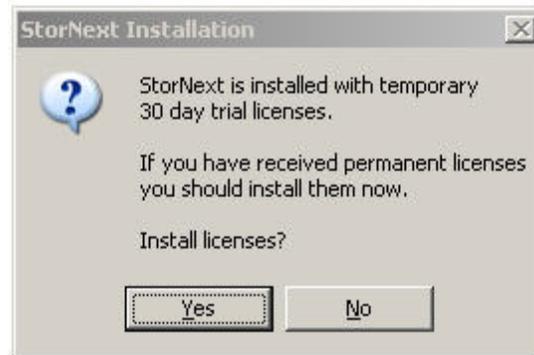


10. Click **Finish** to close the setup wizard.

A dialog box opens letting you know that 30-day temporary licenses are installed and that you should install permanent licenses now (see [Figure 25 on the next page](#)). If you choose not to install them now,

you can install them later using the Windows **Start** button (**Start > Licenses** or **Start > All Programs > StorNext Licenses**) or by following the instructions in [Adding or Removing StorNext Components on page 124](#).

Figure 25: Temporary Licenses Dialog Box



11. Click **Yes** to install permanent licenses now, or click **No** to install licenses later. If you choose to install now, complete the license installation screens that follow (for details, see [Obtaining and Installing a Permanent License on page 78](#)).

The **StorNext Installation** screen displays again with choices to Add/Remove Components, Remove StorNext, or Configure StorNext ([Figure 26 below](#)).

Figure 26: Client Setup: Add/Remove Components



12. The installation is complete. Click one of the following options:

- **Add/Remove Components:** The components you selected during the install are already added, but if you changed your mind and want to select different components, you can do so now. See [Adding or Removing StorNext Components on page 124](#) for details.
- **Remove StorNext:** Removes StorNext file system. For more information, see [Removing StorNext Using the StorNext Software on page 175](#).

- **Configure StorNext:** Configures StorNext. For more information, see [Configuring StorNext File System on Windows below](#).
- **Exit:** Exits without making any further changes at this time (you can always perform configuration later).

Configuring StorNext File System on Windows

To configure StorNext File System or the StorNext client on Windows operating systems, use the Windows configuration utilities. The configuration utilities let you set up a Windows-based Metadata Controller, configure a StorNext client, and work with StorNext file systems.

This section contains the required steps to configure StorNext, and also provides a description of all the other configuration utilities that StorNext provides.

Once you have installed StorNext, follow these steps to configure StorNext. These steps are all covered in this section.

1. [Obtaining and Installing a Permanent License on page 78](#)
2. [Configuring Name Servers on page 80](#)
3. [Labeling Disk Drives on page 81](#)
4. [Configuring a Server \(Advanced\) on page 83](#)
5. [Configuring the Client on page 93](#)

This section covers the above configuration utilities plus all of the additional Windows configuration utilities. See:

- [Available Configuration Utilities below](#)
- [Accessing the Configuration Utilities on the next page](#)

Available Configuration Utilities

The following configuration utilities are accessible from the Windows **Start** menu (**Start > All Programs > StorNext File System**).

For more information on using these utilities, see the online help accessible from **Start > All Programs > StorNext File System > StorNext Help**.

- [Configuring the Client on page 93](#): Use this utility to view and modify properties for the StorNext client software.
- [Labeling Disk Drives on page 81](#): Formats hard disks so they can be used by StorNext.
- [Configuring a Server \(Advanced\) on page 83](#): Allows you to configure StorNext file systems. This tool provides access to advanced features of StorNext File Systems. It is assumed that you are familiar with individual features available in the File System Cfg File (.cfg).

- [Configuring the File System Startup List on page 104](#): Allows you to check StorNext file system health status while the file system is active. You can note changes but not commit them in read-only mode. You can also list all of the existing files and their pertinent statistics, such as inode number, size, file type and location in the file system.
- [Repairing a File System on page 106](#): Allows you to check file system health and repair metadata corruption. You can also list all of the existing files and their pertinent statistics, such as inode number, size, file type and location in the file system.
- [Re-initializing a File System on page 105](#): Allows you to re-initialize an existing file system or initialize a file system for the first time.



Caution: Use extreme caution when using this tool. This will destroy all data on the selected file system.

- [Configuring the File System Startup List on page 104](#): Allows you to define which File System Manager (FSM) daemons to start.
- [Retrieving the Host License Identifier on page 78](#): Use this utility to display the host license identifier. The host license identifier is required to obtain a permanent license for StorNext.
- [Obtaining and Installing a Permanent License on page 78](#): Allows you to import StorNext licenses.
- [Editing Drive Mapping on page 96](#): Specifies the name server(s) used by StorNext File System services.
- [Server Administration on page 106](#): Allows you to look at the current status of file systems and to start, stop and perform basic file system administration tasks (similar to the cvadmin CLI).
- [Starting File System Services on page 104](#): Use this utility to start all StorNext services on an MDC or StorNext client.
- [Obtaining Version Information on page 104](#): Use this utility to stop all StorNext services on an MDC or StorNext client.
- [Stopping and Removing File System Services on page 104](#): Use this utility to stop all StorNext services on an MDC or StorNext client, and also remove registry entries that automatically start the services on bootup.
- **StorNext Help**: View StorNext help for these utilities and other commands.
- [Obtaining Version Information on page 104](#): View information about the currently installed version of the StorNext server and/or client software, such as the version number, build number, and platform.

Accessing the Configuration Utilities

There are two ways to access the configuration utilities:

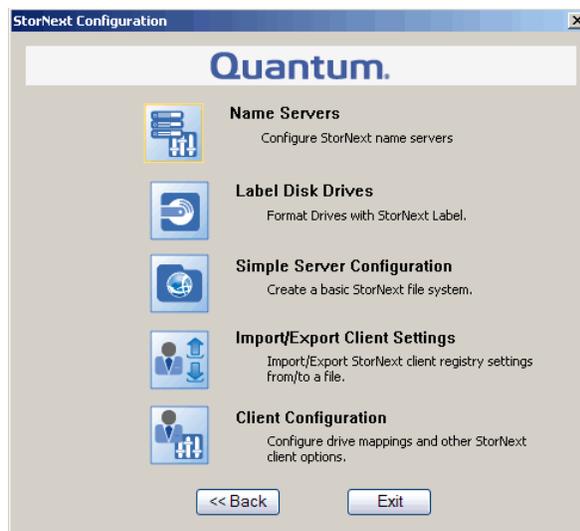
- [Using the StorNext Configuration Window on the next page](#)
- [Using the Windows Start Menu on the next page](#)

Using the StorNext Configuration Window

As soon as you finish installing StorNext, the StorNext Installation window remains open (see [Figure 26 on page 74](#)). If you wish to begin configuring immediately, click the **Configure StorNext** button to open the StorNext Configuration window ([Figure 27 below](#)).

You can return to the StorNext Configuration window at any time by double-clicking the file named **SnfsSetup32.exe** (32-bit systems) or **SnfsSetup64.exe** (64-bit systems) and then clicking the **Configure StorNext** button.

Figure 27: StorNext Configuration



The StorNext Configuration window provides buttons to access several of the most common configuration utilities:

- Name Servers — See [Editing Drive Mapping on page 96](#).
- Label Disk Drives — (Not available for client-only configurations.) See [Labeling Disk Drives on page 81](#).
- Import/Export Client Settings — See [Restoring a Previous StorNext or StorNext FX Client Configuration on page 157](#).
- Client Configuration — See [Configuring the Client on page 93](#).

Using the Windows Start Menu

You can access all of the configuration utilities, along with several others, from the Windows **Start** menu.

To run a configuration utility from the Windows **Start** menu, click **Start > All Programs > StorNext File System**, and then click the utility.

Retrieving the Host License Identifier

Use the License Identifier utility to display the host license identifier. The host license identifier is required to obtain a permanent license for StorNext.

To run the License Identifier utility, on the Windows **Start** menu, click **All Programs > StorNext File System > License Identifier**. A dialog box displays the host license identifier. Record this information.

Obtaining and Installing a Permanent License

To obtain StorNext component and feature licenses, see the “Obtaining Licenses” section in the *StorNext Licensing Guide*. After following those steps, you will receive a **license.dat** file from Quantum.

To install the license:

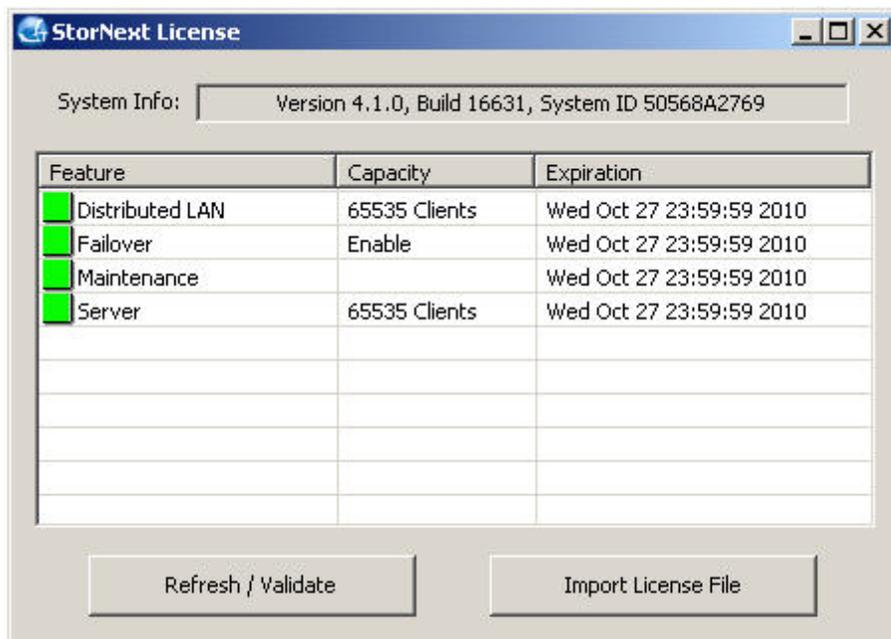
1. Copy the file to the **C:\Program Files\StorNext\config** directory. (If there is a temporary license file, rename the file or move it to a backup location.)

Note: To prevent accidentally losing a valid license, be sure to back up or rename any existing **license.dat** files.

2. Install StorNext File System (see [Installing StorNext File System on Windows MDCs on page 69](#)). Licenses can be installed as part of the installation process or later if desired.
3. If installing licenses after the initial install, click **Start > All Programs > StorNext File System > Licenses**.

The **StorNext License** screen displays (see [Figure 28 below](#)).

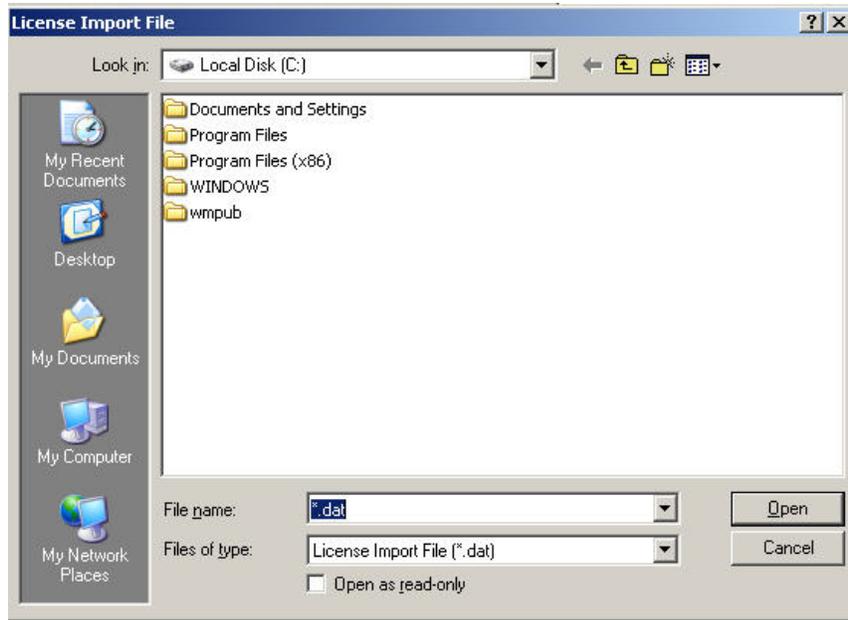
Figure 28: License Import Page



4. Click **Import License File**.

The **License Import File** window opens (see [Figure 29 below](#)).

Figure 29: License Import File Window



5. Browse to the license file location and click **Open**.

The licenses are installed and a confirmation dialog box displays.

6. Click **OK**.

The **StorNext License** screen displays again.

7. Close the window by clicking the X in the upper right corner.

The **Installation Complete** dialog box displays (see [Figure 30 below](#)).

Figure 30: Installation Complete



8. Click **OK** in the **Installation Complete** dialog box.

9. Reboot the system if instructed to do so.

Configuring Name Servers

The purpose of a File System Name Server is to track the IP addresses of StorNext component servers, such as file system servers and gateways. StorNext SAN clients and LAN clients query name servers to locate appropriate services. The name server is a critical component for handling failover.

Every computer running StorNext components must have an `fsnameservers` file. The default location is: **Program Files\StorNext\config\fsnameservers**

At least one, but preferably two of the systems that have StorNext Server installed must be designated as a StorNext Name Server. The Name Server and Metadata Controller (MDC) can be the same machine.

i Note: The Name Servers configuration (including the ordering) must be identical on every computer running StorNext.

StorNext name servers can be added as either IP addresses or computer names, but when possible you should use IP addresses to avoid ambiguity.

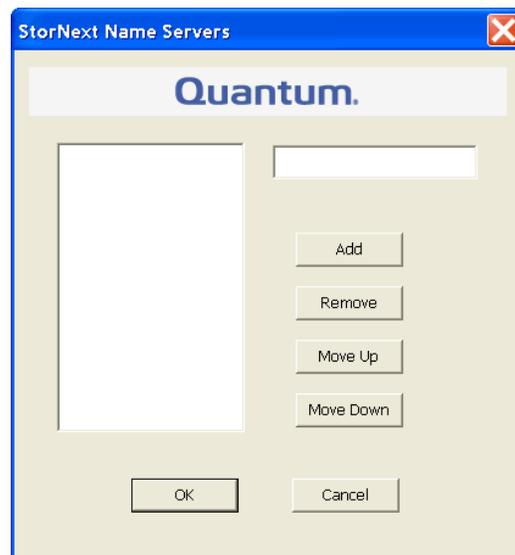
Follow these steps to add a name server:

1. Access the name servers utility from the Windows Start menu (**Start > All Programs > StorNext File System > Name Servers**).

i Note: You may also access the name servers utility from the StorNext configuration window (see [Using the StorNext Configuration Window on page 77](#)).

The **StorNext Name Servers** window appears ([Figure 31 below](#)).

Figure 31: StorNext Name Servers Window



2. Enter the IP address, and then click **Add**. The IP address will be added to the list on the left side of the window.
3. If desired, manipulate the order by selecting a name server and then clicking **Move Up** or **Move Down**. Name servers will be used in the order specified.

i Note: The Name Servers configuration (including the ordering) must be identical on all computers running StorNext.

4. To remove a name server, click the name server you want to remove and then click **Remove**. Confirm the deletion when prompted.
5. When you are finished adding name servers, click **OK**.

Labeling Disk Drives

(Not available for client-only configurations.) The Disk Labeler lets you configure StorNext File System storage area network (SAN) disks. Each disk that is to be used in the file system must have a StorNext File System Label. The Disk Device Label Tool formats the disk so it can be used by StorNext. Use the Disk Device Labeler to create a list of disk labels, associated device names, and (optional) the sectors to use.

Run the Disk Device Labeler on a system that has visibility to all disk devices on the SAN.

! Caution: Use extreme caution when labeling your storage area network disk devices. Inadvertently labeling a Windows system disk will cause irreparable harm to your system and/or loss of data! Only label disk devices that are intended for use with the StorNext File System SAN.

The file system uses the volume labels to determine which disk drives to use. The label name written to a disk device must match the disk name specified in the Server Configuration utility (see [Configuring a Server \(Advanced\) on page 83](#)).

Follow these steps to label disks:

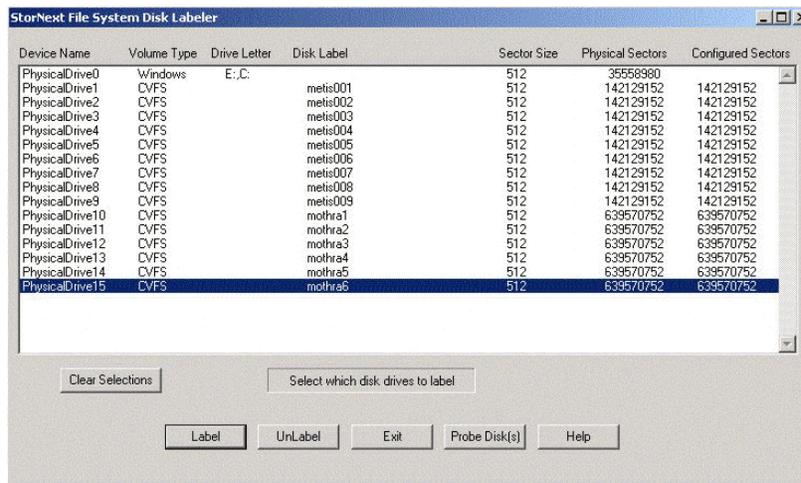
1. Access the disk labeler from the Windows **Start** menu (**Start > All Programs > StorNext File System > Disk Labeler**).

i Note: You may also access the disk labeler from the StorNext configuration window (see [Using the StorNext Configuration Window on page 77](#)).

The **StorNext File System Disk Labeler** window appears ([Figure 32 on the next page](#)). All disk devices are scanned for labels, and those devices with labels are displayed.

i Note: The label type “NotVerified” is used for disks that are unusable or represent a secondary (passive) path to a disk that appears elsewhere in the list. The label type “TooLarge” is used for disks that have valid StorNext labels, but are not usable on this system without re-labeling, because the system SCSI driver cannot access disk blocks beyond block number 4294967295.

Figure 32: File System Disk Labeler



2. Do one of the following:

- Click **Label** to write a volume label to the selected device(s) (see [Labeling Disks below](#) below).
- Click **UnLabel** to remove the existing volume label from the selected device(s).
- Click **Exit** to quit the Disk Device Labeler utility.
- Click **Probe Disk(s)** to pulse the activity light of the selected device(s). Use this feature to correctly identify disks before labeling them.
- Click **Clear Selections** to deselect all devices in the list.

Labeling Disks

Follow these steps to label a disk:

1. Select the disks you wish to label. (If desired, verify that the disks selected are the correct ones by pressing the **Probe Disk(s)** button. The activity light on selected disks will pulse, allowing visual verification that the correct disk drives are selected. This procedure will continue until you click the **Stop** button.)
2. After you have verified that the correct disk devices are selected, press the **Label** button.
A confirmation screen appears asking if you are sure you want to proceed.
3. Click **OK** to continue.
4. A properties screen ([Figure 33 on the next page](#)) for each disk appears, one at a time. This screen allows you to name the disk and assign the configured number of sectors to use on the disk.

Figure 33: Disk Labeler Properties



5. Enter the following fields:

- **New Disk Label:** The label you want to give the disk.
- **New Sectors:** The number in 512-byte sectors you will use in the DiskType configuration during file system configuration.

Normally you will use the default number of new sectors provided by the tool. However, some disks must be configured smaller than their actual size. For example, MPIRE video disks must be under-configured to eliminate using the last zone of the disk.

6. Press the **Create Label** button to commit the label to the disk device. If more than one disk was selected, a properties screen for the next device will appear until all of the selected devices are completed. (Pressing **Skip Disk** allows you to not write a label to the disk and instead proceed to the next selected disk.)

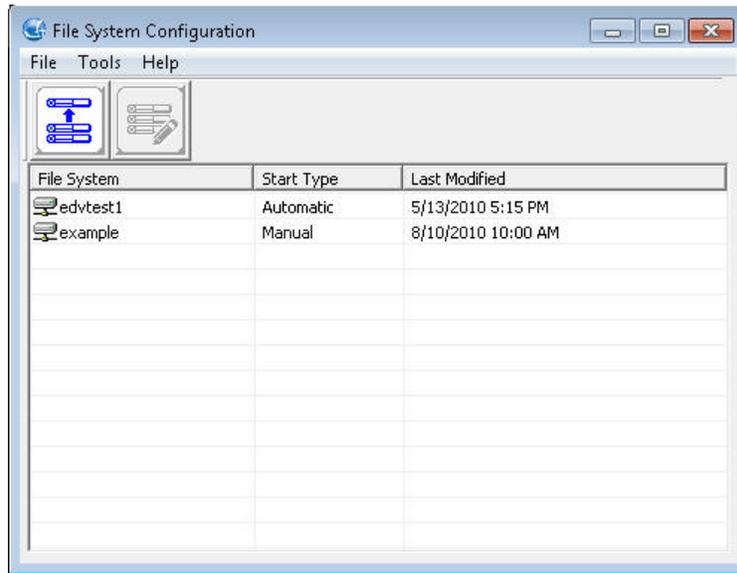
Configuring a Server (Advanced)

(Not available for client-only configurations.) The Advanced Server Configuration utility lets you view and modify properties for an MDC. Use this utility to create a new server configuration or modify an existing configuration. This tool provides access to advanced features of StorNext File Systems. It is assumed that you are familiar with individual features available in the File System Cfg File (.cfg).

1. Access the advanced server configuration utility from the Windows Start menu (**Start > All Programs > StorNext File System > File System Cfg (Advanced)**).

The File System Configuration window displays ([Figure 34 on the next page](#)).

Figure 34: Configuration Administrator



2. Do one of the following:
 - Click the **Create New Configuration** button to create a new configuration file.
 - Select an existing file and click the **Open Existing Configuration** button to edit an existing configuration file.

The Properties window displays (see [Figure 35 on the next page](#)). This window includes four tabs:

- [Global Settings below](#)
 - [Disk Types on page 88](#)
 - [Disk Definitions on page 90](#)
 - [Stripe Groups on page 91](#)
3. Click a tab to view or modify StorNext File System properties. After making changes on one or more tabs, click **OK** to save the changes. Specify a name and a location for the *.cfg file, and then click **Save**.

i Note: Before configuring a file system, you should label disk devices. For more information, see [Labeling Disk Drives on page 81](#).

Global Settings

Use the **Global Settings** tab ([Figure 35 on the next page](#)) to specify general file system properties. [Table 1 on the next page](#) describes the fields on the **Global Settings** tab.

Figure 35: Properties: Global Settings

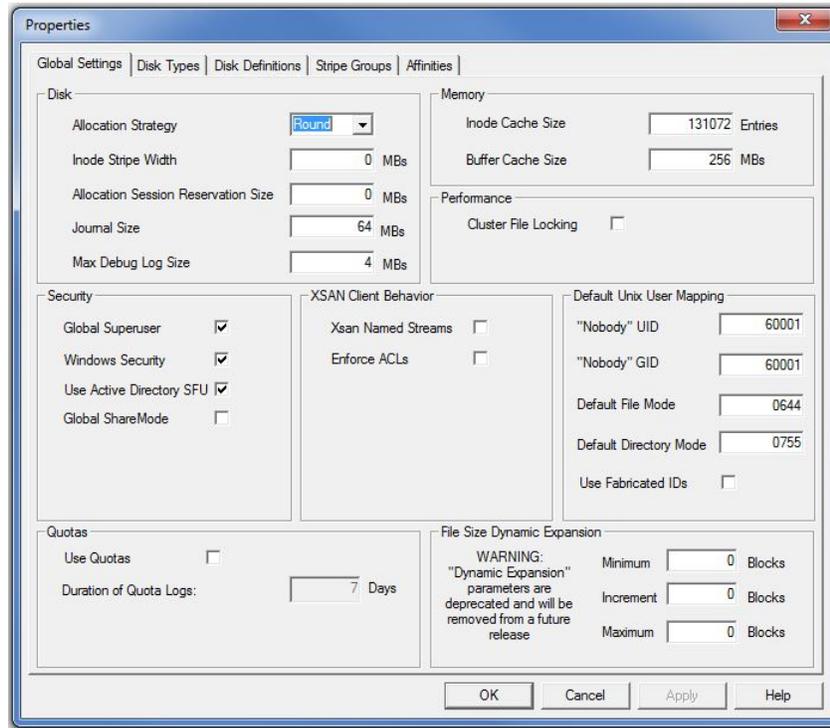


Table 1: Server Configuration: Global Settings

Field/Button	Description
Disk	
Allocation Strategy	Select the method of allocation for new disk blocks: <ul style="list-style-type: none"> • Round: Alternate between similar stripe groups. (Default) • Fill: Use the stripe group with the least amount of free space (that can accommodate the file) before using the stripe group with the next smallest amount of free space. • Balance: Use the stripe group with the most free space.
Inode Stripe Width	(Optional) Specify a value in MB. This feature defines how a file is striped across the file system's data stripe groups. See the Windows on-line help for additional information.

Field/Button	Description
Allocation Session Reservation Size	<p>(Optional) Specify the size (in MB) this feature should use when allocating segments for a session.</p> <p>This feature allows a file system to benefit from optimized allocation behavior for certain rich media streaming applications, and potentially other workloads. The feature also focuses on reducing free space fragmentation.</p> <p>This feature is disabled by default; a value of 0 is the default value, which means the feature is turned off. When enabled, the value can range from 128 MB (134217728) to 1 TB (1099511627776); the largest value would indicate segments are 1 TB in size, which is extremely large.</p>
Journal Size	Type the maximum size (in MB) for the journal.
Max Debug Log Size	Type the maximum size (in MB) for the debug log.
Memory	
Inode Cache Size	Type the number of entries in the inode cache.
Buffer Cache Size	Type the amount of memory (in MB) used for general metadata information caching.
Performance	
Cluster File Locking	<p>(Optional) Select to send a warning when a user attempts to access a file that is locked or already in use.</p>
Security	
Global Superuser	<p>(Optional) Select to allow a user with superuser privileges to have global access rights on the file system.</p>
Windows Security	<p>(Optional) Select to use Windows Security Reference Monitor (ACLs) on Windows clients.</p>

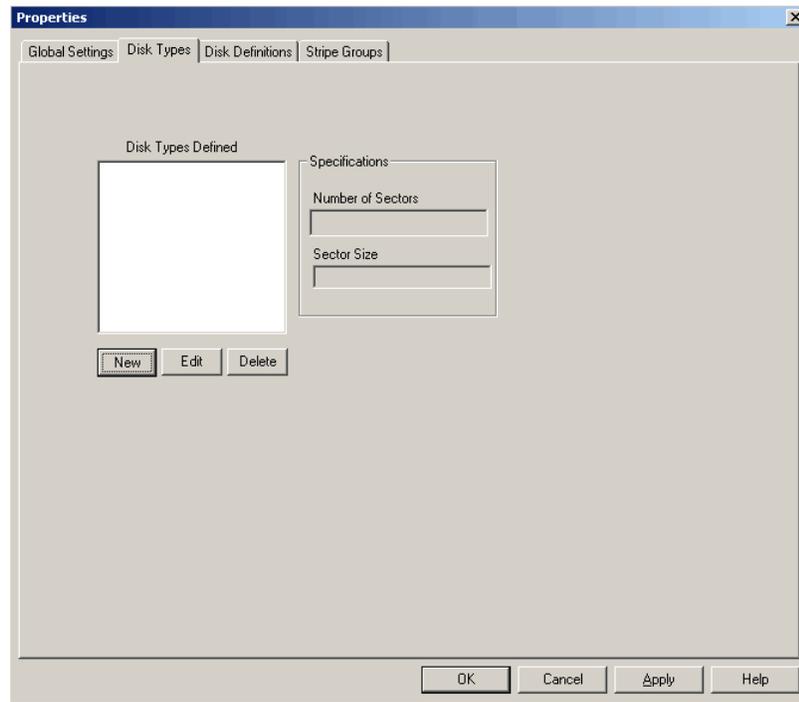
Field/Button	Description
Use Active Directory SFU	<p>(Optional) Select to enable or disable the use of Microsoft's Active Directory Services for UNIX (SFU) on Windows based SNFS clients.</p> <p>Always use Active Directory SFU in a mixed Windows/Unix environment, or if there is a possibility in the future of moving to a mixed environment. If Use Active Directory SFU is disabled, files created on Windows based SNFS clients will always have their UID and GID set to NOBODY with default permissions.</p>
Global ShareMode	<p>(Optional) Select to enable or disable the enforcement of Windows Share Modes across StorNext clients. This feature is limited to StorNext clients running on Microsoft Windows platforms.</p> <p>See the Windows CreateFile documentation for the details on the behavior of share modes.</p> <p>When enabled, sharing violations will be detected between processes on different StorNext clients accessing the same file. Otherwise, sharing violations will only be detected between processes on the same system.</p>
XSAN Client Behavior	
Xsan Named Streams	<p>(Optional) Select to enable or disable support for Apple Named Streams.</p> <p>Named Streams are utilized by Apple Xsan clients. Enabling Named Streams support on a file system is a permanent change. It cannot be disabled once enabled.</p> <p>Only Apple Xsan clients should be used with named streams enabled file systems. Use of clients other than Apple Xsan may result in loss of named streams data.</p>
Enforce ACLs	<p>(Optional) Select to enable Access Control List enforcement on XSan clients. On non-XSan MDCs, Windows Security should also be enabled for this feature to work with XSan clients.</p>
Default Unix User Mapping	
"Nobody" UID	<p>Type the Windows user ID to use when no user ID can be found using Active Directory.</p>

Field/Button	Description
"Nobody" GID	Type the Windows group ID to use when no group ID can be found using Active Directory.
Default File Mode	Type the permission mode to use when creating files.
Default Directory Mode	Type the permission mode to use when creating directories.
Use Fabricated IDs	Select if the Metadata Controller is running on Apple MacOS X.
Quotas	
Use Quotas	(Optional) Select to enforce file system quotas and track storage usage for individual users and groups.
Duration of Quota Logs	Type the duration (in days) of the system quota logs.
File Size Dynamic Expansion	
File Size Dynamic Expansion is calculated on a file-by-file basis for better performance. If this is not working optimally, you can use these settings to override the file-by-file calculations.	
Minimum	(Deprecated) Type the minimum number (in blocks) to allocate when a file is created.
Increment	(Deprecated) Type the initial increment (in blocks) by which a file is expanded.
Maximum	(Deprecated) Type the maximum increment (in blocks) by which a file is expanded.

Disk Types

Use the Disk Types tab ([Figure 36 on the next page](#)) to define disk types used in the file system.

Figure 36: Server Configuration: Disk Types



On the **Disk Types** tab, do one of the following:

- To add a new disk type, click **New**.
- To modify a disk type, select the disk type in the list and click **Edit**.
- To delete a disk type, select it in the list and click **Delete**.

When you add or modify a disk type, the **Disk Type Editor** dialog box appears ([Figure 37 below](#)). [Table 2 on the next page](#) describes the fields on the **Enter New Disk Type** dialog box.

i Note: The **Sectors** and **Sector Size** fields are populated with values from the Disk Labeler utility. For more information, see [Labeling Disk Drives on page 81](#).

Figure 37: Server Configuration: Enter New Disk Type

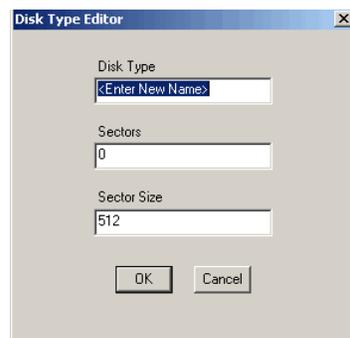


Table 2: Server Configuration: Enter New Disk Type

Field / Button	Description
Disk Type	Type a descriptive name for the disk.
Sectors	Type the number of physical sectors on the disk.
Sector Size	Type the size of sectors on the disk.
OK	Click to create the new disk type with the specified properties.
Cancel	Click to close the Disk Type Editor dialog box without saving changes.

Disk Definitions

Use the **Disk Definitions** tab ([Figure 38 below](#)) to create disk definitions and modify disk specifications. [Table 3 on the next page](#) describes the fields on the **Disk Definitions** tab.

Figure 38: Server Configuration: Disk Definitions

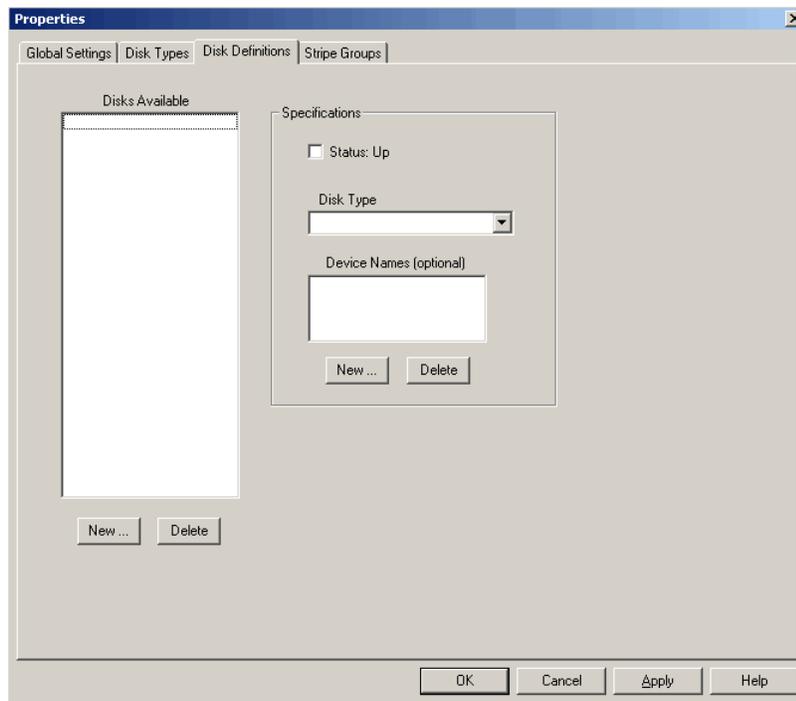


Table 3: Server Configuration: Disk Definitions

Field / Button	Description
Disks Available - New	Click to create a new disk definition. Type a name for the disk and click OK .
Disks Available - Delete	Click to delete the selected disk definition.
Status: Up	Select to enable the selected disk definition. When enabled, the defined disk is available to the configured file system for I/O.
Disk Type	Select a disk type for the selected disk definition. (Disk types are defined on the Disk Types tab.)
Device Names - New	Click to add a device name to the disk definition. Type a device name and click OK .
Device Names - Delete	Click to delete the selected device name.

Stripe Groups

Use the Stripe Groups tab ([Figure 39 below](#)) to define stripe groups. (A stripe group is a logical storage unit consisting of one or more disk drives.) [Table 4 on the next page](#) describes the fields on the Stripe Groups tab.

Figure 39: Server Configuration: Stripe Groups

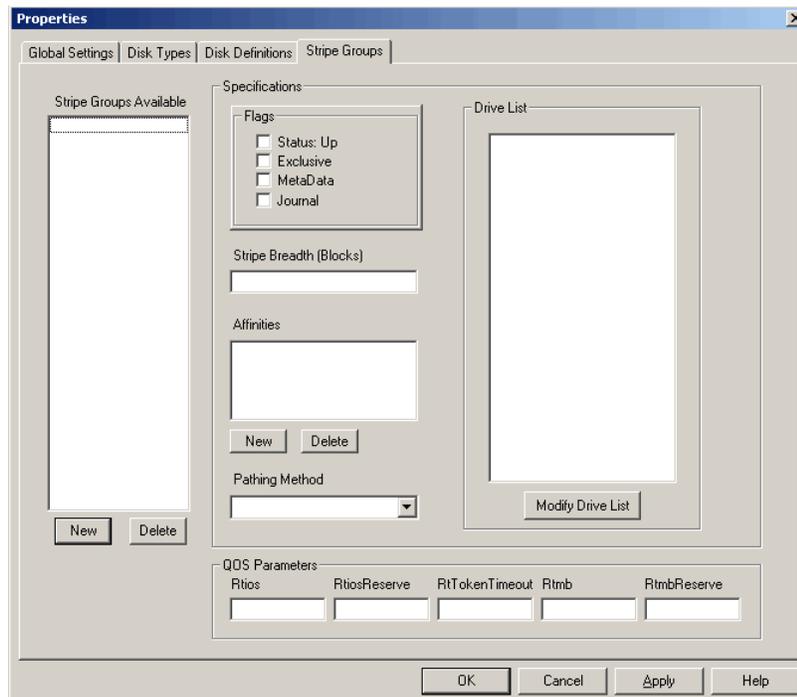


Table 4: Server Configuration: Stripe Groups

Field / Button	Description
Stripe Groups Available - New	Click to create a new stripe group. Type a name for the stripe group and click OK .
Stripe Groups Available - Delete	Click to delete the selected stripe group.
Status: Up	Select to enable the selected stripe group. When enabled, the stripe group is available to the configured file system for I/O.
Exclusive	Select to allow only file types associated with the affinities specified under Affinities to be stored on the stripe group.
MetaData	Select to allow file system metadata to be stored on the stripe group.
Journal	Select to allow the file system logging journal to be stored on the stripe group.
Stripe Breadth (Blocks)	Describes the number of file system blocks that are appended to a file before switching to the next disk in the stripe group.
Affinities - New	Click to add a new affinity to the stripe group. Type the name of the new affinity and click OK . (Affinity names cannot be longer than eight characters.)
Affinities - Delete	Click to delete the selected affinity.
Pathing Method	Select a method for how the file system accesses the disk: <ul style="list-style-type: none"> • Rotate: Chooses an I/O path based on load. • Static: Always uses the same I/O path. • Sticky: Chooses an I/O path based on the identity of the target file.
Rtios	Type the maximum number of disk I/O operations per second available to real-time applications using the Quality of Service (QOS) API.
RtiosReserve	Type the minimum number of disk I/O operations per second reserved for non-real-time applications.
RtTokenTimeout	Type the number of seconds to wait for clients to respond to a token callback.
Rtmb	Type the maximum number of MBs per second available to real-time applications using the Quality of Service (QOS) API.
RtmbReserve	Type the minimum number of MBs per second reserved for non-real-time applications.
Modify Drive List	Click to add or remove disks for the selected stripe group. Use the left and right arrows to add or remove disks in the Primary Disks list, and then click OK .

⚠ Caution: When adding a disk to an existing stripe group, make sure the disk is added to the bottom of the **Drive List**. If the disk is inserted in the middle of the list, the file system behaves as if files on the file system are corrupted.

Importing and Exporting Client Settings

This feature is described in [Restoring a Previous StorNext or StorNext FX Client Configuration on page 157](#).

Configuring the Client

In order for a client to access a StorNext file system, the file system must be mapped to a folder or drive letter. The Client Configuration Tool maps a StorNext file system to a Windows drive letter or folder and controls various configuration settings.

The values for the Client Configuration are stored in the Windows Registry and are referenced by StorNext when the file system is mounted.

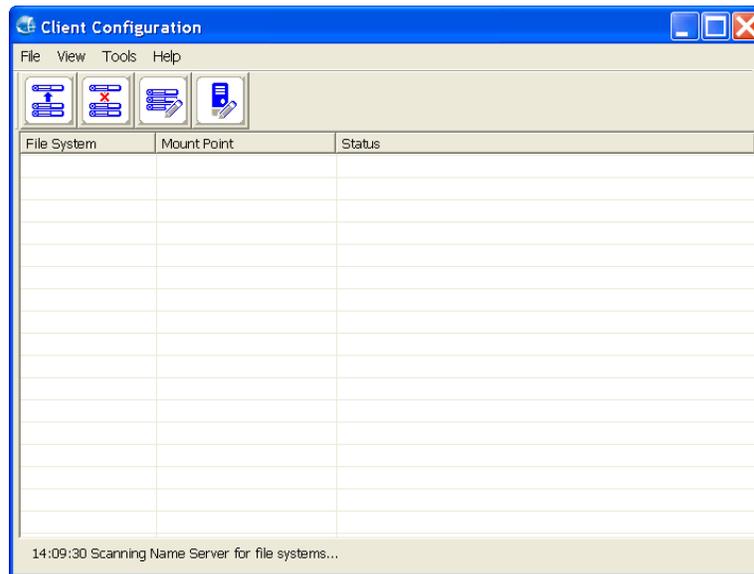
Follow these steps to configure the client:

1. Access the client configuration utility from the Windows Start menu (**Start > All Programs > StorNext File System > Client Configuration**).

i Note: You may also access the client configuration utility from the StorNext configuration window (see [Using the StorNext Configuration Window on page 77](#)).

The **Client Configuration** window appears ([Figure 40 on the next page](#)). Displayed under the File System column heading are all file systems advertised by the name server, and currently mapped StorNext file systems found in the Windows registry.

Figure 40: Client Configuration Window



The **Client Configuration** screen includes the following functions:

- [Mapping a Drive below](#): Map a StorNext file system to a folder or drive letter.
- [Unmapping a Drive on the next page](#): Unmap a StorNext file system from a folder or drive letter.
- [Editing Drive Mapping on page 96](#): Change the drive mapping.
- [Configuring Name Servers on page 96](#): Edit, add or remove name servers.
- [Configuring LAN Clients and Gateway Servers on page 96](#)
- [Configuring Logging Options on page 98](#)
- [Advanced Mount Options on page 99](#)
- [Advanced Cache Options on page 101](#)

Mapping a Drive

To map a StorNext file system to a folder or drive letter, double-click the desired file system (or select it and click the **Map Drive** icon or **Tools > Map Drive**). The **Client Properties** screen appears.

Use the **Mount Point** tab ([Figure 41 on the next page](#)) to specify drive mappings. [Table 5 on the next page](#) describes the fields on the **Mount Point** tab.

If your file systems are not displayed, check the status bar at the bottom. The most likely problems are: incorrect Name Server Configuration, network problems, the file system is not running, or StorNext Services are not running.

StorNext file systems can be mapped to a drive letter or to a folder. When mapping to a folder, the folder must be empty or non-existent, and must exist within an NTFS file system (e.g., **C:\MountMySnfs**).

Note: Verify the **fsnameservers** configuration is the same for all clients on the SAN. An incorrect or incomplete **fsnameservers** configuration may prevent the client from connecting to the file system.

Figure 41: Client Configuration: Mount Point

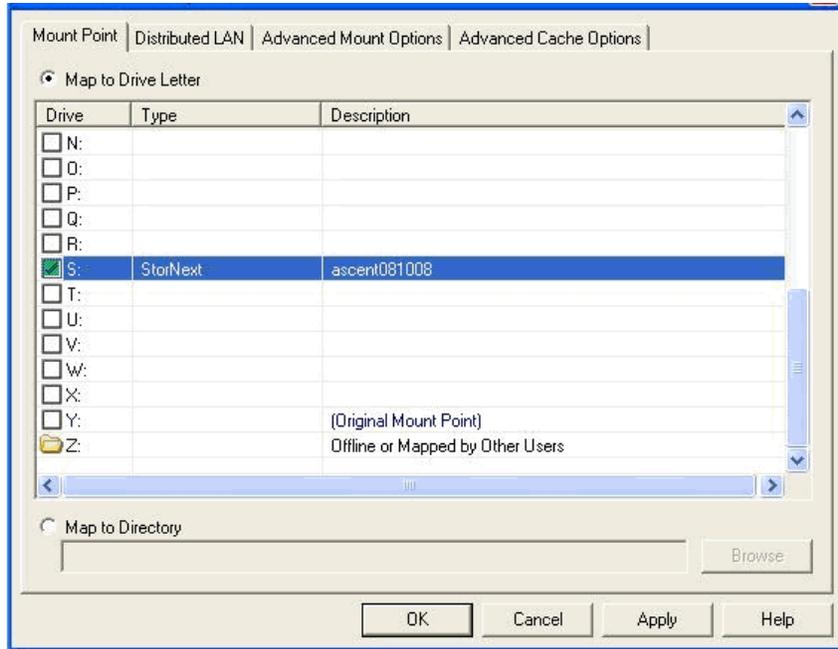


Table 5: Client Configuration: Mount Point

Field / Button	Description
Map to Drive Letter	Select Map to Drive Letter to map the drive to a specific drive letter.
Drive (Letter)	Select the desired drive letter.
Map to Directory	Instead of selecting Map to Drive Letter, select Map to Directory. Enter a directory path, or click Browse to navigate to the directory path.

Note: If this is a LAN client or gateway, be sure to enter the parameters on the Distributed LAN tab (see [Configuring LAN Clients and Gateway Servers on the next page](#)).

Unmapping a Drive

Select the file system you want to unmap and then click the **Unmap Drive** icon or select **Unmap Drive** from the **Tools** menu. You must close all applications (included Windows Explorer) which might be using the file system. If the file system is busy, you will not be allowed to unmap the drive.

Note: In order to unmap a drive, you must have Administrator rights on the local computer, and you must have read/write access to root of the StorNext file system.

Editing Drive Mapping

Once a file system is mapped, you can change the mapping by double-click the file system. Alternatively, select the file system and click the **Properties** button, or select the file system and click **Tools > Edit Drive Mapping**. This opens the **Properties** window where you can change drive mapping. See [Mapping a Drive on page 94](#) for instructions.

Configuring Name Servers

Click the **Edit Name Servers** icon or choose **Configure Name Servers** from the **Tools** menu. Follow the instructions in [Configuring Name Servers on page 80](#).

Configuring LAN Clients and Gateway Servers

To configure StorNext LAN clients and gateway servers, double-click the desired file system (or select it and click the **Properties** icon). The **Properties** screen appears.

i Note: Do not enable gateway functionality for MDCs, connected to Lattus systems.

Use the **Distributed LAN** tab to enable and configure StorNext LAN clients and gateway servers for a file system. The Enable Client and Enable Server radio buttons determine whether the system is a LAN client or gateway Server. Note that separate licensing is required for LAN clients.

StorNext LAN clients provide the same functionality as StorNext SAN clients but do not need to be connected directly to the SAN. They instead send I/O via the TCP/IP network through a gateway server - a StorNext SAN client enabled as a gateway server. Metadata is sent over the TCP/IP network directly to the File System Metadata Controller (Server/MDC).

LAN Clients request the location of gateway servers via the Name Server.

- **Gateway Server:** A gateway server has direct access to data disks (using fibre channel) and makes the shared storage pool available to distributed LAN clients over a network.
- **LAN Client:** A StorNext LAN client does not have direct access to data disks and instead accesses the shared storage pool by connecting to a gateway server over a network. (LAN clients have full StorNext client functionality.)

i Note: A StorNext SAN client configured as a gateway server requires a dedicated system. Do not run other applications or services on a system configured as a gateway server.

Use the **Distributed LAN** tab ([Figure 42 on the next page](#)) to configure a gateway server or a LAN client. [Table 6 on the next page](#) describes the fields on the **Distributed LAN** tab.

Figure 42: Client Configuration: Distributed LAN

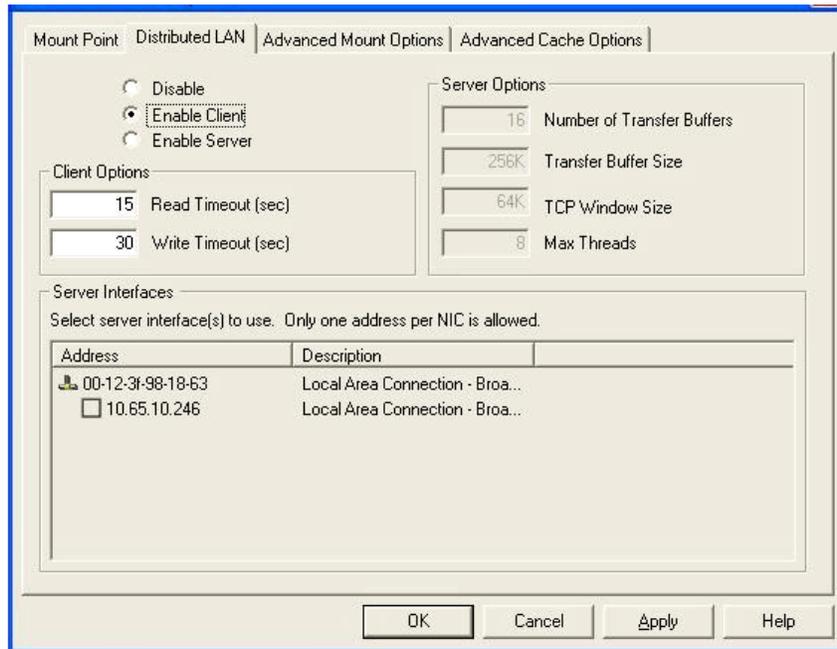


Table 6: Client Configuration: Distributed LAN

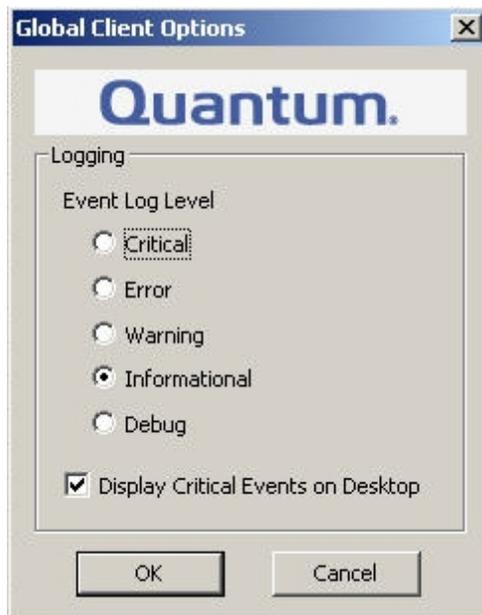
Field / Button	Description
Disable	Select this option to disable the StorNext client as a StorNext LAN client or gateway server.
Enable Client	Select to configure the StorNext client as a LAN client. The StorNext client will connect to all available gateway servers. (If you select this check box, all other fields on the tab become unavailable.)
Enable Server	Select to configure the StorNext SAN client as a gateway server. The StorNext client will make the disks for this file system available to LAN clients over the specified LAN.
Read Timeout (sec)	Specify how long the LAN client will wait for a read operation to complete before retrying it on a different gateway server.
Write Timeout (sec)	Specify how long the LAN client will wait for a write operation to complete before retrying it on a different gateway server.
Number of Transfer Buffers	Specify the number of socket transfer buffers used for LAN client I/O.
Transfer Buffer Size (kb)	Specify the size in kilobytes of the socket transfer buffers used for LAN client I/O.

Field / Button	Description
TCP Window Size (kb)	Specify the size in kilobytes of the TCP window used for LAN client I/O connections.
Max Threads	Specify the number of kernel threads that will be used to service LAN client I/O requests.
Server Interfaces	To complete gateway server configuration, select one or more network interfaces to be used for LAN client traffic.

Configuring Logging Options

From the Client Configuration screen, select **Tools Global Options**. The **Global Client Options** window displays (Figure 43 below).

Figure 43: Global Client Options



Select the level of logging you want to receive and whether you want to display critical events on your desktop. Log information is available in the Windows Event Viewer.

Field / Button	Description
Event Log Level	Controls how many messages are inserted into the Windows Event Viewer. Critical provides the fewest messages; Debug provides the most. Each level includes all the messages in the levels listed above it.
Display Critical Events to Desktop	Enables a notification of critical events to be sent to work station's desktop in a message box. If this is not desired, clear the check box.

Advanced Mount Options

The **Mount Options** tab (Figure 44 below) displays the mount options for the drive currently selected on the **Drive Mappings** tab. Table 6 on page 97 describes the fields on the **Distributed LAN** tab.

⚠ Caution: Changing the values on the **Mount Options** tab can affect system performance and stability. Do not change mount options unless instructed to do so by the Quantum Technical Assistance Center.

Figure 44: Client Configuration: Advanced Mount Options

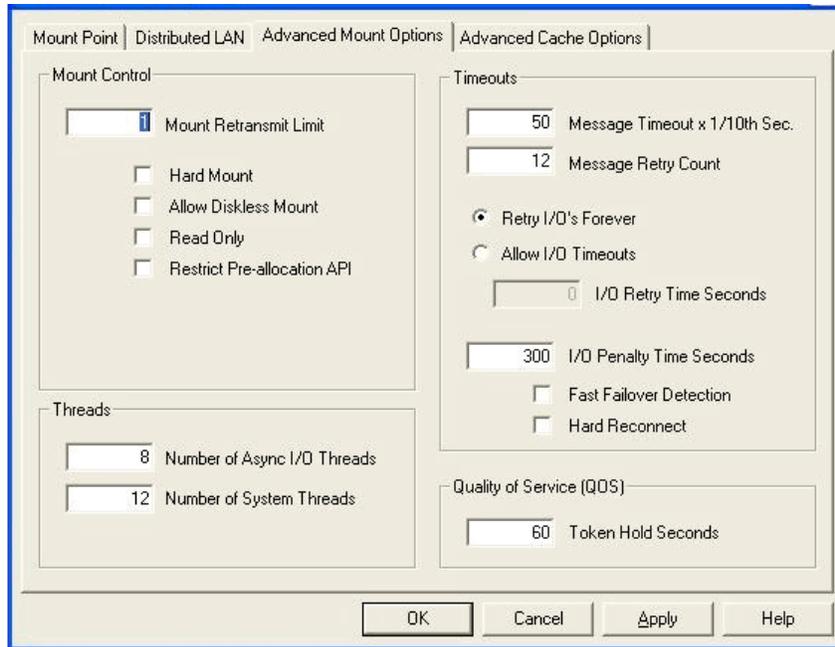


Table 7: Client Configuration: Advanced Mount Options

Field / Button	Description
Mount Retransmit Limit	Specify the number of times the driver will re-transmit a message to the FSM. After a successful connection, this value is no longer used. The default is 1.
Hard Mount	When this box is checked, the driver attempts to mount the file system forever. The default is off (Soft Mount). Quantum recommends that Hard Mount NOT be used on Windows systems.

Field / Button	Description
Allow Diskless Mount	<p>When this box is checked, the file system can be mounted and accessed without all the disks being accessible in the file system stripe groups. In this mode, file metadata can be viewed and changed, but no data can be accessed.</p> <p>The default is to not allow a file system to be mounted unless all disks are accessible.</p>
Read Only	<p>When this box is checked, the file system is mounted in read-only mode. The default is off or not checked.</p>
Restrict Pre-allocation API	<p>When set to yes, non-administrator users are unable to use the preallocation ioctl.</p>
Number of Async I/O Threads	<p>Specify the number of threads created to be used as asynchronous I/O threads for user applications. The default is 8. The allowed range is 4 to 32.</p>
Number of System Threads	<p>Specify the number of threads created for use by the file system. The default value is 16.</p>
Message Timeout x 1/10th Sec.	<p>Specify (in tenths of a second) the amount of time before a message to the FSM is timed out. The default is 50 (five seconds).</p>
Message Retry Count	<p>Specify the number of attempts to be made for sending a message to the File System Service. The default is 12.</p>
Retry I/Os Forever or Allow I/O Timeouts	<p>Choose either Retry I/Os Forever or Allow I/O Timeouts, depending on whether you want to allow timeouts or keep trying I/O. The default value is to Retry I/Os Forever.</p>
I/O Retry Time Seconds	<p>When you choose Allow I/O Timouts, this option controls the I/O retry behavior. This parameter establishes the amount of time that may elapse during an I/O retry sequence.</p> <p>An I/O retry sequence consists of the following:</p> <ul style="list-style-type: none">• Retry an I/O request across all available paths that are currently present.• Compare the current time to the Instantiation time of the I/O request, if at least <n> seconds have elapsed, return the I/O request in error, otherwise reset the paths used, and retry again.

Field / Button	Description
I/O Penalty Time Seconds	<p>This option controls the Multi-Path I/O penalty value, where <n> is expressed in seconds with a minimum value of 1 and a maximum value of 15.</p> <p>This parameter establishes the amount of time a Path_In_Error will be bypassed in favor of an Operational Path during a Multi-Path selection sequence. If all paths are currently in the Path_In_Error state, the first available path will be selected, independent of the Path_In_Error state. The default value is 5 seconds.</p>
Fast Failover Detection	<p>When this box is checked, the client uses a more aggressive approach to detecting if the FSM has failed. With this option on, the client monitors the FSM heartbeat. If no heartbeat is detected within three (3) seconds, a failover request is initiated.</p> <p>This option is desirable for near realtime activities that cannot sustain more than 10 seconds of access loss to the server. Quantum does not recommend enabling this option for normal file system operations.</p>
Hard Reconnect	<p>When this box is checked, the file system attempts to reconnect to the FSM forever. If this option is not enabled, the file system attempts to reconnect to the FSM for the number of times specified at the Mount Retransmit Limit field before failing the request.</p> <p>The default value is off.</p>
Token Hold Seconds	<p>The QOS Token Hold Time parameter is applicable only when using the StorNext Quality of Service (QOS) feature for real-time IO.</p> <p>This parameter determines the number of seconds a client stripe group holds on to a non-realtime I/O token during periods of inactivity. If no I/O is performed on a stripe group within the specified number of seconds, the token is released back to the FSM.</p> <p>The default value is 60 seconds. The parameter should be specified in five-second increments; if the parameter is not a multiple of five, it will be rounded up automatically.</p>

Advanced Cache Options

The Data Buffer Cache keeps the file system data in memory on the local computer to speed up performance for small I/O operations.

The **Advanced Cache Options** tab ([Figure 45 on the next page](#)) displays performance values that control how many file system lookup names are kept in memory.

 **Caution:** Changing the values on the **Advanced Cache Options** tab can affect system performance and stability. Do not change cache parameters unless instructed to do so by the Quantum Technical Assistance Center.

Figure 45: Client Configuration: Advanced Cache Options

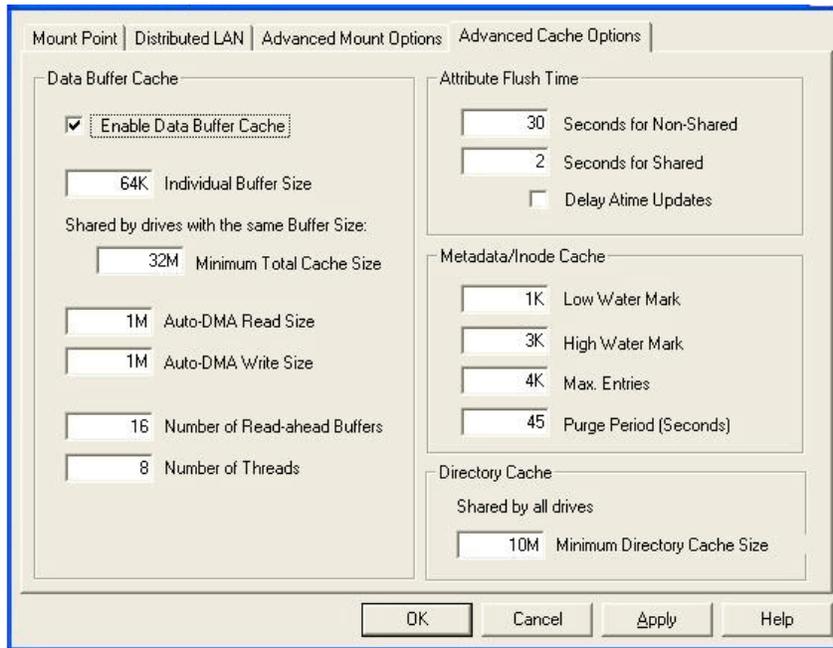


Table 8: Client Configuration: Advanced Cache Options

Field / Button	Description
Enable Data Buffer Cache	When this box is not checked, the file system will not buffer any data. All files will be read directly into the application's memory using DMA. Requests that are not properly aligned will be read into temporary buffers, then copied to the application's buffer. If Buffer Cache is disabled, the remaining Data Buffer Cache options are ignored.
Individual Buffer Size	This option sets the size of each cache buffer. This determines the I/O transfer size used for the buffer cache. To determine optimal performance, try different sizes or contact your RAID vendor. This size must be divisible by the file system block size. The maximum value allowed is 512K and the minimum value allowed is the file system block size. The value default is 64K.
Minimum Total Cache Size	This value controls the amount of memory used to cache data from the file system. This parameter is shared by all file systems with the same block size.

Field / Button	Description
Auto-DMA Read/Write Sizes	<p>Buffer Cache Auto DMA Read Length and Buffer Cache Auto DMA Write Length control the minimum I/O size for DMA transfers. That is, any smaller transfer will always go through the buffer cache.</p> <p>The default value is 1MB.</p>
Number of Read-ahead Buffers	<p>This option controls the size of the read-ahead window used by the buffer cache.</p> <p>The default value is 16 buffers with a maximum of 100. Using a value of 0 disables read-ahead.</p>
Number of Threads	<p>This option controls the number of dedicated background threads used by the buffer cache for performing I/O.</p> <p>The default value is 8, with a minimum of 1 and a maximum of 100. Using a larger value can increase I/O concurrency in the buffer cache and therefore improve performance.</p>
Seconds for Shared/ Non-Shared	<p>The Attribute Flush Time parameters control the length of time attributes are held on the client before they are flushed back to the FSM (unless there is an explicit attribute request from the FSM).</p> <p>The default values are 30 seconds for non-shared files (Attribute Flush Time, non shared), and 2 seconds for shared files (Attribute Flush Time, shared).</p> <p>Setting these parameters lower will greatly increase the amount of metadata traffic between clients and the FSM. However, in circumstances where files are frequently shared on the SAN, setting the Attribute Flush Time Shared can result in other clients seeing size updates more frequently if a file is being written on one client and read on another.</p> <p>A value of zero is invalid, and will result in using the default setting.</p>
Delay Atime Updates	<p>When this box is checked, the file system delays Atime (access time) updates when reading a file to the time when the file is closed. This cuts down on FSM metadata updates at the expense of coherency.</p>
Low Water Mark	<p>Metadata Caches contain non-data information such as file names, sizes, update times, etc.</p>
High Water Mark	<p>Tuning the low and high water marks and the frequency of purge passes can help certain large mix applications.</p>
Max. Entries	
Purge Period (Seconds)	
Minimum Directory Cache Size	<p>This option sets the size of the directory cache. Directory entries are cached on the client to reduce client-FSM communications during directory reads.</p> <p>The default value is 10 MB.</p>

Starting File System Services

The Start File System Services utility starts all StorNext services on an MDC or StorNext client.

The StorNext services must be running on the MDC for file systems to be active and available. In addition, the StorNext services must be running to use the StorNext configuration utilities and to mount file systems using the client software.

To start StorNext File System services, on the Windows **Start** menu, click **All Programs > StorNext File System > Services Start**.

Stopping File System Services

The Stop File System Services utility stops all StorNext services on an MDC or StorNext client.

To stop StorNext File System services, on the Windows **Start** menu, click **All Programs StorNext File System Services Stop**.

To start the StorNext services again, reboot the system or use the Start File System Services utility. For more information, see [Starting File System Services above](#).

Stopping and Removing File System Services

The Stop and Remove File System Services utility stops all StorNext services on an MDC or StorNext client, and also removes registry entries that automatically start the services on bootup.

To stop and remove StorNext File System services, on the Windows **Start** menu, click **All Programs > StorNext File System > Services Stop and Remove**.

To start the StorNext services again, you must use the Start File System Services utility. Rebooting the system will not restart services. For more information, see [Starting File System Services above](#).

Obtaining Version Information

The Version Information utility displays information about the currently installed version of the StorNext server and/or client software, such as the version number, build number, and platform.

To run the Version Information utility, on the Windows **Start** menu, click **All Programs > StorNext File System > Version Information**. A dialog box displays version information for the StorNext server and/or client software installed on your system.

Configuring the File System Startup List

The File System Startup List utility lets you modify the File System Manager (FSM) services list and set file system priority.

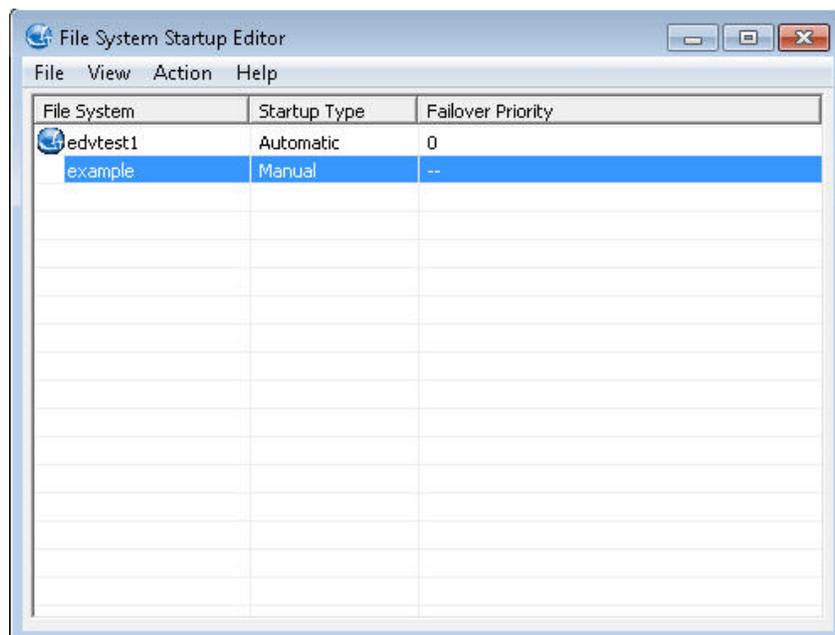
The File System Manager is a process that manages the name space, allocations, and metadata coherency for a file system. Each file system uses its own FSM process. When there are multiple file systems (and therefore multiple FSM processes), the FSM services list controls which FSM processes are run when the server starts up, and also sets the priority for each file system (for failover configurations).

To run the File System Startup List utility, on the Windows **Start** menu, click **All Programs > StorNext File System > File System Startup List**. The **File System Startup Editor** opens ([Figure 46 below](#)).

Select a file system do any of the following. When finished making changes, select **File > Save** to save your changes.

Action	Description
Action Toggle Startup Type	Allows you to choose if the file system will start up automatically upon server startup. This action toggles the startup type between automatic and manual.
Action Priority	(Optional) Select the priority for the selected file system. This priority is used for failover configurations. 0 is highest priority and 9 is lowest priority.

Figure 46: File System Startup List



Re-initializing a File System

The Re-initialize a File System utility allows you to initialize an existing file system. Initializing a file system prepares it for use.

⚠ Caution: Use extreme caution when using this tool. This will destroy all data on the selected file system.

To initialize a file system, on the Windows **Start** menu, click **All Programs > StorNext File System > Re-initialize a File System**. Type the number that corresponds to the file system you want to re-initialize, and then press **<Enter>**.

Checking a File System (Read-Only)

The File System Check (Read-Only) utility allows you to check a StorNext file system for metadata corruption (due to a system crash, bad disk, or other failure). Run the utility on an MDC that contains the file system you want to check.

To check a file system, on the Windows **Start** menu, click **All Programs > StorNext File System > File System Check (Read-Only)**. Type the number that corresponds to the file system you want to check, and then press **<Enter>**.

Because the file system check is run in read-only mode, any problems that exist are not repaired. If the utility identifies errors or corruption in metadata, you must repair the file system (see [Repairing a File System below](#)).

Repairing a File System

The File System Check (Repair) utility lets you repair corrupted metadata on a file system. Repair a file system if errors were identified when checking the file system (see [Checking a File System \(Read-Only\) above](#)).

The file system must be inactive in order to be repaired. To stop a file system, see [Stopping File System Services on page 104](#).

To repair a file system, on the Windows **Start** menu, click **All Programs > StorNext File System > File System Check (Repair)**. Type the number that corresponds to the file system you want to repair, and then press **<Enter>**.

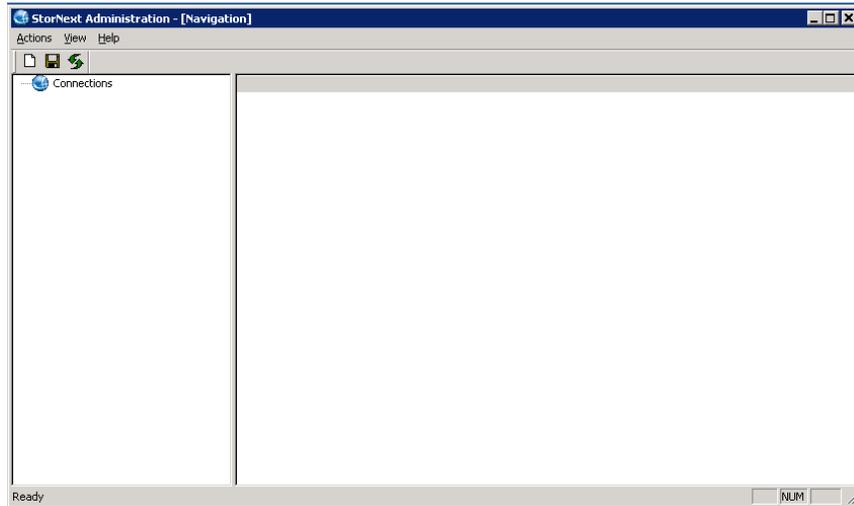
i Note: Multiple repair passes may be needed to fully fix a damaged file system. Run the repair utility repeatedly until no problems are reported by the utility.

Server Administration

The Server Administration utility lets you view and modify stripe group properties and set quotas. A stripe group is a logical storage unit made up of one or more disks. A quota is a space limit that is set for specified users or groups.

To run the Server Administration utility, on the Windows Start menu, click **All Programs > StorNext File System > Server Administration**. The **StorNext Administration** window appears.

Figure 47: The **StorNext Administration** window



In the **StorNext Administration** window, you may perform one of the following procedures:

- [Connect to an MDC below](#)
- [Start a File System below](#)
- [Activate a File System below](#)
- [Stop a File System below](#)
- [Update the List of File Systems on the next page](#)

Connect to an MDC

1. Click **Connections**, and then click **Actions > New**.
2. Type the host name and click **OK**. Disks and File Systems are displayed in the left pane.

Start a File System

1. Right-click **File Systems**, and then click **Start**.
2. Enter file system information. For additional details, see [To Start a File System on page 110](#).

Activate a File System

1. Click **File Systems** in the left pane.
2. Right-click the name of the file system under **File Systems**, and then click **Activate**.

Stop a File System

1. Click **File Systems** in the left pane.

2. Right-click the name of the file system under **File Systems**, and then click **Stop**.

Update the List of File Systems

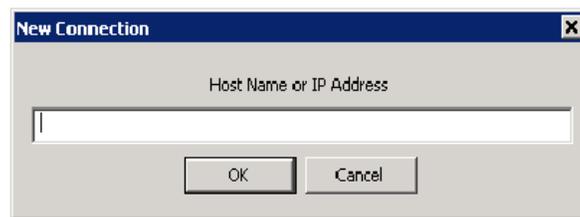
- Press **Ctrl+R**, or click **View**, and then click **Refresh**.

Create a Connection

You can create a connection to any StorNext client or server.

1. To create a new connection, click **Actions**, and then click **New**. The **New Connection** dialog box appears.

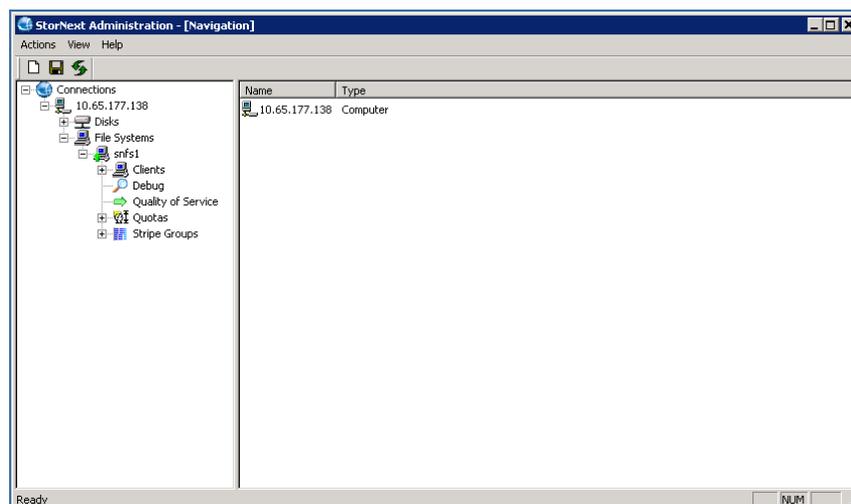
Figure 48: The **New Connection** dialog



2. In the **New Connection** dialog, enter the host name or IP address of the computer to add, and then click **OK**. The new connection information appears (refer to [Figure 49 below](#)). The left pane displays file systems running on the connected MDC.

Note: Expand a file system to see stripe groups, quotas, and additional file system properties.

Figure 49: New connection information

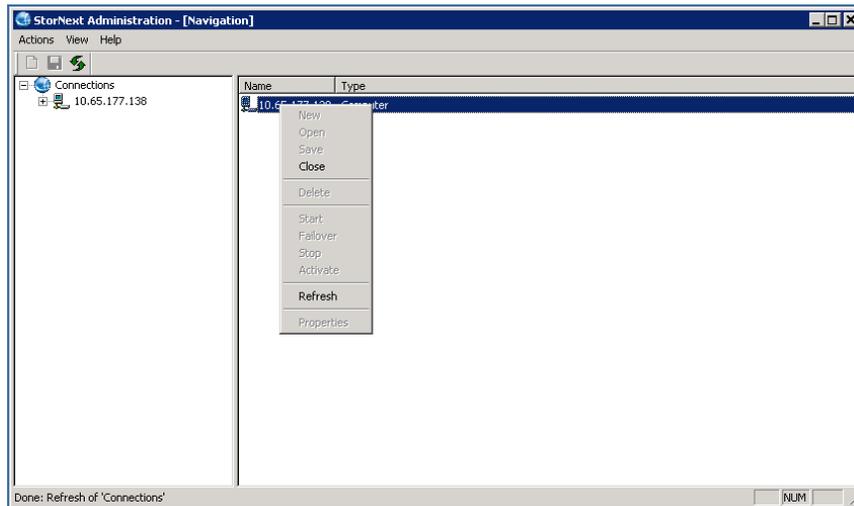


Close Connection

You can close a connection to any StorNext client or server.

To close an existing connection, right-click the connection, and then click **Close** (refer to [Figure 50 below](#).)

Figure 50: Closing an existing connection



Save Connections

You can save the current connections. The next time you open the StorNext Administration utility, the utility will query the saved list to automatically open connections. To save the list, perform the following:

- Click **Connections** (in the left pane.), click **Actions** on the menu, and then click **Save**.

File System Tools

The StorNext Administration's File System Control Dialog

The StorNext Administration's File System Control dialog is used to Start, Stop, Failover and Activate a StorNext file systems. The actions in the File System Control dialog perform actions equivalent to the `cvadmin` commands.

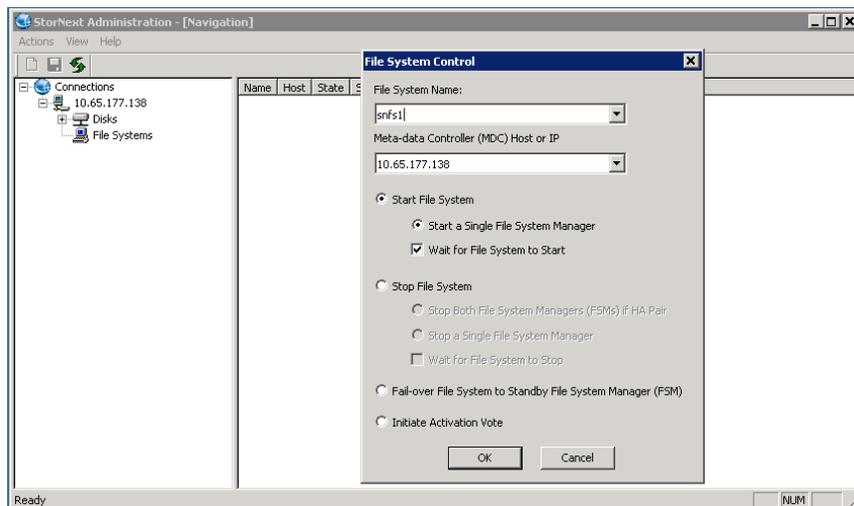
- i Note:** To prevent long delays, the StorNext Administration tool does not automatically refresh. After issuing commands from the File System Control dialog, you may need to issue a **Refresh** before the changes will appear.

To Start a File System

To start a file system, perform the following procedure:

1. Right-click **File Systems**, and then click **Start**. The **File System Control** dialog displayed (refer to [Figure 51 below](#)).
2. Enter the file system name and the IP address of the MDC.
 - The **File System Name** is the name of a file system configuration file without the .cfg/.cfgx file extension.
 - The **Meta-data Controller (MDC) Host or IP** is the hostname or IP address of the MDC managing the specified file system.
 - If **Start a Single File System Manager** is checked, this will start a single FSM on the specified host. If it is unchecked, it will start FSMs on both HA (High Availability) MDCs if they are an HA pair. Optionally, you may have the dialog wait for the file system to start before returning. Otherwise the request will be issued and return immediately.

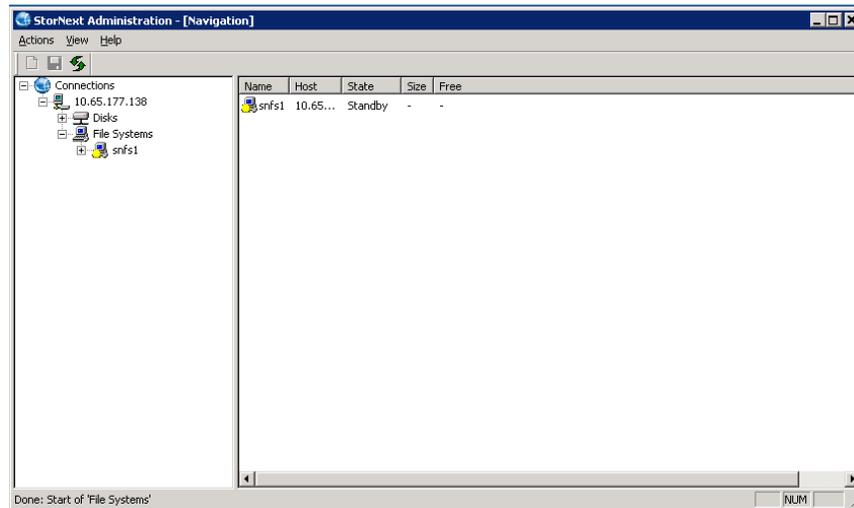
Figure 51: The File System Control dialog



Once the file system is started, the file system status is displayed (refer to [Figure 52 on the next page](#)).

- The **yellow dot** indicates the file system is in the **standby** state.
- A **green arrow** indicates the file system is in the **active** state.

Figure 52: The File System Status indicator



To Activate a File System

Once the file system is started, perform the following procedure to activate the file system:

1. Right-click the file system, and then click **Activate** (refer to [Figure 53 below](#)). The **File System Control** dialog is displayed (refer to [Figure 54 on the next page](#)) with **Initiate Activation Vote** checked.
 - **Initiate Activation Vote** will cause a client "vote" to commence and may cause a file system to activate. If an FSM is already active, no action is taken.
2. Click **OK** to activate.

Figure 53: Activating a file system

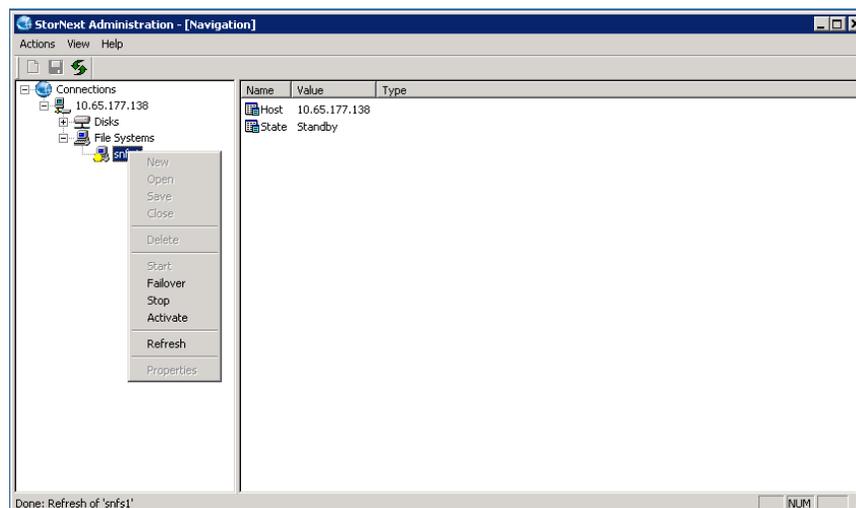
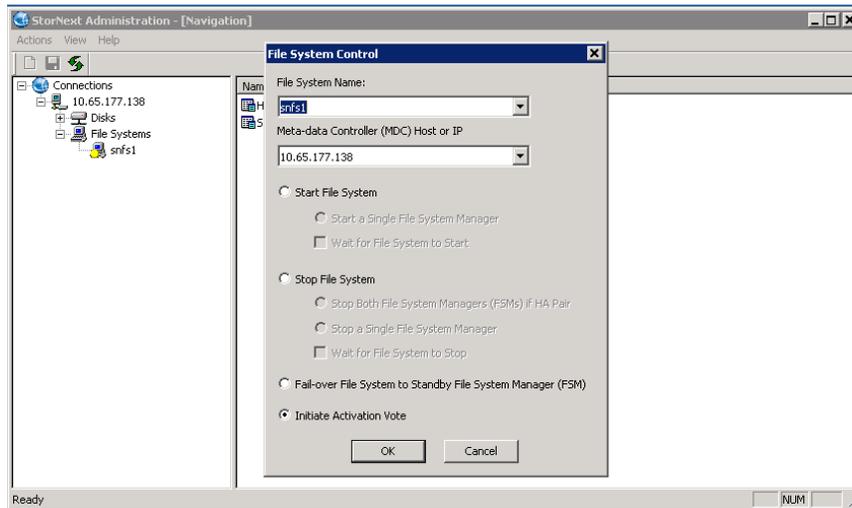
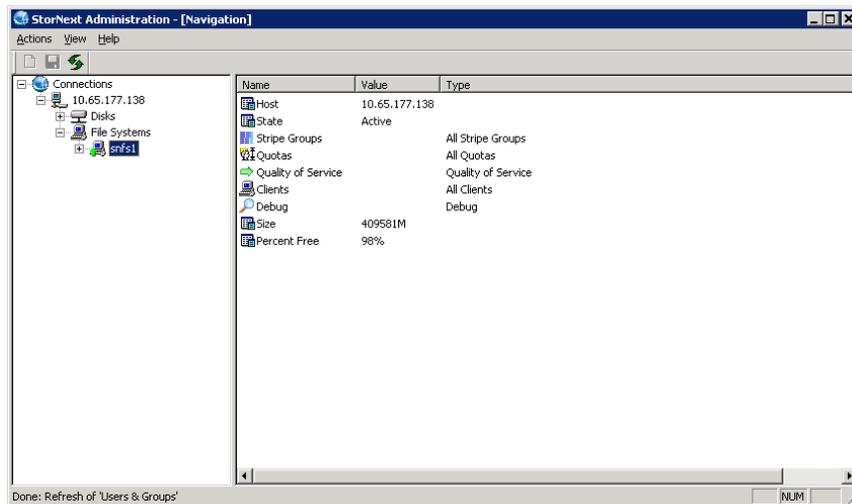


Figure 54: Initiating Activation Vote



If the file system activates successfully, the **File System Control** status is updated to display the following (refer to [Figure 55 below](#)).

Figure 55: Active file system display



Other radio buttons in the **File System Control** specify the following parameters:

- **Stopping the File System**
 - The **Stop File System** radio button is used to stop a single FSM or to stop both FSMs, if they are HA pairs. As with the **Start File System** option, you can have the dialog wait for the command to complete before return control back to you.
- **Fail-over**
 - This option can be used on a HA MDC. This radio button will cause the file system to fail-over from the active FSM to the standby FSM (regardless of which MDC host is specified.)

File System Displays

Select a file system to display clients, debug options, quality of service, quotas and stripe groups (refer to [Figure 56 below](#)).

[Table 9 below](#) provides the description of the various fields in the **File System Properties** display.

Figure 56: File System Properties display

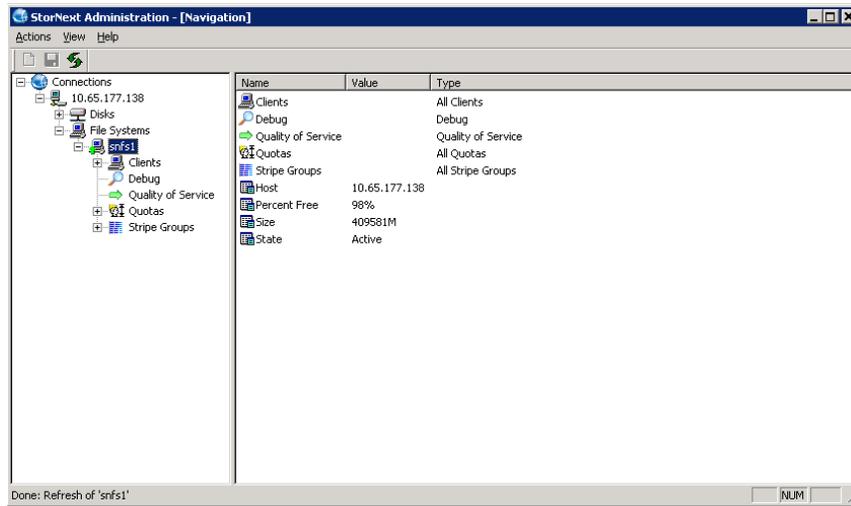


Table 9: Description of fields in the File System display

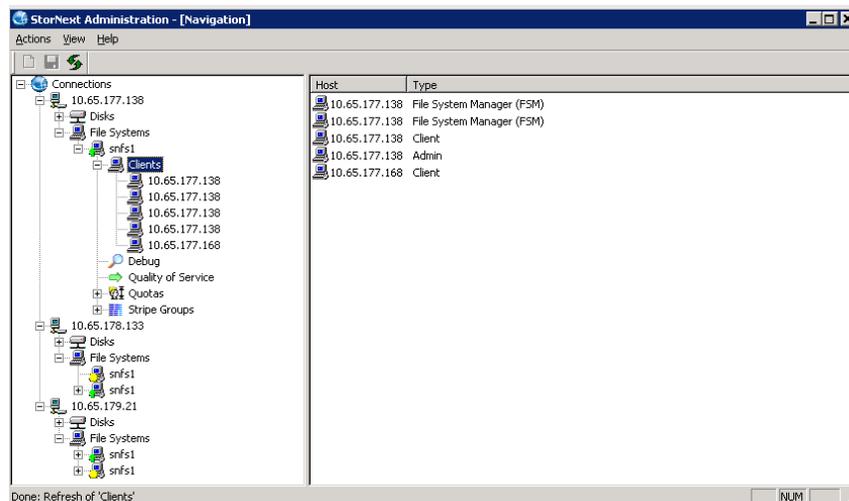
Name	Value	Type
Clients		Expandable list of connects to the file system (clients with file system mounts and control connections) and the client properties.
Debug	None	Click to expand to a clickable list of debug flags.
Quality Of Service	None	Click to display QOS properties (if QOS is enabled on file system.)
Quotas	None	Click to display Quotas properties (if Quotas are enabled on file system.)
Stripe Groups	None	Expandable list of stripe groups and stripe group properties.
Host	IP address of the MDC running the file system.	
Percent Free	Percentage of free space on the file system.	

Name	Value	Type
Size	Size of the file system	
State	Current state of the file system.	

Clients Information

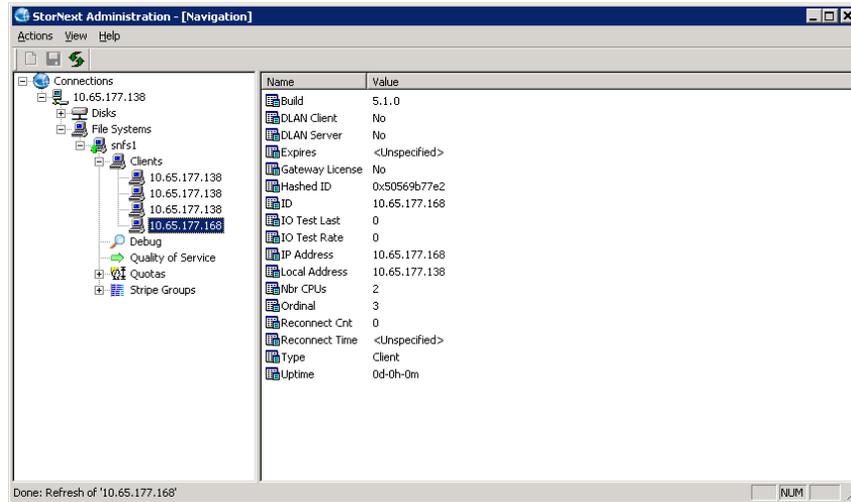
To view information about clients connected to the file system, expand a file system in the left pane, and then click **Clients**. Information about the clients currently connected appears in the right pane (refer to [Figure 57 below](#)).

Figure 57: The File System Clients display



Click on a specific client to see the client's properties (refer to [Figure 58 on the next page](#)).

Figure 58: The **Single Client** display



Selecting a specific **Client** will provide the following information:

Table 10: Description of fields in the Client display

Name	Value
Build	StorNext version
DLAN Client	Is it a Distributed LAN Client?
DLAN Server	Is it a Distributed LAN Gateway?
Expires	When the license expires
Gateway License	Distributed LAN Gateway license installed
Hashed ID	SNFS Identifier hash value
ID	ID or IP address
IO Test Last	Last IO Test result
IO Test Rate	IO Test rate
IP Address	Address of connection
Local Address	Alternate local address
Nbr CPUs	CPU count on Client
Ordinal	FSM Connection number
Reconnect Cnt	Number of reconnections

Name	Value
Type	Type of connection
Uptime	Connection time

Debugging Information

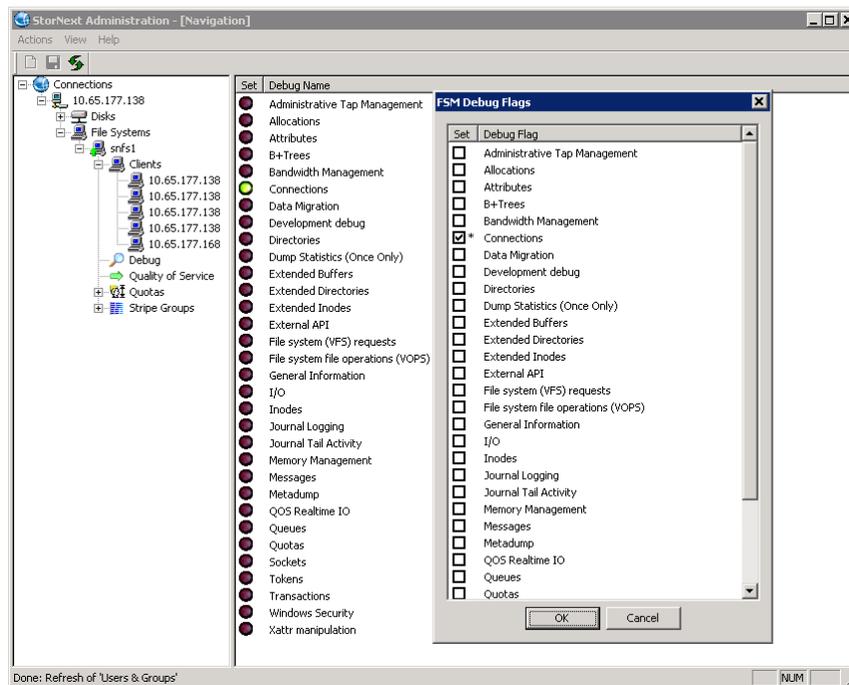
Click the **Debug** icon to display the current active debug flags used by the File System Manager (FSM) process (refer to [Figure 59 below](#)). If any of the debug flags are turned on, the debug output is printed to the file:

```
<StorNext Install Directory>/data/<file system name>/log/cvlog.txt
```

Caution: Turning on debug flags can severely impact file system performance!

Do not turn on debugging flags unless recommended by Quantum.

Figure 59: The Debug display

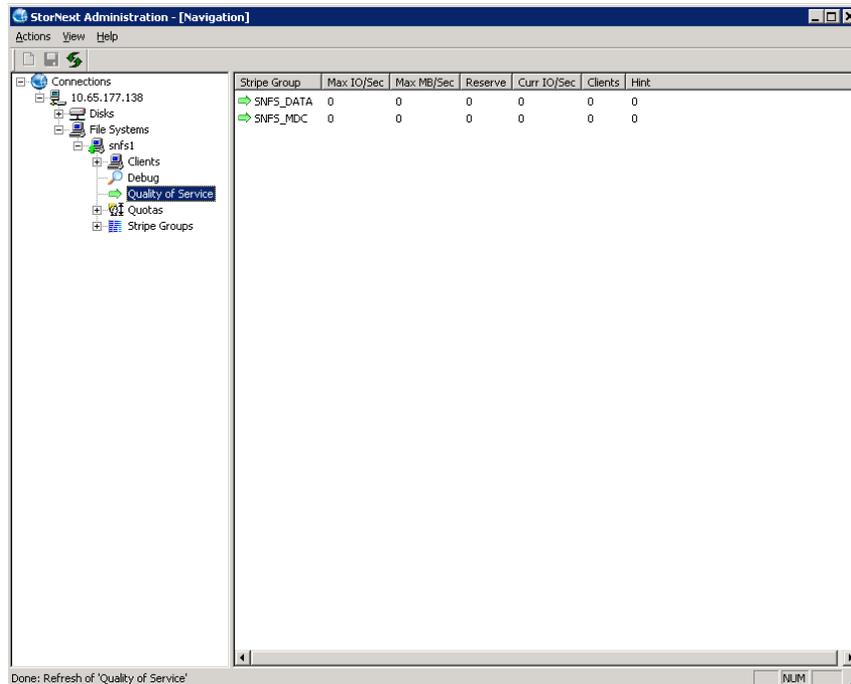


Quality of Service Information

The **Quality of Service** (QOS) pane displays the settings and current metrics (refer to [Figure 60 on the next page](#)). Quality of Service must be enabled on the file system for it to be active. See [Quality of Service](#)

[Feature on page 205](#) for additional details.

Figure 60: The **Quality of Service** display



Quota Properties

Quotas define the amount of storage space a specified user or group is allowed to own. You can set hard or soft quota limits. Quotas must be enabled in the File System Configuration file to be able to set and change quotas.

- To view quota properties, expand a file system in the left pane, expand **Quotas** and then click **Directories** or **Users & Groups**.
- To change quotas, right click on **Directories** or **Users & Groups**.

The **User/Group Quota** dialog box appears (refer to [Figure 61 on the next page](#) and [Figure 62 on page 119](#)).

There are three types of quotas you can configure:

- Set quotas for users on the **User Quotas** button.
- Set quotas for groups on the **Group Quotas** button.
- Set data or file quotas for directories under the **Directory Quotas** heading.

Figure 61: The User/Group Quota dialog box

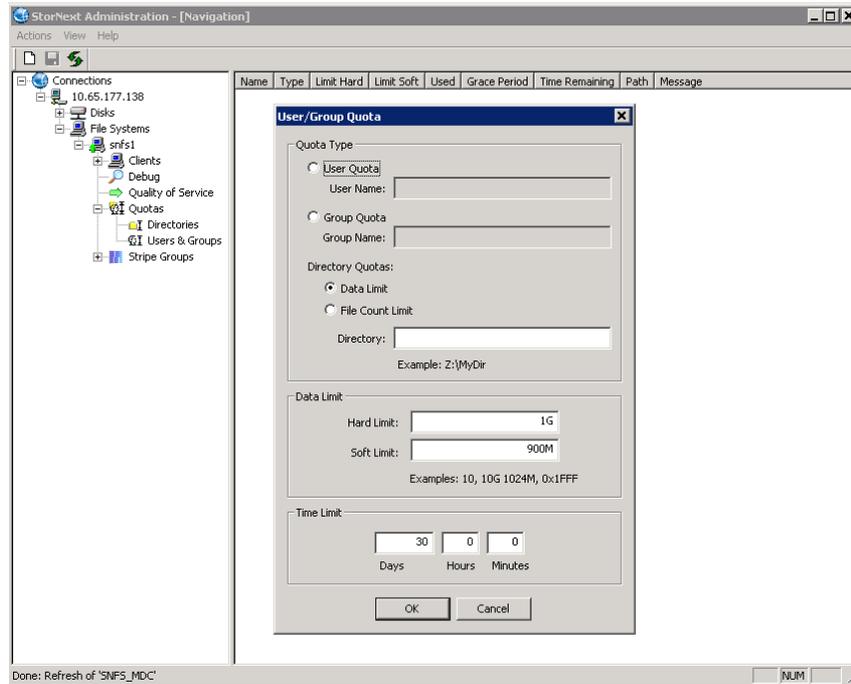


Table 11: Description of fields in User/Group Quota Dialog box

Field / Button	Description
User or Group Quota	Type the name of the user or group for which you want to set a quota.
Directory Quotas	Set a data size limit on the directory
	Set a limit on the number of files under a directory.
Data Limit	Set the amount of data or number of files (depending on the quota type.) Specify an amount in bytes or with the extensions M (megabytes), G (gigabytes) or T (terabytes).
	This is the maximum amount of space the specified user or group can use.
	Once the user or group exceeds this limit, a warning is sent. (Typically, this is set at 80% of the hard limit.)
Time Limit	Specify the amount of time it takes for the soft limit to turn into a hard limit.

Figure 62: The **Directory Quotas** display

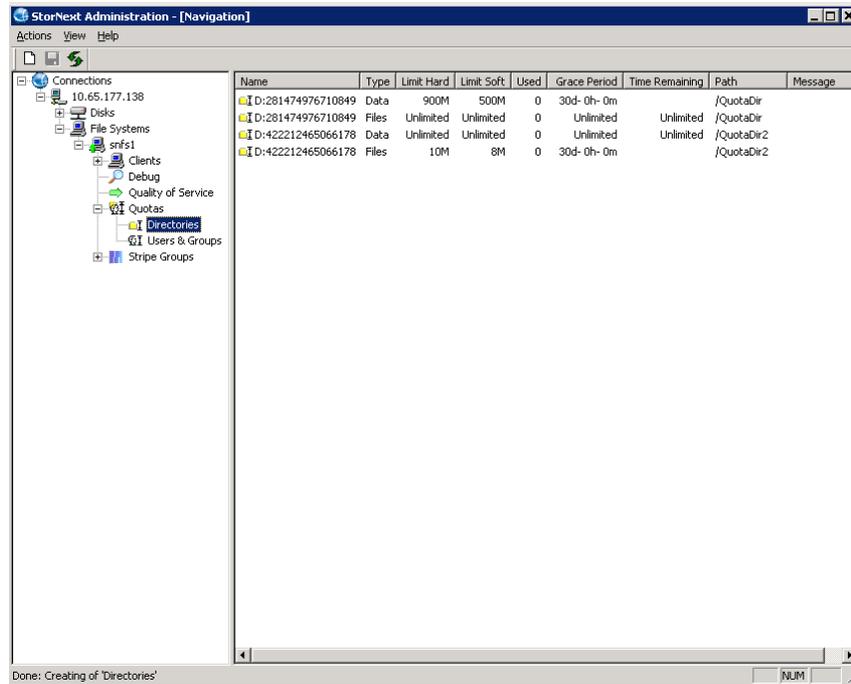


Table 12: The description of fields in the Quotas display

Field / Button	Description
Name	The Linux user or group name
Type	The type of quota (User or Group)
Limit Hard	The absolute maximum amount of data the user or group can consume
Limit Soft	The maximum amount of data the user or group can consume. They can exceed this limit for Grace Period amount of time, but cannot exceed the Hard Limit.
Used	The amount of data currently consumed.
Grace Period	The amount of time the user or group is allowed to exceed the Soft Limit
Time Remaining	Amount of time remaining before the user or group cannot allocate any more space in the file system. If the value is negative, the user can no longer allocate any more space.

Stripe Group Properties

To view stripe group properties, expand a file system in the left pane, click **Stripe Groups**, and then click the stripe group name in the left pane. The stripe group’s property appears in the right pane (refer to [Figure 63](#)

[on the next page](#)). Table 4 describes the fields of the stripe group property display.

Figure 63: The Stripe Group Properties

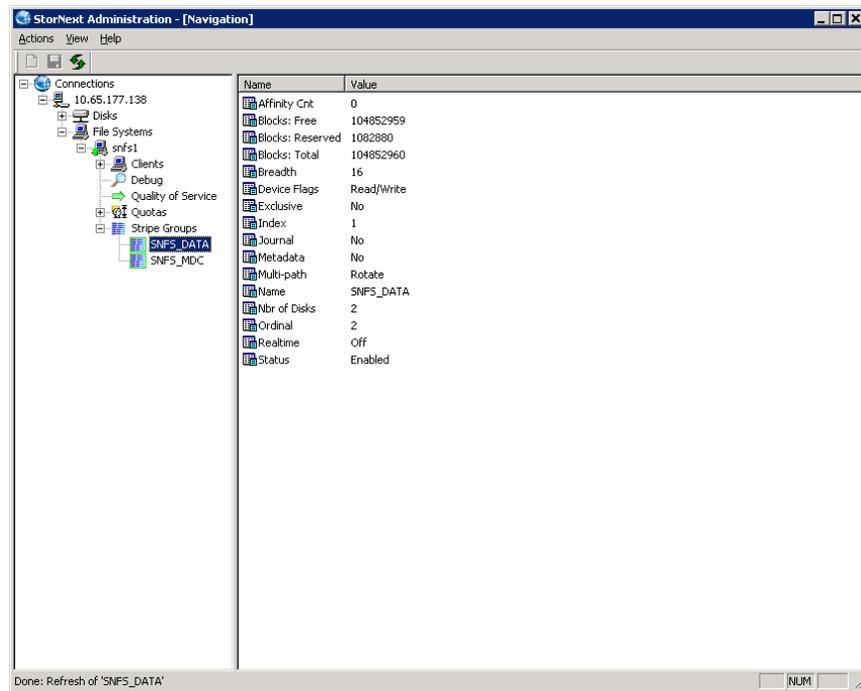


Table 13: The description of fields in the Stripe Group display

Name	Value
Affinity Cnt	Number of affinities
Blocks: Free	Number of blocks free
Blocks: Reserved	Number of blocks reserved
Blocks: Total	Total number of blocks
Stripe Breadth	The number of file system blocks to write before switching to the next disk in the stripe group.
Stripe Depth	The number of disks in the stripe group.
Device Flags	Read and Write flags
Exclusive	Indicates if only specified file types (associated with the stripe group affinities) can be stored on the stripe group.
Index	Disk index in configuration

Name	Value
Journal	Indicates if the file system logging journal can be stored on the stripe group.
Metadata	Indicates if file system metadata can be stored on the stripe group.
Multi-path	Indicates the method the file system uses to access the disk: round, static, or sticky.
Name	Stripe group name
Nbr of Disks	Number of disks in group
Ordinal	Internal index
Realtime	Uses Real-time IO
Status	Current status

Disk Properties

Click **Disks** to see all disks visible to the currently selected host. Click a specific disk to display the various attributes of that disk (refer to [Figure 64 below](#) and [Table 14 on the next page](#)).

Figure 64: The Disks Property display

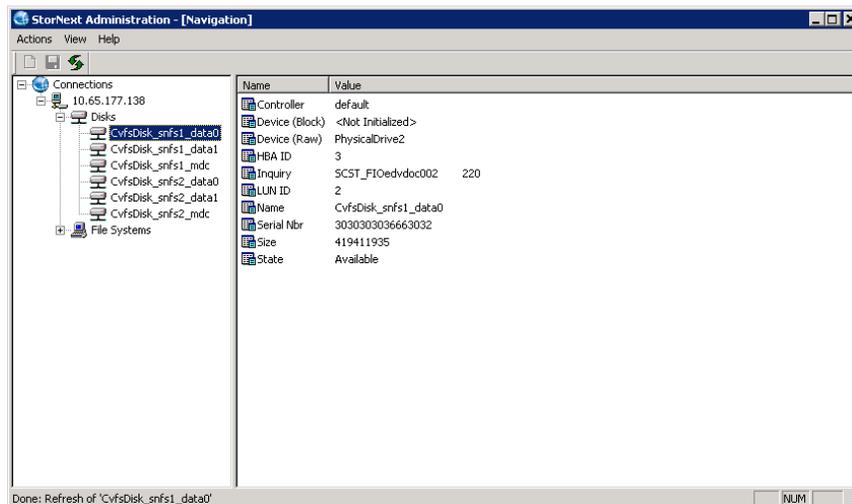


Table 14: Description of fields in the Disks Property display

Name	Value
Controller	Device driver
Device (Block)	The block device
Device (Raw)	The Raw Device
HBA ID	Host Bus Adapter identifier
Inquiry	Manufacturer string
LUN ID	Logical Unit Number
Name	Disk Label
Serial Nbr	Disk's Serial Number
Size	Size of the disk
State	State of the disk

Configuring a High Availability System on Windows

Follow these steps to configure a High Availability (HA) system on Windows:

1. Install StorNext if not already installed (see [Installing StorNext File System on Windows MDCs on page 69](#)).
2. Obtain and install StorNext licenses, which must include at least Maintenance, Server and Failover licenses for both MDCs (see [Obtaining and Installing a Permanent License on page 78](#)).
3. If this is an existing configuration with clients, it is recommended that you stop StorNext services on all StorNext clients to avoid the clients hanging (see [Stopping File System Services on page 104](#)).
4. Verify that configuration files are correct and identical on both MDCs.
 - a. The ***.cfg** files should be identical on both computers.
 - b. The **fsnameservers** files should be identical on both computers.
 - c. The **fsmlist** files should be identical on both computers.
 - d. If the optional `ha_smith_interval` file is configured, it must be identical on both computers (for more details, see [High Availability Systems](#) in the *StorNext 5 User's Guide*).

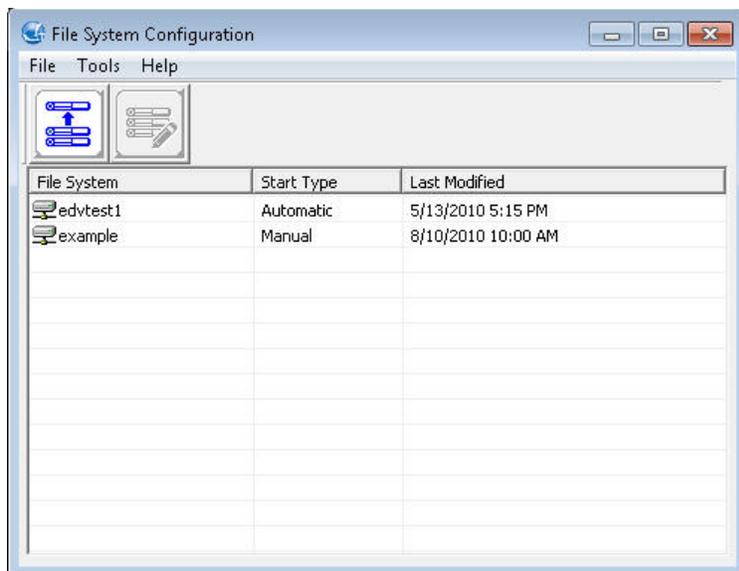
- e. Copy and paste the *.cfg files and fsmlist files from the primary MDC to the secondary MDC before proceeding to step 5.
5. Create the **ha_peer** file in the configuration directory of each MDC (**C:\Program Files\StorNext\config\ha_peer**). The **ha_peer** file on each MDC must contain the numerical IP address of its redundant-peer MDC, which enables intra-MDC communication for HA functionality.
6. Enable High Availability (HA) on both redundant-peer MDCs by doing the following:

⚠ Caution: If you do not perform these steps on both MDCs your metadata could become corrupted.

- a. After installing StorNext, on each MDC run: **Start > All Programs > StorNext > File System Cfg (Advanced)**.

The **File System Configuration** window displays ([Figure 65 below](#)).

Figure 65: Configuration Administrator



- b. On the **Tools** menu, click **HA Configuration**.
 - c. Click **Enable High Availability (HA)**. Note that you cannot enable HA if there are no file systems configured.
7. High Availability is now configured. You may now test the HA reset functionality by running the following command on either MDC:

```
cvadmin -e "hamon smith"
```

The MDC will immediately reboot. Clients for any StorNext file systems that were being served by active FSMs on the reset MDC will trigger elections that will result in the activations of corresponding FSMs on the redundant HA MDC. This can be observed by running the following command on the redundant MDC both before and after resetting its peer MDC:

```
cvadmin -e "select"
```

- Restart services on any clients that you stopped earlier (see [Starting File System Services on page 104](#)).

i Note: Restarting StorNext faster than once per three minutes can trigger a startup delay of three minutes. The delay slows down looping HA resets so that an administrator can correct any configuration problems that are causing the resets.

Adding or Removing StorNext Components

After installing StorNext File System, you may wish to add or remove components. Specifically, you can add or remove the online help files, the StorNext client, and the StorNext server.

- If you just completed installing StorNext, the **StorNext Installation** window displays ([Figure 66 below](#)). The components you selected during the install are already added, but if you changed your mind and want to select different components, you can do so now.

Figure 66: StorNext Installation Window: Add/Remove Components



If you previously installed StorNext and would like to add or remove components, display the **StorNext Installation** window by double-clicking the file named **SnfsSetup64.exe** (64-bit systems). Note that the screen is slightly different from [Figure 66 above](#): instead of **Add/Remove Components**, the button you need to click is called **Upgrade/Reinstall StorNext** (see [Figure 67 on the next page](#)).

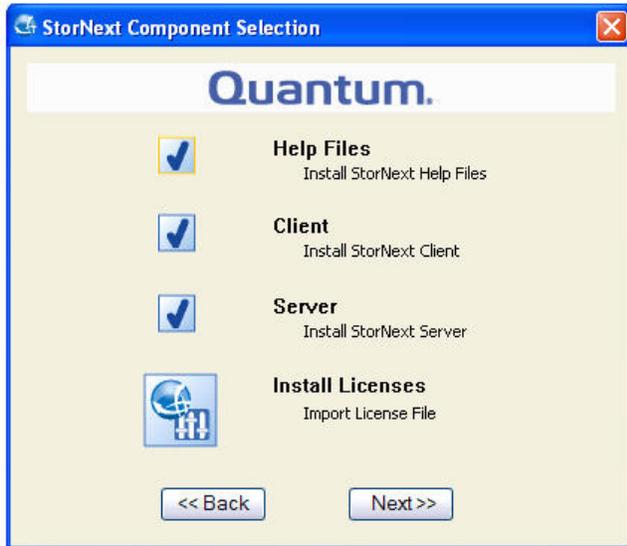
Figure 67: StorNext Installation Window: Upgrade/Reinstall StorNext



2. Click **Add/Remove Component** or **Upgrade/Reinstall StorNext**, depending on which screen you are looking at.

The **Component Selection** screen appears ([Figure 68 below](#)).

Figure 68: Component Selection



3. Select the check boxes of the components you want to add. Clear the check boxes of the components you want to remove. Click **Next** to proceed.

Note: The **Install Licenses** option allows you to import your StorNext licenses onto the StorNext server, if you have not already done so. You may also install licenses later using this screen or the Windows Start button (**Start > Licenses** or **Start > All Programs > StorNext > Licenses**).

The StorNext End User License Agreement (EULA) appears ([Figure 19 on page 71](#)).

4. Read and accept the EULA by selecting “I accept the terms in the License Agreement” and clicking **Next**.

It may take several minutes for the selected components to finish being added or removed.

5. When a message informs you that the process is complete, click **OK**.
6. Click **Exit**.

Restoring a Previous Client Configuration

For information about this feature, please see [Restoring a Previous StorNext or StorNext FX Client Configuration on page 157](#).

Upgrading or Reinstalling StorNext on a Windows Server

The **Upgrade/Reinstall** button allows you to upgrade to a new version of StorNext or reinstall the current version. You might want to reinstall if you accidentally removed some components and need to get them back. During an upgrade/reinstall, the old software is removed and the new software is installed. Your previous configuration settings remain intact.

i Note: If you are upgrading a Windows 3.x high-availability system to StorNext 5, additional steps are required. Follow the instructions in the *StorNext 5 Upgrade Guide*.

1. Copy the file named **/fs_only/snfs_full_Windows_x86_64.zip** from the installation DVD and place it on the system onto which you want to install it. Be sure to select the file from the **fs_only** directory and not the **stornext_full** directory.
2. Unzip the file.
3. Double-click the file named **SnfsSetup64.exe** to launch the installer.

The StorNext Installation screen appears ([Figure 69 on the next page](#)).

Figure 69: StorNext Installation Window: Upgrade/Reinstall StorNext



4. Click **Upgrade/Reinstall StorNext** to begin installation.

The **StorNext Component Selection** window appears ([Figure 70 below](#)).

Figure 70: Component Selection



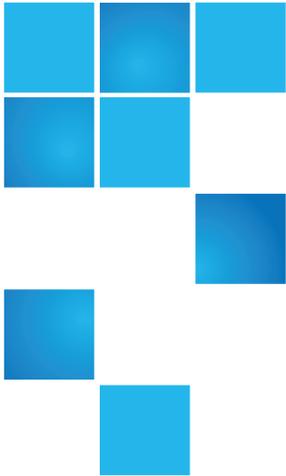
5. Select the check boxes of the components you want to include in the upgrade. Clear the check boxes of the components you want to exclude. Click **Next** to proceed.

The StorNext EULA appears (see [Figure 19 on page 71](#)).

6. Read the EULA. If you accept, select "I accept the terms in the License Agreement" and then click **Next** to continue the install.

It may take several minutes for the selected components to finish being added or removed.

7. When a message informs you that the installation is finished, click **OK**.



Chapter 5: StorNext and StorNext FX Client Installation/Configuration

This chapter contains the following topics:

StorNext and StorNext FX Client Installation/Configuration	129
StorNext and StorNext FX Client System Requirements	129
Downloading StorNext Client Software	131
Downloading StorNext FX Client Software	134
Installing StorNext and StorNext FX Client Software on Linux or Unix	135
Installing StorNext and StorNext FX Client Software on Windows	147
Configuring the StorNext and StorNext FX Client on Windows	152

StorNext and StorNext FX Client Installation/Configuration

This topic describes how to perform a StorNext and StorNext FX client-only installations (without StorNext File System or StorNext Storage Manager) on supported platforms. StorNext and StorNext FX client software lets you mount and work with StorNext and Xsan file systems, respectively.

To ensure successful operation, make sure the StorNext or StorNext FX client system meets all operating system and hardware requirements (see [StorNext and StorNext FX Client System Requirements below](#)).

i Note: Before installing the StorNext or StorNext FX client software you must install and configure your StorNext or Xsan MDC, activate StorNext with a license key, and create necessary File Systems. For Xsan MDCs consult your Apple Xsan documentation for information on configuring the MDC.

This topic covers:

- [StorNext and StorNext FX Client System Requirements below](#)
- [Downloading StorNext Client Software on page 131](#)
- [Downloading StorNext FX Client Software on page 134](#)
- [Installing StorNext and StorNext FX Client Software on Linux or Unix on page 135](#)
- [Installing StorNext and StorNext FX Client Software on Windows on page 147](#)
- [Configuring the StorNext and StorNext FX Client on Windows on page 152](#)

StorNext and StorNext FX Client System Requirements

To run the StorNext and StorNext FX client software, the client system must meet all operating system and hardware requirements.

StorNext Software Requirements

Installing StorNext 5 on all UNIX-based (including Linux) platforms requires installing these quantum-supplied packages:

- zeromq
- protobuf

These packages are used by StorNext and are bundled with the StorNext .bin file.

Operating System Requirements

The operating systems, kernel versions, rpm package dependencies, and hardware platforms supported by StorNext File System are listed in the *StorNext Compatibility Guide* posted here:

<http://www.quantum.com/sn5docs>

Make sure the system meets the operating system and platform requirements outlined in the guide, and, if necessary, update to a supported release or kernel version before installing StorNext.

For Linux clients, C-States should be disabled through kernel boot parameters. Refer to [Modifying the grub.conf File to Disable the Intel Sleep State on page 8](#).

StorNext and StorNext FX Client Hardware Requirements

RAM, hard disk, and CPU requirements to run the StorNext and StorNext FX clients are listed in the “*StorNext Client and StorNext FX RAM, Disk and CPU Requirements*” section of the *StorNext Compatibility Guide* posted here:

<http://www.quantum.com/sn5docs>

Make sure the system to be used as a StorNext or StorNext FX client meets the hardware requirements outlined in the guide, and, if necessary, update the system before installing StorNext.

For improved performance and stability, on Windows clients it is strongly recommended that CPU C-States be disabled in the BIOS if they are supported by your system. Refer to system vendor documentation for additional information.

StorNext and StorNext FX Client File System Buffer Cache Requirements

File System Buffer cache requirements for the StorNext and StorNext FX clients are listed in the “*StorNext Client and StorNext FX File System Buffer Cache*” section of the *StorNext Compatibility Guide* posted here:

<http://www.quantum.com/sn5docs>

Make sure the system to be used as a StorNext or StorNext FX client meets the hardware requirements outlined in the guide, and, if necessary, update the system before installing StorNext.

Ensuring You Have Enough Space to Extract the Installation Software

The Linux/Unix StorNext and StorNext FX client installation software files are extracted into the **/tmp/stornext** directory by default. The software, when extracted, requires approximately 40 MB of space. Make sure there is enough free space in the default directory to extract the files. If there is not sufficient space, you may need to specify an alternative directory with the **-d** option.

To specify an alternate location before beginning the installation, enter the following command:

```
# ./<archive name> -d <dir>
```

where *<archive name>* is the name of the client software file you downloaded, and *<dir>* is the directory into which you want to extract the installation files.

Other Requirements

Additional requirements that must be met for the StorNext system are listed in the “*Additional StorNext MDC and StorNext Client Requirements*” section of the *StorNext Compatibility Guide* posted here:

<http://www.quantum.com/sn5docs>

Make sure the system meets the additional requirements outlined in the guide, and, if necessary, update the system before installing StorNext.

Downloading StorNext Client Software

StorNext client software can be downloaded from the StorNext installation DVD, the Web, or from a StorNext Metadata Controller (MDC) running the StorNext GUI. You can only download client software from a StorNext MDC if you have SNFS and SNSM installed and are running the StorNext GUI.

This section covers:

- [Locating StorNext Client Software on the Installation DVD, ftp Site on the next page](#)
- [Downloading StorNext Client Software from the StorNext MDC GUI on the next page](#)

i Note: If you are using StorNextFX clients in your environment, see [Downloading StorNext FX Client Software on page 134](#).

Locating StorNext Client Software on the Installation DVD, ftp Site

If your StorNext MDC is not running the StorNext GUI, you must download client software from the installation DVD or the Web.

If you have the installation DVD, retrieve the client software from the **fs_only** directory on the DVD. If you are obtaining software from the FTP site, download the client software from the **fs_only** directory.

The names of the client install files begin with **snfs_client_<system>**, where **<system>** is the name of the operating system for which the install file is intended. Copy the appropriate install file to an accessible location on your computer and proceed to the installation instructions.

Downloading StorNext Client Software from the StorNext MDC GUI

To download the StorNext client software from the StorNext MDC GUI, the client system must have network access to the MDC.

i Note: StorNext FX client downloads are not supported from an Xsan MDC.

1. From a web browser, access the URL (host name and port number) of the StorNext MDC. For example, **http://servername:81**

Use one of the web browsers supported by StorNext to access the MDC (make sure pop-up blockers are turned off). For a list of currently-supported browsers, see the *StorNext Compatibility Guide* posted here:

<http://www.quantum.com/sn5docs>

2. When prompted, type the username and password for the MDC, and then click **OK**. (The default username is **admin**, and the default password is **password**.)

The StorNext home page appears.

3. Choose **Client Download** from the **Tools** menu. The **Tools > Client Download** page appears.

Figure 71: Client Download Page



4. Select from the **Platform** list the desired operating system.
5. Select from the **OS Version** list the desired operating system version corresponding to the platform you selected.
6. When a window appears containing a link to the client software download location, click the link to begin downloading.

Figure 72: StorNext and StorNext FX Client Download Link



7. Click **Download** to begin the process.
8. When prompted, choose the **Save to Disk** option, and then click **OK**.
9. Browse to the location where you want to save the file, and then click **Save**.
10. After the client package has been saved, click **Done**.
11. Continue with the installation procedure for your operating system as described in this StorNext Installation Guide or the online help:
 - [Installing StorNext and StorNext FX Client Software on Linux or Unix on page 135](#)
 - [Installing StorNext and StorNext FX Client Software on Windows on page 147.](#)

Downloading StorNext FX Client Software

Locating StorNext FX Client Software on the Quantum Web Site

If you are using StorNext FX clients in your environment, follow the instructions below to download StorNext FX client software.

For New Customers

1. Go to <https://swdownload.quantum.com>.
2. Click **Register Now**. Complete the registration form.
3. Click **Submit**. The system will create an account and then send you an email with the password within five minutes. If you do not receive the email after five minutes, go to login page, enter your email and click **Recover Password**. You will receive an encrypted link to reset your password. Once your email has been registered and verified, you will be able to enter and manage your **Download Authorization Code**.
4. Go to the login page and sign in using your **User ID** and **Password**.
5. Register the **Download Authorization Code** and click **Submit**.
6. Click the **Product Name** link to begin downloading the software.

For Existing Customers

1. Go to <https://swdownload.quantum.com> and log in.
2. Click **Register Additional Download Authorization Codes**.
3. Enter your **Download Authorization Code** and click **Register**.
4. The system will register the download authorization code and make the download available.
5. Click the **Product Name** link to begin downloading the software.

Note: StorNext FX client downloads are not supported from an Xsan MDC.

Depending on your operating system, proceed to one of the following sections to install the software:

- [Installing StorNext and StorNext FX Client Software on Linux or Unix on the next page](#)
- [Installing StorNext and StorNext FX Client Software on Windows on page 147](#)

After you have installed the software, proceed to the following section to configure the software:

- [Configuring the StorNext and StorNext FX Client on Windows on page 152](#)

Installing StorNext and StorNext FX Client Software on Linux or Unix

After downloading the StorNext or StorNext FX client software from the MDC or installation DVD, first make sure you have enough space to extract the software files by following the instructions in [Ensuring You Have Enough Space to Extract the Installation Software on page 131](#). Then install the software on the StorNext or StorNext FX client system using the correct procedure for your operating system:

- [Installing StorNext and StorNext FX Client Software on Red Hat or SUSE Linux below](#)
- [Installing StorNext Client Software on Debian or Ubuntu Linux on page 138](#)
- [Installing StorNext Client Software on Sun Solaris on page 140](#)
- [Installing StorNext Client Software on HP-UX on page 142](#)
- [Installing StorNext Client on IBM AIX on page 144](#)

i Note: Regardless of the operating system platform onto which you are installing, you must view and accept the StorNext end user license agreement (EULA) before you can install StorNext.

Installing StorNext and StorNext FX Client Software on Red Hat or SUSE Linux

To run the StorNext or StorNext FX client software on Red Hat Linux or SUSE Linux Enterprise, first install the client software package, and then configure the client.

! Caution: Before installing the StorNext or StorNext FX client software, you must install the kernel source code. You can install the kernel source code by using the installation disks for your operating system.

i Note: Client software is extracted by default to the directory `/tmp/stornext`.

1. Log on to the StorNext or StorNext FX client system as **root**.
2. Change to the directory where the client software archive file you downloaded is located.
3. Run the client software binary. At the command prompt, type:

```
./<archive name>
```

where `<archive name>` is the name of the client software archive file you downloaded. (For example, the file for RH5 is `snfs_client_RedHat50AS_26x86_64.bin`.)

4. When you are presented with the StorNext End User License Agreement (EULA), press **<ENTER>** to read the EULA. After reading the EULA enter **y** to accept the EULA, or enter any other key to decline.

After you accept the EULA, the client software is extracted to **/tmp/stornext** (or to another directory if you specified an alternate location; see [Ensuring You Have Enough Space to Extract the Installation Software on page 131](#)).

Note: If the directory into which the files are being extracted does not have enough space, the installation will fail and you will receive an error message. You will need to identify an alternate location into which to extract the files by entering the following command:

```
# ./<archive name> -d <dir>
```

Note:

where <archive name> is the name of the client software archive file you downloaded, and <dir> is the directory into which you want to extract the installation files.

Caution: If the directory into which the files are being extracted already exists, you will receive a warning message. If this occurs, either remove the directory and try the installation again, or change the installation directory by entering the following command:

```
# ./<archive name> -d <dir>
```

Caution:

where <archive name> is the name of the client software archive file you downloaded, and <dir> is the directory into which you want to extract the installation files.

It is NOT recommended that you force using an existing directory (by using the `-f` command) because this could lead to additional problems installing the `.rpm` files.

5. Change directories to **/tmp/stornext** (or to the alternate directory if you specified one in the step above).
6. List the packages extracted from the software archive file. At the command prompt, type:

```
ls -l
```

Identify the correct package to install. The correct package begins with **snfs-client** and ends with the **.rpm** file name extension.

Note: The file that ends with **.rpm.md5sum** is a checksum file, not the client software package.

7. Install the required `.rpm` files in the following order. Use the command `rpm -ivh` before each package. For example, `rpm -ivh quantum_jansson-<version>.rpm`. The files are installed in the directory: **/usr/cvfs**.
 - a. `quantum_jansson-<version>.rpm`
 - b. `quantum_protobuf-<version>.rpm`
 - c. `quantum_zeromq-<version>.rpm`

- d. `snfs-common-<version>.rpm`
- e. `snfs-extapi-<version>.rpm`
- f. `snfs-client-<version>.rpm`
- g. `supdate-<version>.rpm`

8. Configure the boot order for system services.

Note: Skip this step for Red Hat Enterprise Linux 7.x and SuSE Linux Enterprise Server 12.x clients. The boot order is determined by `systemd.unit(5)` unit file dependencies.

Perform one of the following:

- For Red Hat Linux, at the command prompt, type:

```
chkconfig --level 345 cvfs on
```

- For SUSE Linux Enterprise, at the command prompt, type:

```
chkconfig -s raw 235  
chkconfig -s cvfs 345
```

9. Edit the `/usr/cvfs/config/fsnameservers` text file to contain the IP address of the MDC to which the StorNext or StorNext FX client will connect.

The `fsnameservers` file on the client must be exactly the same as on the MDC. If the `fsnameservers` file does not exist, use a text editor to create it.

Note: The `fsnameservers` file needs to contain only the IP address of the MDC.

10. For StorNext FX clients **ONLY**, copy the `.auth_secret` file from the Xsan MDC to `/usr/cvfs/config/.auth_secret` on the client system.

11. Create a mount point for the file system. At the command prompt, type:

```
mkdir -p <mount point>  
chmod 777 <mount point>
```

where `<mount point>` is the directory path where you want the file system to be mounted. For example: `/stornext/snfs1`

12. Configure the file system to automatically mount after reboot. To do this, edit the `/etc/fstab` file so that it contains the following line:

```
<file system> <mount point> cvfs rw 0 0
```

where `<file system>` is the name of the StorNext file system and `<mount point>` is the directory path created in [Step 11](#).

13. Reboot the StorNext or StorNext FX client system.

After reboot, the StorNext file system is mounted at the mount point you specified.

i Note: To manually mount a file system, at the command prompt, type:

```
mount -t cvfs <file system/volume> <mount point>
```

i Note:

where `<file system>` is the name of the StorNext file system and `<volume>` is the name of the Xsan volume you will use, and `<mount point>` is the directory path where you want the file system to be mounted.

Installing StorNext Client Software on Debian or Ubuntu Linux

To run the StorNext client software on Debian or Ubuntu Linux, first install the client software package, and then configure the StorNext client.

To install the client software package:

1. Log on to the StorNext client system as **root**.
2. Change to the directory where the client software archive file you downloaded is located.
3. Unbundle the **snfs_client_Debian60_26x86_64.bin** or **snfs_client_Ubuntu14_x86_64.bin** package.
4. When you are presented with the StorNext End User License Agreement (EULA), press **Enter** to read the EULA. After reading the EULA enter **y** to accept the EULA, or enter any other key to decline.

After you accept the EULA, the client software is extracted to `/tmp/stornext` (or to another directory if you specified an alternate location; see [Ensuring You Have Enough Space to Extract the Installation Software on page 131](#)).

i Note: If the directory into which the files are being extracted does not have enough space, the installation will fail and you will receive an error message. You will need to identify an alternate location into which to extract the files by entering the following command:

```
# ./<archive name> -d <dir>
```

i Note:

where `<archive name>` is the name of the client software archive file you downloaded, and `<dir>` is the directory into which you want to extract the installation files.

⚠ Caution: If the directory into which the files are being extracted already exists, you will receive a warning message. If this occurs, either remove the directory and try the installation again, or change the installation directory by entering the following command:

```
# ./<archive name> -d <dir>
```

⚠ Caution:

where *<archive name>* is the name of the client software archive file you downloaded, and *<dir>* is the directory into which you want to extract the installation files.

It is NOT recommended that you force using an existing directory (by using the `-f` command) because this could lead to additional problems installing the `.rpm` files.

5. From the `/tmp/stornext` directory, install all the `.deb` packages packages by typing:

```
# dpkg -i *.deb
```

6. Copy the **fsnameservers** file from MDC to `/usr/cvfs/config/fsnameservers`.

i Note: Note: The **fsnameservers** file on the client must be exactly the same as on the MDC.

7. If this is a SAN client, check to make sure LUNs are visible. At the command prompt, type:

```
/usr/cvfs/bin/cvlabel -l
```

8. Create a mount point.

Example:

```
/stornext/<snfs1>
```

Where *<snfs1>* is the name of the StorNext File System/Xsan volume you are using on your system.

9. Edit the **/etc/fstab** to add the client mount options.

Example:

```
<snfs1> /stornext/snfs1 cvfs rw 0 0
```

Where *<snfs1>* is the name of the StorNext File System/Xsan volume you are using on your system.

10. Start the file system service. At the command prompt, type:

```
service cvfs start
```

11. Verify file systems are mounted.

Installing StorNext Client Software on Sun Solaris

To run the StorNext Client software on Sun Solaris, first install the client software package, and then configure the client.

1. Log on to the StorNext Client system as **root**.
2. Change to the directory where the client software archive file you downloaded is located.
3. Run the client software binary. At the command prompt, type:

```
./<archive name>
```

where *<archive name>* is the name of the client software archive file you downloaded. (For example, the file for RH5 is **snfs_client_RedHat50AS_26x86_64.bin**)

4. When you are presented with the StorNext End User License Agreement (EULA), press **<ENTER>** to read the EULA. After reading the EULA enter **y** to accept the EULA, or enter any other key to decline.

After you accept the EULA, the client software is extracted to **/tmp/stornext** (or to another directory if you specified an alternate location; see [Ensuring You Have Enough Space to Extract the Installation Software on page 131](#)).

Note: If the directory into which the files are being extracted does not have enough space, the installation will fail and you will receive an error message. You will need to identify an alternate location into which to extract the files by entering the following command:

```
# ./<archive name> -d <dir>
```

Note:

where *<archive name>* is the name of the client software archive file you downloaded, and *<dir>* is the directory into which you want to extract the installation files.

Caution: If the directory into which the files are being extracted already exists, you will receive a warning message. If this occurs, either remove the directory and try the installation again, or change the installation directory by entering the following command:

```
# ./<archive name> -d <dir>
```

Caution:

where *<archive name>* is the name of the client software archive file you downloaded, and *<dir>* is the directory into which you want to extract the installation files.

It is NOT recommended that you force using an existing directory (by using the **-f** command) because this could lead to additional problems installing the **.rpm** files.

⚠ Caution: If you have other Quantum products that share the zeromg and protobuf packages, it is recommend you use the newer versions. Consult the other product's documentation on how to remove the older versions.

5. Change to the `/tmp/stornext` directory.
6. Install the required SNFS packages first, and then install the client software package. At the command prompt, type:

```
pkgadd -d . QUANTUMjansson
pkgadd -d . QUANTUMprotobuf
pkgadd -d . QUANTUMzeromq
pkgadd -d . ADICsnfs
pkgadd -d . QUANTUMsupdate
```

This package contains scripts which will be executed with super-user permission during the process of installing this package.

Do you want to continue with the installation of <ADICsnfs> [y,n,?]

7. Type `y` to confirm installation of the `ADICsnfs` package.
8. Edit the `/usr/cvfs/config/fsnameservers` text file to contain the IP address of the MDC to which the client will connect.

The `fsnameservers` file on the client must be exactly the same as on the MDC. If the `fsnameservers` file does not exist, use a text editor to create it.

i Note: The `fsnameservers` file needs to contain only the IP address of the MDC. For example, if the IP address for the MDC is `192.168.143.1`, then the `fsnameservers` file should contain a single line with `192.168.143.1`

9. Create a mount point for the file system. At the command prompt, type:

```
mkdir -p <mount point>
chmod 777 <mount point>
```

where `<mount point>` is the directory path where you want the file system to be mounted. For example: `/stornext/snfs1`

10. Configure the file system to automatically mount after a reboot. To do this, edit the `/etc/vfstab` file so that it contains the following line:

```
<file system> - <mount point> cvfs 0 auto rw
```

where `<file system>` is the name of the StorNext file system and `<mount point>` is the directory path created in [Step 9](#).

While a reboot is not required at this time, in the future, a reboot of the client will mount the StorNext file system at the mount point you specified.

11. Restart StorNext services on the solaris client. To restart the services, type:

```
/usr/cvfs/bin/cvfs stop  
/usr/cvfs/bin/cvfs start
```

i Note: To manually mount a file system, at the command prompt type:

```
mount -F cvfs <file system/volume> <mount point>
```

i Note:

where <file system> is the name of the StorNext file system/Xsan volume you will use, and <mount point> is the directory path where you want the file system to be mounted.

Installing StorNext Client Software on HP-UX

To run the StorNext Client software on HP-UX, first install the client software package, and then configure the client.

1. Log on to the StorNext Client system as **root**.
2. Change to the directory where the client software archive file you downloaded is located.
3. Run the client software binary. At the command prompt, type:

```
./<archive name>
```

where <archive name> is the name of the software archive file you downloaded from the MDC. (For example, the file for RH5 is **snfs_client_RedHat50AS_26x86_64.bin**)

4. When you are presented with the StorNext End User License Agreement (EULA), press **<ENTER>** to read the EULA. After reading the EULA enter **y** to accept the EULA, or enter any other key to decline.

After you accept the EULA, the client software is extracted to **/tmp/stornext** (or to another directory if you specified an alternate location; see [Ensuring You Have Enough Space to Extract the Installation Software on page 131](#)).

i Note: If the directory into which the files are being extracted does not have enough space, the installation will fail and you will receive an error message. You will need to identify an alternate location into which to extract the files by entering the following command:

```
# ./<archive name> -d <dir>
```

i Note:

where <archive name> is the name of the client software archive file you downloaded, and <dir> is the directory into which you want to extract the installation files.

⚠ Caution: If the directory into which the files are being extracted already exists, you will receive a warning message. If this occurs, either remove the directory and try the installation again, or change the installation directory by entering the following command:

```
# ./<archive name> -d <dir>
```

⚠ Caution:

where `<archive name>` is the name of the client software archive file you downloaded, and `<dir>` is the directory into which you want to extract the installation files.

It is NOT recommended that you force using an existing directory (by using the `-f` command) because this could lead to additional problems installing the `.rpm` files.

5. Change directories to `/tmp/stornext`.
6. List the packages extracted from the software archive file. At the command prompt, type:

```
ls -l
```

Identify the correct package to install. The correct package begins with `snfs-client` and ends with the `.depot` file name extension.

7. Install the required SNFS packages first, and then install the client software package. At the command prompt, type:

```
swinstall -s /tmp/stornext/quantum_zeromq-<version>.depot -x mount_all_
filesystems=false \*
swinstall -s /tmp/stornext/quantum_protobuf-<version>.depot -x mount_all_
filesystems=false \*
swinstall -s /tmp/stornext/snfs-client_hpux-<version>.depot -x mount_all_
filesystems=false \*
```

8. Edit the `/usr/cvfs/config/fsnameservers` text file to contain the IP address of the MDC to which the client will connect.

The `fsnameservers` file on the client must be exactly the same as on the MDC. If the `fsnameservers` file does not exist, use a text editor to create it.

i Note: The `fsnameservers` file needs to contain only the IP address(es) of the MDC(s).

9. Create a mount point for the file system. At the command prompt, type:

```
mkdir -p <mount point>
chmod 777 <mount point>
```

where `<mount point>` is the directory path where you want the file system to be mounted. For example: `/stornext/snfs1`

10. Configure the file system to automatically mount after reboot. To do this, edit the `/etc/fstab` file so that it contains the following line:

```
/stornext/snfs1 /stornext/snfs1 cvfs rw,fsname=RH5-DATA 0 0
```

- `fsname` defines the StorNext file system name (for example, **RH5-DATA**).
- `/stornext/snfs1` is the StorNext mount point.

i Note: Regarding the two file system mount points in the `/etc/fstab` file:
The first mount point entry is ignored.
The second mount point entry is the StorNext mount point you want to have the file system mounted on.

11. Reboot the client system.

After reboot, the StorNext file system is mounted at the mount point you specified.

i Note: To manually mount a file system, at the command prompt, type:

```
mount -F cvfs <mount point> <mount point>
```

i Note:

where `<mount point>` is the directory path where you want the file system to be mounted.

Installing StorNext Client on IBM AIX

To run the StorNext Client software on IBM AIX, first install the client software package, and then configure the client.

1. Log on to the StorNext Client system as **root**.
2. Change to the directory where the client software archive file you downloaded is located.
3. Run the client software binary. At the command prompt, type:

```
./<archive name>
```

where `<archive name>` is the name of the software archive file you downloaded. (For example, the file for RH5 is **snfs_client_RedHat50AS_26x86_64.bin**.)

4. When you are presented with the StorNext End User License Agreement (EULA), press **<ENTER>** to read the EULA. After reading the EULA enter **y** to accept the EULA, or enter any other key to decline.

After you accept the EULA, the client software is extracted to **/tmp/stornext** (or to another directory if you specified an alternate location; see [Ensuring You Have Enough Space to Extract the Installation Software on page 131](#)).

- Note:** If the directory into which the files are being extracted does not have enough space, the installation will fail and you will receive an error message. You will need to identify an alternate location into which to extract the files by entering the following command:

```
# ./<archive name> -d <dir>
```

Note:

where `<archive name>` is the name of the client software file you downloaded, and `<dir>` is the directory into which you want to extract the installation files.

- Caution:** If the directory into which the files are being extracted already exists, you will receive a warning message. If this occurs, either remove the directory and try the installation again, or change the installation directory by entering the following command:

```
# ./<archive name> -d <dir>
```

Caution:

where `<archive name>` is the name of the client software file you downloaded, and `<dir>` is the directory into which you want to extract the installation files.

It is NOT recommended that you force using an existing directory (by using the `-f` command) because this could lead to additional problems installing the `.rpm` files.

5. Change directories to `/tmp/stornext`.
6. List the packages extracted from the software archive file. At the command prompt, type:

```
ls -l
```

Identify the correct package to install. The correct package begins with `snfs` and ends with the `.bff` file name extension.

7. Install the required SNFS packages, and then install the client software package. At the command prompt, type:

```
installp -ac -d . all
```

8. Edit the `/usr/cvfs/config/fsnameservers` file for the IP address of the MDC to which the client will connect.

The `fsnameservers` file on the StorNext Client must be exactly the same as on the MDC. If the `fsnameservers` file does not exist, use a text editor to create it.

- Note:** The `fsnameservers` file needs to contain only the IP address(es) of the MDC(s).

9. Create a mount point for the file system. At the command prompt, type:

```
mkdir -p <mount point>  
chmod 777 <mount point>
```

where <mount point> is the directory path where you want the file system to be mounted. For example:
/stornext/snfs1

10. Configure the file system to automatically mount. For default mount options, at the command prompt, type:

```
crfs -v cvfs -d <file system> -a verbose=yes -a type=cvfs -A yes -m <mount point>
```

where <file system> is the name of the StorNext file system and <mount point> is the directory path created in [Step 9](#).

Or, if any mount options are required, type:

```
crfs -v cvfs -d <file system> -a verbose=yes -a options=<mount options> -a type=cvfs -A yes -m <mount point>
```

where <mount options> is a comma separated list. StorNext mount options are documented in the `mount_cvfs(8)` man-page.

The StorNext file system is mounted at the mount point you specified.

i Note: To manually mount a file system, at the command prompt, type:

```
mount <mount point>
```

i Note: where <mount point> is the directory path where you want the file system to be mounted.

11. Start the new StorNext client software. At the command prompt, type:

```
/etc/rc.cvfs start
```

Alternatively, you can reboot the system.

Additional Considerations

In Red Hat Enterprise Linux 7.x and SuSE Linux Enterprise Server 12.x clients, the `init.d(7)/service(8)` system service utilities have been replaced by the `systemd(1)/systemctl(1)` utilities.

The most notable difference is that the `systemctl(1)` utility does not write status output to the controlling TTY during start and stop operations. The user must run `systemctl status cvfs` after the start or stop request to view the status information.

Red Hat Enterprise Linux 7.x and SuSE Linux Enterprise Server 12.x clients provide a script in `/sbin/service` for convenience and compatibility that is simply a wrapper that calls the `systemctl(1)` command with appropriate arguments. Like `systemctl(1)`, the `service(8)` script will not write status output to the TTY during start and stop operations. The user must execute `/sbin/service cvfs status` to view the status information.

Additional kernel module verification is enabled in Red Hat Enterprise Linux 7.x and SuSE Linux Enterprise Server 12.x clients. Since StorNext is not shipped with a signed `cvfs` kernel module, an additional warning message will be seen in the `syslog` when the `cvfs` kernel module is loaded:

```
[44.915641] cvfs: module verification failed: signature and/or required key  
missing - tainting kernel
```

You can safely ignore the warning message.

Installing StorNext and StorNext FX Client Software on Windows

The StorNext setup wizard guides you through the process of installing the StorNext and StorNext FX client software on Windows machines.

If you did not install all StorNext components when you initially installed StorNext or wish to remove them later, you can add or remove components at any time (see [Adding or Removing StorNext Components on page 155](#)).

(Optional) After installation, restore the previous client configuration (see [Restoring a Previous StorNext or StorNext FX Client Configuration on page 157](#)). This is only necessary if you have performed a complete removal of StorNext. The StorNext and StorNext FX client configurations are fully maintained on upgrades from version 3.0 and later.

As new versions of StorNext are released, you can upgrade to a new version or reinstall (see [Upgrading or Reinstalling StorNext and StorNext FX Clients on page 159](#)).

i Note: You must log on as an Administrator to install StorNext.

If you are installing on Windows Vista, answer Yes to any messages asking if you want to run the installation process with administrative privileges.

To Install the StorNext or StorNext FX client on Windows:

1. Download the StorNext or StorNext FX client software from the MDC as described in [Downloading StorNext Client Software on page 131](#) or [Downloading StorNext FX Client Software on page 134](#).

i Note: If you are running SNFS-only on a Windows machine or have an Xsan MDC, you cannot download the StorNext nor StorNext FX client software from the MDC. Instead, you will need to obtain the StorNext or StorNext FX client software from the StorNext installation DVD. Copy one of the following files from the DVD and place it in an accessible location on the client system, then proceed to the next step.

- **fs_only/snfs_client_Windows_i386.zip** (for 32-bit systems)
- **fs_only/snfs_client_Windows_x86_64.zip** (for 64-bit systems)

2. If necessary, unzip the client software file you downloaded.
3. Open the unzipped folder and double-click the client software installer file. This file is named **SnfsSetup.exe**.

The **StorNext Installation** window appears ([Figure 73 below](#)).

Figure 73: StorNext Installation Window: Install StorNext



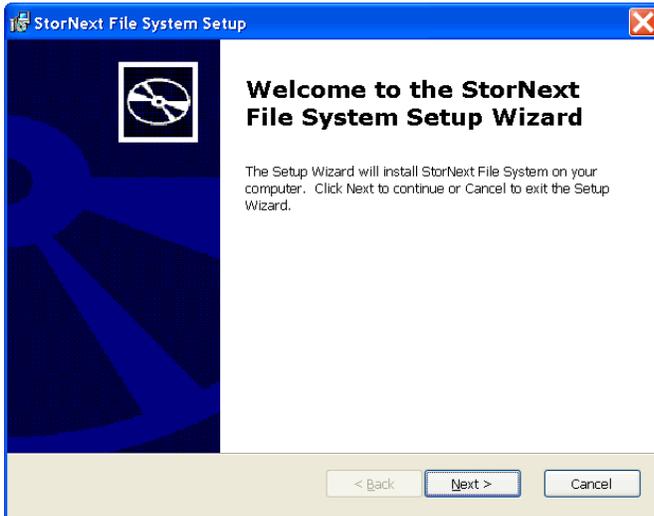
4. Click **Install StorNext** to begin installation.

The **StorNext File System License Agreement** window appears.

5. Read the license. If you agree to the terms, select “I accept the terms in the License Agreement” and click **Next** to continue the install.

The StorNext setup wizard launches ([Figure 74 on the next page](#)).

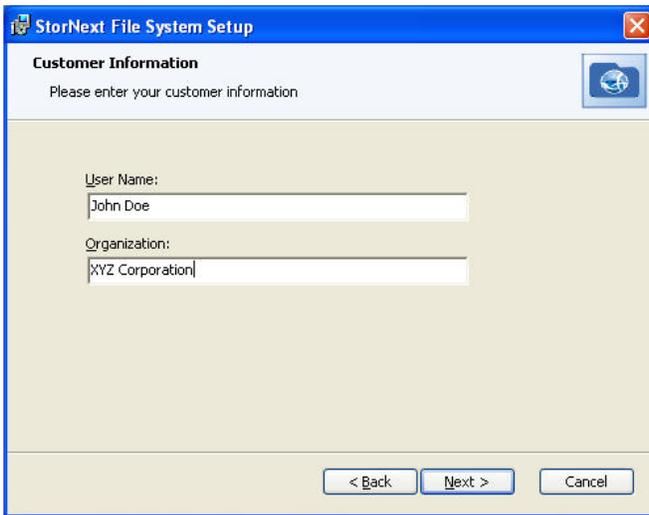
Figure 74: Client Setup: Setup Wizard



6. Click **Next** to continue.

The **Customer Information** window appears ([Figure 75 below](#)).

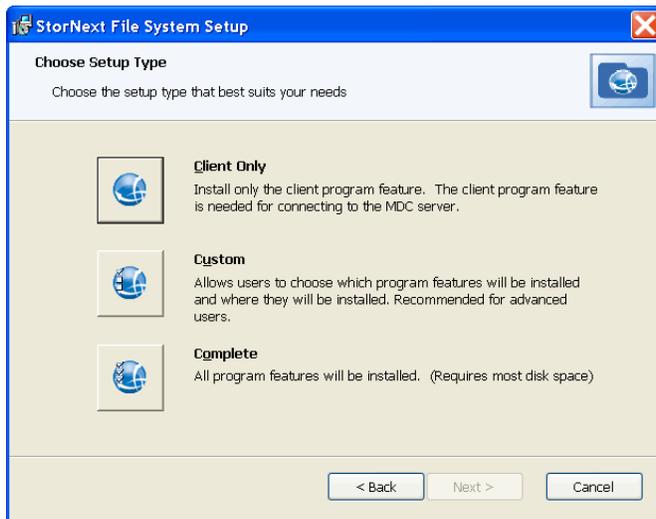
Figure 75: Client Setup: Customer Information



7. Type your name and the name of your company or organization in the boxes, and then click **Next** to continue.

The **Choose Setup Type** window appears ([Figure 76 on the next page](#)).

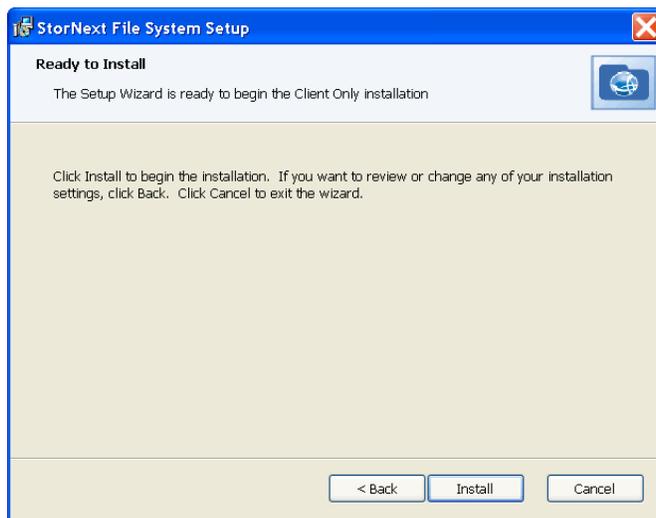
Figure 76: Client Setup: Choose Setup Type



8. Click one of the following installation options. Since this is a client-only install, you should select **Client Only** or **Custom**.
- **Client Only:** Installs the StorNext client software and help files in the default location (**C:\Program Files\StorNext**).
 - **Custom:** Lets you choose which components to install and specify an installation location. When ready, click **Next**.
 - **Complete:** All installable components will be installed in the default location (**C:\Program Files\StorNext**). Since this is a client-only install, only the client software and help files will be installed (the same as if you selected the **Client Only** option).

The **Ready to Install** window appears ([Figure 77 below](#)).

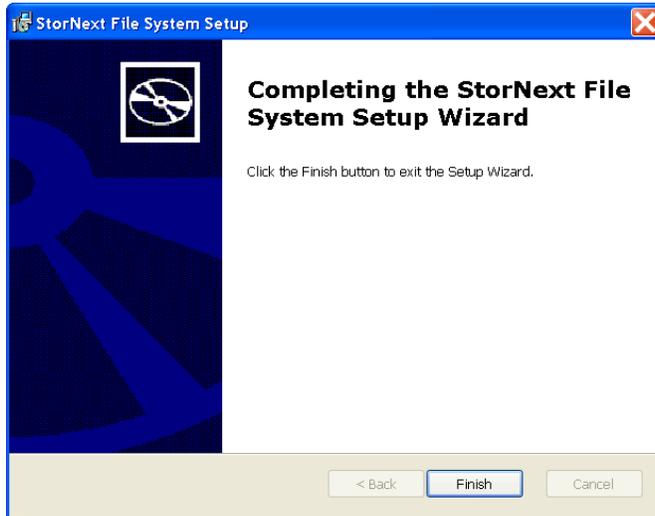
Figure 77: Client Setup: Ready to Install



9. Click **Install** to continue.

Wait while the setup wizard installs StorNext. When installation is complete, the **Finish** window appears ([Figure 78 below](#)). (It may take several minutes for the installation to finish.)

Figure 78: Client Setup: Finish



10. Click **Finish** to close the setup wizard.

The **Installation Complete** dialog box opens (see [Figure 79 below](#)).

Figure 79: Client Setup: Installation Complete



11. Click **OK** in the **Installation Complete** dialog box.

The **StorNext Installation** screen displays again with choices to Add/Remove Components, Remove StorNext, or Configure StorNext ([Figure 80 on the next page](#)).

Figure 80: Client Setup: Add/Remove Components



12. The installation is complete. Click one of the following options:

- **Add/Remove Components:** The components you selected during the install are already added, but if you changed your mind and want to select different components, you can do so now. See [Adding or Removing StorNext Components on page 155](#) for details.
- **Remove StorNext:** Removes StorNext file system. For more information, see [Removing StorNext Using the StorNext Software on page 175](#).
- **Configure StorNext:** Configures the StorNext or StorNext FX client. For more information, see [Configuring the StorNext and StorNext FX Client on Windows below](#).
- **Exit:** Exits without making any further changes at this time (you can always perform configuration later).

Configuring the StorNext and StorNext FX Client on Windows

Configuring StorNext and StorNext FX clients on Windows is similar to configuring a StorNext File System, but with more limited configuration options.

i Note: For StorNext or StorNext FX clients on Windows, copy the `.auth_secret` file from the Xsan MDC to the following directory on the Windows system:

```
c:/Program Files/StorNext/config/.auth_secret
```

To configure the StorNext or StorNext FX client software on Windows operating systems, use the Windows configuration utilities.

The following tools are provided with the StorNext Configuration utility, which is accessible from the StorNext Installation program:

- **Name Servers:** Configure StorNext name servers.
- **Import/Export Client Settings:** Import or export StorNext registry settings from or to a file.
- **Client Configuration:** Configure drive mappings and other StorNext client options.

Additional tools are accessible from the Windows **Start** menu (see [Additional Windows Configuration Utilities on the next page](#)).

Important StorNext FX Client-only Procedure

For StorNext FX clients **ONLY**, copy the **.auth_secret** file from the Xsan MDC to c:/Program Files/StorNext/config/ on the client system.

Accessing the Configuration Utility

1. Open the **StorNext Installation** window by double-clicking the file named **SnfsSetup32.exe** (32-bit systems) or **SnfsSetup64.exe** (64-bit systems).

The **StorNext Installation** window displays appears ([Figure 81 below](#)).

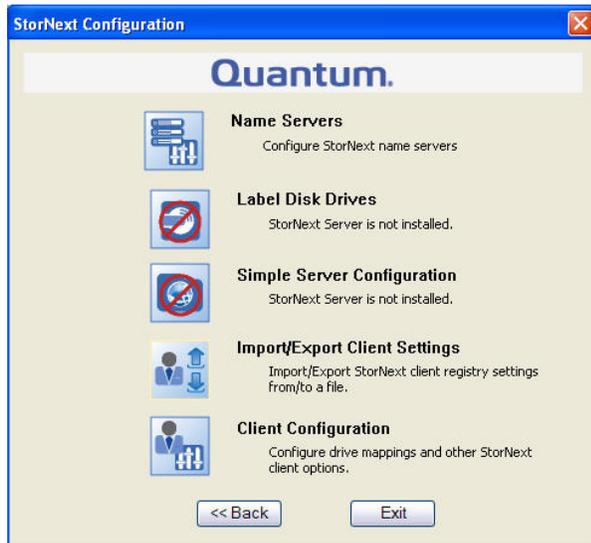
Figure 81: StorNext Installation Window: Upgrade/Reinstall StorNext



2. Click **Configure StorNext**.

The **StorNext Configuration** screen appears ([Figure 82 on the next page](#)).

Figure 82: StorNext Configuration



3. Click one of the following options:

- **Name Servers:** This feature is described in [Configuring Name Servers on page 80](#).
- **Import/Export Client Settings:** This feature is described in [Restoring a Previous StorNext or StorNext FX Client Configuration on page 157](#).
- **Client Configuration:** This feature is described in [Configuring the Client on page 93](#).

Additional Windows Configuration Utilities

The following additional configuration utilities are accessible from the Windows **Start** menu (**Start > All Programs > StorNext File System**).

For instructions on using any of these utilities, see the online help accessible from **Start > All Programs > StorNext File System > StorNext Help**.

- **License Identifier:** Use this utility to display the host license identifier. The host license identifier is required to obtain a permanent license for StorNext. For details, see [Retrieving the Host License Identifier on page 78](#).
- **Services Start:** Use this utility to start all StorNext services on an MDC or StorNext client. For details, see [Starting File System Services on page 104](#).
- **Services Stop:** Use this utility to stop all StorNext services on an MDC or StorNext client. For details, see [Stopping File System Services on page 104](#).
- **Services Stop and Remove:** Use this utility to stop all StorNext services on an MDC or StorNext client, and also remove registry entries that automatically start the services on bootup. For details, see [Stopping and Removing File System Services on page 104](#).
- **StorNext Help:** View StorNext help for these utilities and other commands.

- **Version Information:** View information about the currently installed version of the StorNext server and/or client software, such as the version number, build number, and platform. For details, see [Obtaining Version Information on page 104](#).

Adding or Removing StorNext Components

After installing the StorNext or StorNext FX client, you may wish to add or remove components. If you installed the client only, you can add or remove the online help files or the StorNext or StorNext FX client.

1. If you just completed installing the client, the **StorNext Installation** window displays ([Figure 83 below](#)). The components you selected during the install are already added, but if you changed your mind and want to select different components, you can do so now.

Figure 83: StorNext Installation Window: Add/Remove Components



If you previously installed StorNext and would like to add or remove components, display the **StorNext Installation** window by double-clicking the file named **SnfsSetup32.exe** (32-bit systems) or **SnfsSetup64.exe** (64-bit systems). Note that the screen is slightly different from [Figure 83 above](#): instead of **Add/Remove Components**, the button you need to click is called **Upgrade/Reinstall StorNext** (see [Figure 84 on the next page](#)).

Figure 84: StorNext Installation Window: Upgrade/Reinstall StorNext



2. Click **Add/Remove Component** or **Upgrade/Reinstall StorNext**, depending on which screen you are looking at.

The **Component Selection** screen appears ([Figure 85 below](#)).

Figure 85: Component Selection



3. Select the check boxes of the components you want to add. Clear the check boxes of the components you want to remove. Click **Next** to proceed.

The StorNext EULA appears.

4. Read and accept the EULA by selecting "I accept the terms in the License Agreement" and clicking **Next**.

It may take several minutes for the selected components to finish being added or removed.

5. When a message informs you that the process is complete, click **OK**.
6. Click **Exit**.

Restoring a Previous StorNext or StorNext FX Client Configuration

StorNext and StorNext FX client configuration files are automatically saved when you remove StorNext, or can be manually saved for backup purposes.

If you want to restore a saved a client configuration file, you can import it using the StorNext Installation tool. This configures StorNext using the settings from a previous installation.

1. Start the StorNext installation tool if it is not already running by double-clicking the file named **SnfsSetup32.exe** (32-bit systems) or **SnfsSetup64.exe** (64-bit systems). (See [Step 1](#) and [Step 2](#) of [Installing StorNext and StorNext FX Client Software on Windows on page 147.](#))

The **StorNext Installation** window appears ([Figure 86 below](#)).

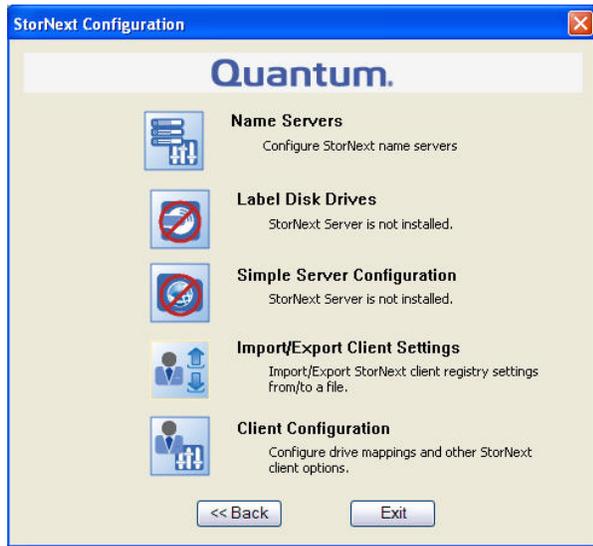
Figure 86: StorNext Installation Window: Configure StorNext



2. Click **Configure StorNext**.

The **StorNext Configuration** window appears ([Figure 87 on the next page](#)).

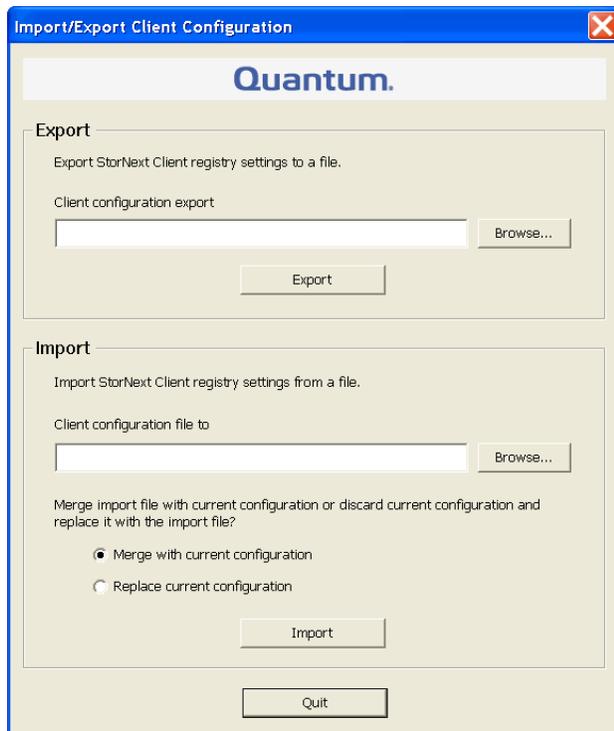
Figure 87: StorNext Configuration Window



3. Click **Import/Export Client Settings**.

The **Import/Export Client Configuration** window appears ([Figure 88 below](#)).

Figure 88: Import/Export Client Configuration Window



4. Under **Import**, click **Browse**. Locate the client configuration (*.reg) file to import, and then click **Open**.

Client configuration files saved during removal of a previous version of StorNext are located in the following directory by default:

C:\Program Files\StorNext\config

5. Click an option for handling current configuration settings:
 - **Merge with current configuration:** The imported configuration is merged with the current configuration settings. Imported mount information is added to, or overwrites, existing information.
 - **Replace current configuration:** The current mount information is completely removed and replaced by the imported configuration.
6. Click **Import**, and then click **Yes** to confirm.

A message appears informing you the configuration settings were successfully added to the registry.
7. Click **OK**, and then click **Quit** to close the **Import/Export Client Configuration** window.

Upgrading or Reinstalling StorNext and StorNext FX Clients

The **Upgrade/Reinstall** button allows you to upgrade to a new version of StorNext or StorNext FX client software, or reinstall the current version. You might want to reinstall if you accidentally removed some components and need to get them back. During an upgrade/reinstall, the old software is removed and the new software is installed. Your previous configuration settings remain intact.

1. To upgrade or reinstall a StorNext or StorNext FX client after the initial installation, download the new client software from the MDC as described in [Downloading StorNext Client Software on page 131](#).

Exception: If you are running SNFS-only on a Windows machine, you cannot download the client software from the MDC. Instead, you will need to obtain the client software from the StorNext installation DVD. Copy one of the following files from the DVD and place it in an accessible location on the client system, then proceed to the next step.

- **fs_only/snfs_client_Windows_i386.zip** (for 32-bit systems)
 - **fs_only/snfs_client_Windows_x86_64.zip** (for 64-bit systems)
2. If necessary, unzip the client software file you downloaded.
 3. Open the unzipped folder and double-click the client software installer file. This file is named **SnfsSetup32.exe** (32-bit systems) or **SnfsSetup64.exe** (64-bit systems).

The **StorNext Installation** screen appears ([Figure 89 on the next page](#)).

Figure 89: StorNext Installation Window: Upgrade/Reinstall StorNext



4. Click **Upgrade/Reinstall StorNext**.

The **StorNext Component Selection** window appears ([Figure 90 below](#)).

Figure 90: Component Selection



5. Select the check boxes of the components you want to include in the upgrade. Clear the check boxes of the components you want to exclude. Click **Next** to proceed.

The StorNext EULA appears.

6. Read and accept the EULA by selecting "I accept the terms in the License Agreement" and then clicking **Next**.

It make take several minutes for the selected components to finish being added or removed.

7. When a message informs you that the installation is finished, click **OK**.



Chapter 6: Configuring LAN Clients and Gateway Servers

This chapter contains the following topics:

Configuring LAN Clients and Gateway Servers	161
Configuring a StorNext LAN Client on Linux	162
Configuring a Gateway Server on Linux	163
Linux LAN Clients or Gateway Servers in HA Environments	166
Configuring LAN Clients or Gateway Servers on Windows	166
Configuring Gateway Functionality on an MDC	166

Configuring LAN Clients and Gateway Servers

Linux or Windows StorNext clients can be configured as LAN (local area network) clients or gateway servers (including the StorNext G300 Gateway Appliance and the M660 Metadata Appliance). The StorNext G300 is a dedicated gateway server. The M660 is a meta-data controller (MDC) that can be configured as a gateway server (in non-Lattus systems only).

Traditional StorNext SAN clients access data storage (hard disk drives) in the SAN using a high throughput, low-latency fibre channel connection. In addition to this fibre channel connection, StorNext also provides access for LAN clients through a StorNext G300 or M660, or SAN client configured as a gateway for those LAN clients. In this environment, StorNext LAN clients access data disks over a network instead of directly accessing disks on the SAN.

A StorNext client running on Linux or Windows can be configured as a LAN client or a gateway. (This is a licensed feature.)

- **Gateway:** A gateway is a StorNext client which has direct access to data disks (using fibre channel) on the SAN and makes the shared storage pool available to LAN clients over a LAN connected to that gateway.
- **LAN Client:** A LAN client cannot have direct access to data disks and instead accesses the shared storage pool by connecting to a gateway over a network (LAN clients have full StorNext client functionality).

i Note: If the `diskproxy` option is set to `client`, then the mount may use a Proxy Server to do its data I/O. If the host has SAN connectivity to some or all of the disks in the file system, then those disks will be accessed via the SAN connection, not the network. This client is then referred to as a disk proxy hybrid client. When SAN connectivity is used, the server license on the MDC will be charged for this mount. If it is desired that this client use the network for the mount, then the disks should be made unavailable to this host or the `cvpaths` file should be configured to prevent StorNext from using the directly attached disks. The `who` subcommand of `cvadmin` shows the type of proxy mount.

i Note: A StorNext client configured as a gateway requires a dedicated system. Do not run other applications or services on a system configured as a gateway.

i Note: Do not enable gateway functionality for MDCs connected to Lattus systems. While there are no functional issues in enabling the LAN gateway functionality within a Lattus environment, observed throughput when moving data to Lattus through the 10GbE ports will be slower than expected if this feature is enabled.

This topic covers:

- [Configuring a StorNext LAN Client on Linux below](#)
- [Configuring a Gateway Server on Linux on the next page](#)
- [Linux LAN Clients or Gateway Servers in HA Environments on page 166](#)
- [Configuring LAN Clients or Gateway Servers on Windows on page 166](#)
- [Configuring Gateway Functionality on an MDC on page 166](#)

Configuring a StorNext LAN Client on Linux

To configure a StorNext client as a StorNext LAN client, edit mount options in the `/etc/fstab` file.

1. Stop the StorNext client. At the command prompt, type:

```
/etc/init.d/cvfs stop
```

2. Configure the client to mount a file system as a LAN client. To do this, edit the `/etc/fstab` file so that it contains the following line:

```
<file_system> <mount_point> cvfs rw,diskproxy=client 0 0
```

where **<file_system>** is the name of the StorNext file system and **<mount_point>** is the directory path where the file system is mounted.

3. Start the StorNext client. At the command prompt, type:

```
/etc/init.d/cvfs start
```

Configuring a Gateway Server on Linux

To configure a StorNext SAN client as a gateway server, edit mount options in the **/etc/fstab** file, and then configure gateway server options.

i Note: The StorNext G300 and M660 come pre-configured as gateways. Do not use these commands to configure those systems.

1. Stop the StorNext SAN client. At the command prompt, type:

```
/etc/init.d/cvfs stop
```

2. Configure the client to mount a file system as a gateway. To do this, edit the **/etc/fstab** file so that it contains the following line:

```
<file_system> <mount_point> cvfs rw,diskproxy=server 0 0
```

where **<file_system>** is the name of the StorNext file system and **<mount_point>** is the directory path where the file system is mounted.

3. Change to the **/usr/cvfs/bin/** directory.
4. Launch the StorNext gateway configuration utility. At the command prompt, type:

```
./sndpscfcfg -e
```

i Note: To get help for the **sndpscfcfg** utility, at the command prompt, type: **./sndpscfcfg -h**

The gateway configuration utility appears ([Figure 91 on the next page](#)).

Figure 91: sndpscfg Configuration Utility

```
# Disk Proxy Server Configuration
# -----

# =====
# Tunable Parameters
# =====

# Un-comment and modify any of the following lines to override the default
# values for tunable parameters.
#tcp_window_size_kb 64
#transfer_buffer_size_kb 256
#transfer_buffer_count 16
#server_buffer_count 8
#daemon_threads 8

# =====
# Interface Configuration
# =====

# One or more interfaces must be configured for Disk Proxy Server I/O.

# Un-comment one (and only one) of the 2 lines below to allow Disk Proxy
# Server I/O on interface 'eth0' and to select the address to listen for
# connections on.
#interface eth0
interface eth0 address fec0::215:f2ff:fe68:afa2
```

5. Edit the default gateway configuration:

- (Required) Uncomment (delete the # next to) the line that corresponds to the network interface used by the gateway server when connecting to LAN clients. (For best performance, do not choose the network used for metadata.)
- (Optional) To change a tunable parameter from the default value, uncomment the parameter, and then specify a new value. [Table 1 below](#) describes the tunable parameters.

Note: The gateway configuration utility uses the default text editor. If a default text editor has not been specified, the utility uses the vi editor.

Table 1: Gateway Parameters

Field / Button	Description
tcp_window_size_kb	The TCP window size (in KB) used by the gateway server. (Default: 64)
transfer_buffer_size_kb	The transfer buffer size (in KB) used by the gateway server. A larger buffer may increase performance for larger files. (Default: 256)
transfer_buffer_count	The number of transfer buffers used by the gateway server. This parameter is used only by Windows servers and clients. Linux servers pass the value of this parameter to Windows clients. (Default: 16)
server_buffer_count	The number of I/O buffers allocated for each network interface on the gateway server. This parameter is used only by Linux servers. (Default: 8)
daemon_threads	The maximum number of daemon threads used by the gateway server. (Default: 8)

6. When you are done making edits, type :x to save and close the configuration file.

The configuration is saved in the file **dpserver** in the **/user/cvfs/config/** directory.

i Note: To edit this file at a later date, you can run the **sndpscfcg** utility again or edit the **dpserver** file directly.

7. Start the StorNext SAN client, which is now functioning as a gateway server. At the command prompt, type:

```
/etc/init.d/cvfs start
```

Creating an Override Configuration

By default, the settings specified in the **dpserver** configuration file are used for all file systems mounted by the gateway server. To use different settings for a file system, create an override configuration file for that file system. At the command prompt, type:

```
/usr/cvfs/bin/sndpscfcg -E <file_system>
```

where **<file_system>** is the name of the file system to which the override settings apply. Edit the configuration file, and then save and exit. A new configuration file with the name **dpserver. <file_system>** is created in the **/user/cvfs/config/** directory.

Using LAN Client and Server Commands

Use the **cvadmin** commands described in [Table 2 below](#) to see information about gateway servers and LAN clients. (For more information about using **cvadmin** commands, see the *MAN Pages Reference Guide*.)

Table 2: LAN Client and Gateway Server Commands

Command	Description
proxy	Lists all gateway servers for the currently selected file system.
proxy long	Lists all gateway servers for the currently selected file system, as well as tunable parameters and attached disks.
proxy who <LAN_client>	Lists gateway servers connected to the specified LAN client, as well as current I/O statistics.
proxy who <gateway_server>	Lists LAN clients connected to the specified gateway server, as well as current I/O statistics.

Linux LAN Clients or Gateway Servers in HA Environments

When a StorNext High Availability (HA) configuration is used and the StorNext LAN Client/Gateway Server feature is configured on the HA server nodes, each node in the HA pair should be configured separately and independently. This allows for the best and highest availability of the LAN client capability.

Ideally, each node in the HA pair should have the same number of network interfaces and be on the same networks. The dpserver configuration should be done before converting an MDC pair into an HA pair.

When deduplication/replication is enabled, Virtual IPs (VIPs) are configured and applied to the active blockpool server. In such a setting, the network interface(s) with VIP configured can potentially have more than one IP addresses (physical and virtual IPs). If such an interface is also used for a LAN client, use the interface with the physical IP address to specify the network interface.

Configuring LAN Clients or Gateway Servers on Windows

To configure a Windows client as a gateway server or a LAN client, use the Windows Client Configuration utility (see [Configuring LAN Clients and Gateway Servers on page 96](#)).

Configuring Gateway Functionality on an MDC

The StorNext M660 Metadata Appliance and appropriately provisioned Metadata Controllers (MDCs) can be configured to also operate as a LAN gateway. The following instructions describe the steps to configure gateway functionality on MDCs.

i Note: Do not enable gateway functionality for M662s connected to Lattus systems. While there are no functional issues in enabling the LAN gateway functionality within a Lattus environment, observed throughput when moving data to Lattus through the 10GbE ports will be slower than expected if this feature is enabled.

Enable Gateway Functionality on an MDC

To enable gateway functionality:

1. Log on to the primary and, if applicable, secondary nodes using as the “**stornext**” user with the default password of **password**.
2. Run the **sudo rootsh** command to gain root access.
3. At the command prompt, type:

```
/usr/cvfs/bin/sndpscfcg -e
```

4. Select an appropriate interface and set tuning parameters. This creates or updates **/usr/cvfs/config/dpserver**.

i Note: This must be done on both the primary and secondary nodes, if applicable. This file is not synchronized from the primary to the secondary node.

5. For HA pairs, update the **/usr/cvfs/config/sngateway_config** file so that both files include the IP address of both MDC nodes.
6. On the primary node, edit the **/etc/fstab** file. Add the following to the mount option on the file system to be used as the gateway:

```
diskproxy=server
```

For example, the file system mount option:

```
snfs1 /stornext/snfs1 cvfs rw 0 0
```

Becomes:

```
snfs1 /stornext/snfs1 cvfs rw,diskproxy=server 0 0
```

i Note: If the file system being configured is a managed file system, stop the TSM processes before unmounting the file system. At the command prompt, type:

```
TSM_control stop
```

i Note:

7. On the primary node, un-mount and re-mount the file system.

At the command prompt, type:

```
umount /stornext/snfs1  
mount snfs1
```

8. If Gateway functionality is being configured on a single-node MDC continue to [Step 12](#). Otherwise continue on with the next steps to complete the configuration on the secondary MDC node.
9. On the secondary node, wait for the **/etc/fstab** change to synchronize with the primary node. It should take less than two minutes for the change to appear in this file.

10. When you see **diskproxy=server** change in the **fstab** file on the secondary, un-mount and re-mount the file system on the secondary.
11. Run the mount command with no parameters on both the primary and secondary nodes. Verify that the file system is mounted and that the **diskproxy=server** mount option is present.

Example output:

```
/dev/cvfsctl2_snfs1 on /stornext/snfs1 type cvfs  
(rw,diskproxy=server,sparse=yes)
```

12. If the TSM processes were stopped, restart the TSM process from the primary MDC. At the command prompt, type:

```
TSM_control start
```

Disabling Gateway Functionality on an MDC

To disable gateway functionality on these devices:

1. Log into the primary MDC node, and, if applicable, the secondary MDC node as root.
2. On the primary node, edit the **/etc/fstab** file. Remove the following from the mount option on the file system to be used as the gateway:

```
diskproxy=server
```

For example, the file system mount option:

```
snfs1 /stornext/snfs1 cvfs rw,diskproxy=server 0 0
```

Becomes:

```
snfs1 /stornext/snfs1 cvfs rw 0 0
```

- i Note:** If the file system being configured is a managed file system, stop the TSM processes before unmounting the file system. At the command prompt, type:

```
TSM_control stop
```

i Note:

3. On the primary node, un-mount and re-mount the file system.

At the command prompt, type:

```
umount /stornext/snfs1  
mount snfs1
```

4. If Gateway functionality is being removed from a single-node MDC continue to [Step 8](#). Otherwise continue on with the next steps to complete the configuration on the secondary MDC node.
5. On the secondary node, wait for the **/etc/fstab** change to synchronize with the primary node. It should take less than two minutes for the change to appear in this file.
6. When you see **diskproxy=server** removed from the fstab file on the secondary, un-mount and re-mount the file system on the secondary.
7. Run the mount command with no parameters on both the primary and secondary nodes. Verify that the file system is mounted and that the **diskproxy=server** mount option has been removed.

Example output:

```
/dev/cvfsctl2_snfs1 on /stornext/snfs1 type cvfs (rw,sparse=yes)
```

8. If the TSM processes were stopped, restart the TSM process from the primary MDC. At the command prompt, type:

```
TSM_control start
```



Appendix A: Uninstalling StorNext

This appendix contains the following topics:

Uninstalling StorNext

If you no longer need to use StorNext, uninstall the software to remove it from your system. To uninstall StorNext, use the appropriate method for your operating system:

- [Uninstalling StorNext on Linux below](#)
- [Uninstalling StorNext on Windows on page 174](#)

Uninstalling StorNext on Linux

To uninstall StorNext on a Metadata Controller (MDC), use the installation script (see [Uninstalling SNSM and SNFS on the next page](#)).

To uninstall the StorNext client software, use the appropriate method for your operating system (see [Uninstalling the StorNext Client Software on page 172](#)).

Uninstalling SNSM and SNFS

To uninstall StorNext File System and Storage Manager on an MDC running Unix or Linux, run the installation script with the **-remove** or **-removeall** option. To launch the script, access the folder for your operating system on the StorNext installation DVD.

1. Log on to the MDC as **root**.
2. Mount the StorNext installation DVD and change to the DVD root directory.

i Note: When you mount a DVD in a Red Hat 5 system, DVDs are mounted by default with a `noexec` (non-executable) option which prevents you from proceeding with the installation.

For Red Hat users only, before proceeding you must remount the DVD by typing

```
mount -o remount, exec ...
```

i Note:

3. List the installation directories on the DVD. At the command prompt, type:

```
ls -l
```

4. Identify the correct installation directory for your operating system and hardware platform, and then change to that directory.

For example, for Red Hat Linux 5 running on an x86 64-bit platform, change to the **RedHat50AS_26x86_64** directory.

5. Do one of the following steps:
 - (Recommended) Completely uninstall StorNext and return the system to a pristine state. At the command prompt, type:

```
./install.stornext -removeall
```

- Uninstall StorNext binaries but leave files that are useful if you are going to perform an HA upgrade (such as license files, some configuration files, and log files). At the command prompt, type:

```
./install.stornext -remove
```

The installation script runs ([Figure 92 on the next page](#)).

Figure 92: StorNext Remove Main Menu

```
Stornext Remove          MAIN MENU
[U.S. Pat. No. 5,990,810]

1) Installation Configuration
2) Remove stornext
3) Show Status
4) Quit

Enter your choice <4>: 
```

6. Type **2** and press **<Enter>**.

Uninstalling the StorNext Client Software

To uninstall the StorNext client software, unmount all file systems and stop StorNext software. Then remove the client software package using the appropriate command for your operating system.

i Note: This procedure removes the client software only. To uninstall StorNext File System and Storage Manager, see [Uninstalling SNSM and SNFS on the previous page](#).

1. Unmount all file systems. To unmount a file system, at the command prompt, type:

```
umount <mount_point>
```

where **<mount_point>** is the location where the file system is mounted.

2. Stop the StorNext client software. At the command prompt, type:

- **HP-UX:**

```
/sbin/init.d/cvfs fullstop
```

- **IBM AIX:**

```
/etc/rc.cvfs fullstop
```

- **Solaris:**

```
/usr/cvfs/bin/cvfs fullstop
```

- **Others:**

```
/etc/init.d/cvfs fullstop
```

3. Remove the StorNext software packages using the correct commands for your operating system.

- Red Hat and SUSE Linux:

```
rpm -e <package_names>
```

where <package_names> are the names of the client software packages that were installed.

- **Debian and Ubuntu Linux:**

```
dpkg -P <package_names>
```

where <package_names> are the names of the client software packages that were installed.

- **Solaris:**

```
pkgrm ADICsnfs
```

- **HP-UX:**

```
swremove -x mount_all_filesystems=false snfsclient
```

- **IBM AIX:**

```
installp -u <package_name>
```

where <package_name> is the name of the client software package that was installed.

- **SGI IRIX:**

```
Inst  
remove cv_base  
remove cv_clnt  
go
```

i Note: If you do not know the package name, you can download the client software for your operating system and check the package name (see [Downloading StorNext Client Software on page 131](#)).

Uninstalling a StorNext RPM Server (SNFS server-only)

To uninstall the SNFS-only Server install, unmount all file systems and stop the SNFS software. Then remove the SNFS software package using the rpm command.

i Note: This procedure only removes the RPM software. To uninstall StorNext File System with Storage Manager, see [Uninstalling SNSM and SNFS on page 171](#).

1. Unmount all SNFS file systems using the following at the command prompt:

```
umount <mount_point>
```

where <mount_point> is the location where the file system is mounted.

2. Stop the StorNext client software. At the command prompt, type:

```
/etc/init.d/cvfs fullstop
```

3. Remove the StorNext software package using the following commands:

```
rpm -e <package_names>
```

where <package_names> are the names of the client software packages that were installed.

Uninstalling StorNext on Windows

There are two ways to uninstall StorNext (server or client) on Windows:

- [Removing StorNext Using the StorNext Software on the next page](#)
- [Uninstalling Via the Windows Control Panel on the next page](#)

Either way will remove all installed StorNext components from your system, but will save the previous client configurations, debug file, and RAS files. All of the saved files are located in:

C:\Program Files\StorNext\config\

i Note: Systems prior to StorNext 3.0 used the default directory C:\SNFS\config\.

Removing StorNext Using the StorNext Software

To remove StorNext using the StorNext software:

1. Start the StorNext installation tool if it is not already running by double-clicking the file named **SnfsSetup32.exe** (32-bit systems) or **SnfsSetup64.exe** (64-bit systems).

The **StorNext Installation** window appears ([Figure 93 below](#)).

Figure 93: StorNext Installation Window: Remove StorNext



2. Click **Remove StorNext**.
3. Click **OK** to confirm you want to remove StorNext and all of its components.
A dialog box informs you that the current client configuration has been saved and lists the location. You can use this to restore the client configuration later if you wish.
4. Note the name and location of the saved configuration file, and then click **OK**.
5. If prompted, click **Yes** to continue, and then click **OK** to finish the removal.
6. When the removal is complete, you will be notified that you must reboot for the change to take effect. Click **Yes** to reboot the system immediately, or **No** to reboot later.

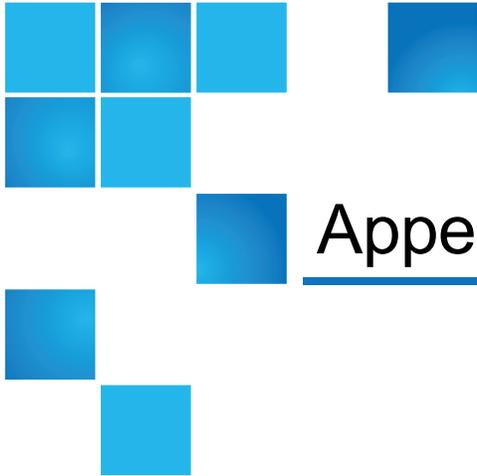
Uninstalling Via the Windows Control Panel

To uninstall StorNext (server or client) on a Windows system, use the **Add or Remove Programs** feature located on the Windows Control Panel. (On Windows Vista, Windows Server 2008 and later, the Control Panel feature is called **Programs and Features**.)

1. Open the Windows Control Panel.
2. Double-click **Add or Remove Programs** (or **Programs and Features** on Windows Vista or Windows Server 2008 and later).

The **Add or Remove Programs** (or **Programs and Features**) window appears.

3. In the list of currently installed programs, click **StorNext File System**, and then click **Remove**.
4. Click **Yes** to confirm the removal.
5. After the uninstall process is complete, reboot the system.



Appendix B: Administration Tasks

This appendix contains the following topics:

Administration Tasks

Use the following information to perform specific file system configuration tasks that do not apply to a typical StorNext set up.

This topic covers:

- [Sharing a Library Between Applications \(Linux Only\) on the next page](#)
- [Manually Modifying Storage Manager Configuration on page 179](#)
- [Connecting Xsan Clients to StorNext MDCs on page 180](#)
- [Viewing a Fibre Channel Device on page 188](#)
- [StorNext Log Rolling Administration on page 188](#)
- [Avoiding Poor System Performance on page 189](#)

Sharing a Library Between Applications (Linux Only)

If two or more software applications (on one or multiple machines), are configured to use the same library, then you must use the following procedure to enable the library to be shared and to prevent media being overwritten when these applications are used. This task must be performed when the Configuration Wizard (CW) is run during initial StorNext setup and configuration. For more information on using the CW, see [Using the StorNext Configuration Wizard on page 40](#).

⚠ Caution: Quantum strongly recommends using library partitioning features to present each application using the library with its own virtual library. Unless partitioning is used, two applications sharing the robot arm, drives and slots may over-write each others data.

Use the following instructions *only* if library partitioning is not an option.

i Note: For library sharing to be effective, the steps in the following procedure must be performed in the order in which they are presented.

You must have root privileges to perform this task.

1. When you match hardware devices to their correct slots on the **Matched Devices With Slots** screen (you will see this screen during the execution of Step 4 of the Configuration Wizard, **Add Tape Drive**), only configure the tape drives that StorNext will use. You do not need to configure all tape drives listed as part of the library.
2. Once the tape drives are added and configured in Step 4 of the CW (**Add Tape Drive**), but before continuing to Step 5 of the CW (**Add Media**), go to a Metadata Controller and perform these steps:

- a. Change directory to the **config** directory. Type:

```
cd /usr/adic/MSM/internal/config
```

- b. List all files in the config directory. Type:

```
ls -l
```

- c. Using a text editor, edit the **media_file_<library_name>** file. For example:

```
vi media_file_<Library_name>
```

The **media_file** contains a filter for barcode labels that are read by StorNext. In the example above, **<Library_name>** is the library that was configured in Step 3, **Add Library**, of the CW.

- d. Set up the pattern matching of the media file.

Multiple entries may exist in the media file. Read the examples in the file to learn how to set up pattern matching.

These are examples of pattern matching:

scsi_archive 1111.. (brings in all media with the 1111 prefix)

scsi_archive AB9... (brings in all six-character media labels with the AB9 prefix)

scsi_archive CLN1.. (brings in all media that have the CLN1 prefix)

3. Continue to the **Add Media section of the Configuration Wizard**.

⚠ Caution: After this procedure is done, StorNext will not use other media, but other applications may try to overwrite StorNext media. To avoid data loss, be sure you configure the other application to prevent overwriting StorNext data.

Manually Modifying Storage Manager Configuration

StorNext employs global parameters that define the Storage Manager configuration. Although the default values in these files are sufficient for most installations, you can edit the files to customize the StorNext software for your specific installation. This section provides a procedure that can be used to modify the following StorNext configuration files:

- `/usr/adic/TSM/config/fs_sysparm_override`
- `/usr/adic/TSM/config/filesize.config`
- `/usr/adic/TSM/logs/log_params`

fs_sysparm_override Configuration File

The **fs_sysparm_override** configuration file is used to tune items related to system administration, drives and media, media manager interface, and other miscellaneous items. For more information about the parameters that can be placed into the **fs_sysparm_override** configuration file, refer to the **fs_sysparm.README** file.

⚠ Caution: Incorrect modification of the **fs_sysparm_override** configuration file can cause a serious, adverse effect on StorNext functionality. Before modifying this file, Quantum recommends that you contact Quantum Global Services.

⚠ Caution: If you have files larger than 100GB and are using LTO2 media, the `MED_SEG_OVER_LTO` parameter may be modified to a value less than or equal to 190G to reduce file fragmentation. This has the adverse effect of reducing the potential for parallel I/O for multiple file segments. Setting the `MED_SEG_OVER_LTO` parameter to a value larger than 190GB may result in allocation failures that prevent file movement to tape.

filesize.config Configuration File

The **filesize.config** configuration file is used to control the file steering feature and has these characteristics:

- Allows the placement of files on different media types, based on the size of the files
- Specifies which drive pool a policy class should use when storing data
- Contains specific syntax and usage information
- Enables the system administrator to make changes without recycling the Tertiary Manager software
- Read the instructions in the `filesize.config.default` file for usage and syntax information.

log_params Configuration File

The **log_params** configuration file is used to control various levels of trace logging. The file specifies each log level and how to enable and/or disable it.

Use the following procedure to modify the **fs_sysparm_override**, **filesize.config**, or **log_params** configuration files.

1. Use a text editor to open one of the following configuration files:
 - `/usr/adic/TSM/config/fs_sysparm_override`
 - `/usr/adic/TSM/config/filesize.config`
 - `/usr/adic/TSM/logs/log_params`
2. Locate the parameter you want to modify and replace the setting with a new, valid value.
When editing a file, be sure to follow the format used by entries in the file. For example, in the **fs_sysparm_override** **log_params** files, all entries must be in the format: **name=value;**
3. Restart the Tertiary Manager software.
 - a. Stop the software by typing **TSM_control stop**
 - b. Restart the software by typing **TSM_control start**

Connecting Xsan Clients to StorNext MDCs

Requirements

In order to connect Xsan Clients to StorNext MDCs, ensure the following:

- StorNext MDCs and Xsan clients must be connected to the same SAN and be able to see the same LUNs
- StorNext MDCs must have **license.dat** file in the configuration directory of the system.

For Linux MDCs, the configuration directory is:

```
/usr/cvfs/config/
```

For Windows MDCs, the configuration directory is:

```
C:\Program Files\StorNext\config\
```

- If the system configuration includes both Xsan and StorNext MDCs, and Xsan clients, **ALL** machines in the configuration must have the identical **.auth_secret** file. However, if the only MDCs in use are StorNext MDCs, the **.auth_secret** files should be removed from the Xsan clients, the StorNext clients, and the MDCs.
- The **fsnameservers** file must be identical on all StorNext MDCs, StorNext and StorNext FX clients, and Xsan clients.

Mounting the StorNext File System on Xsan 4.1

To connect Xsan 4.1 clients to StorNext MDCs:

1. Generate a configuration profile:

```
mdc# cd /usr/cvfs/config  
mdc# /usr/cvfs/lib/make_profile mysan
```

2. Copy the resultant profile to the Xsan 4.1 client:

```
mdc# scp mysan.configprofile root@xsan41client:/tmp
```

3. Remove any existing Xsan profiles from the client:

```
xsan41client$ sudo profiles -L | grep com.apple.xsan | awk '{print $NF}' >  
/tmp/oldprofiles  
xsan41client$ for i in `cat /tmp/oldprofiles`; do sudo profiles -R -p $i; done
```

4. Install the new profile:

```
xsan41client$ cd /tmp  
xsan41client$ sudo profiles -I -F mysan.configprofile
```

5. Restart Xsan:

Note: On a new Xsan 4.1 driver installation, an Xsan client may not have been loaded and an error will be displayed when you execute **launchctl unload**. Quantum recommends you verify a driver is loaded and skip the unload step if the driver is not loaded.

When the Xsan client is loaded using the command **launchctl load**, the client will need to be rebooted before the Xsan client is loaded. Quantum recommends you reboot the client.

If an upgrade to Xsan 4 or later has been performed, Xsan is disabled after the upgrade. Re-enable Xsan using the commands below.

```
xsan41client$ sudo launchctl unload  
/System/Library/LaunchDaemons/com.apple.xsan.plist  
xsan41client$ sudo launchctl load -w  
/System/Library/LaunchDaemons/com.apple.xsan.plist
```

6. Execute the command `cvadmin` to verify the file systems are present.
7. Execute the command `cvadmin -e disks` to verify the all the LUNs used for file systems are displayed.
8. In the Terminal type `xsanctl mount <fsname>`, where `<fsname>` is the file system name displayed in `cvadmin`. See [Special Considerations for Xsan 4.1 Clients below](#).
9. Verify the StorNext file system is mounted on the Mac OS X computer.

Special Considerations for Xsan 4.1 Clients

- The client attempts to mount all of the StorNext file systems automatically, including the **High Availability (HA)** shared file system.
- By default, the **Distributed LAN Client (DLC)** is enabled for all file systems.
- If the `automount.plist` file exists, the client ignores the `/Library/Preferences/Xsan/automount.plist` file. On a fresh installation, the `automount.plist` file does **not** exist.
- To **only** mount a given file system, execute the command similar to the example below. The command enforces mounts on `snfs1` and `snfs2` **only**.

```
sudo defaults write /Library/Preferences/com.apple.xsan onlyMount -array snfs1  
snfs2
```

- To disable **DLC** for a list of file systems, execute the command similar to the example below. The command disables **DLC** on `snfs1` and `snfs2` file systems **only**.

```
sudo defaults write /Library/Preferences/com.apple.xsan denyDLC -array snfs1  
snfs2
```

i Note: For additional information, see the Apple support article available online at <https://support.apple.com/en-us/HT205333>.

Mounting the StorNext File System on Xsan 4

To connect Xsan 4 clients to StorNext MDCs:

1. Generate a configuration profile:

```
mdc# cd /usr/cvfs/config  
mdc# /usr/cvfs/lib/make_profile mysan
```

2. Copy the resultant profile to the Xsan 4 client:

```
mdc# scp mysan.configprofile root@xsan4client:/tmp
```

3. Remove any existing Xsan profiles from the client:

```
xsan4client$ sudo profiles -L | grep com.apple.xsan | awk '{print $NF}' >  
/tmp/oldprofiles  
xsan4client$ for i in `cat /tmp/oldprofiles`; do sudo profiles -R -p $i; done
```

4. Install the new profile:

```
xsan4client$ cd /tmp  
xsan4client$ sudo profiles -I -F mysan.configprofile
```

5. Restart Xsan:

Note: On a new Xsan 4 driver installation, an Xsan client may not have been loaded and an error will be displayed when you execute **launchctl unload**. Quantum recommends you verify a driver is loaded and skip the unload step if the driver is not loaded.

When the Xsan client is loaded using the command **launchctl load**, the client will need to be rebooted before the Xsan client is loaded. Quantum recommends you reboot the client.

If an upgrade to Xsan 4 or later has been performed, Xsan is disabled after the upgrade. Re-enable Xsan using the commands below.

```
xsan4client$ sudo launchctl unload  
/System/Library/LaunchDaemons/com.apple.xsan.plist  
xsan4client$ sudo launchctl load -w  
/System/Library/LaunchDaemons/com.apple.xsan.plist
```

6. Execute the command **cvadmin** to verify the file systems are present.
7. Execute the command **cvdamin -e disks** to verify the all the LUNs used for file systems are displayed.
8. In the Terminal type **xsanctl mount <fsname>**, where **<fsname>** is the file system name displayed in **cvadmin**.
9. Verify the **/Library/Preferences/Xsan/automount.plist** file is created.
10. Verify the StorNext file system is mounted on the Mac OS X computer.

Mounting the StorNext File System on Xsan 2.3 through Xsan 3 Clients

To connect Xsan 2.3 through Xsan 3 clients to StorNext MDCs:

Note: If you are removing clients from an Xsan MDC and connecting them to a StorNext MDC, remove the clients using the Xsan Admin tool on the Xsan MDC. In addition, make sure your Xsan clients do not have a `.auth_secret` file in the Xsan config directory.

1. Connect the Xsan client computer to the StorNext metadata and fibre channel (SAN) networks.
2. Create a `/Library/Preferences/Xsan/config.plist` file using the xml template below:

Note: Items in red indicate data you should enter which applies to your configuration. Do not enter the literal red text shown in the template. In other words, for `<string>My IP Address/Subnet</string>`, you would enter your system metadata IP address or the regular system IP address, not the words `My IP Address`. For example, `<string>192.168.5.0/24</string>`.

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN"
"http://www.apple.com/DTDs/PropertyList-1.0.dtd">
<plist version="1.0">
  <dict>
    <key>computers</key>
    <array/>
    <key>metadataNetwork</key>
    <string>My IP Address/Subnet</string>
    <key>role</key>
    <string>CLIENT</string>
  </dict>
</plist>
```

3. From the StorNext MDC copy the `fsnameservers` file to `/Library/Preferences/Xsan` on the Macintosh client.

On Unix: the `fsnameservers` file is located at `/usr/cvfs/config/`.

On Windows: the `fsnameservers` file is located at `%cvfsroot%\config\` (where `%cvfsroot%` is the directory where the StorNext software is installed). This directory is usually located in `C:\Program Files\Stornext\config\`.

Note: The content of the `fsnameservers` file should be an IP address, not a machine name or fully qualified domain name (FQDN).

4. Run the following in Terminal to update Xsan with the new file system information:

```
launchctl unload /System/Library/LaunchDaemons/com.apple.xsan.plist
launchctl load /System/Library/LaunchDaemons/com.apple.xsan.plist
```

i Note: You can use the Preference Pane to disable and re-enable Xsan.

5. Run **cvadmin** to verify the file systems are present.
6. Run **cvlabel -l** to verify the all the luns used for file systems are displayed.
7. In the Terminal type **Xsanctl mount <fsname>**.
Where **<fsname>** is the file system name displayed in cvadmin.
8. Verify the **/Library/Preferences/Xsan/automount.plist** file is created.
9. Verify the StorNext file system is now mounted on the Mac OS X computer.

Mounting the StorNext File System on Xsan 2.2 and Older Releases

1. Connect the Apple computer to the SAN's metadata Ethernet and fibre channel networks.
2. Install Xsan 2 software on the Apple computer. (Xsan 2 is supported only by the Leopard operating system.)
3. Create the file **/etc/systemserialnumbers/xsan** using that Macintosh's Xsan serial number.

You must create the directory **/etc/systemserialnumbers** if it doesn't already exist. If an Xsan serial number has information printed for *<Licensed to>* and *<Organization>*, these must be part of the serial number string separated by a vertical bar or "pipe" character on two lines. For example:

```
XSAN-020-XXX-X-XXX-XXX-XXX-XXX-XXX-X  
<Licensed to|<Organization>
```

i Note: The file does not have a trailing return on the last line. Use the following:

```
cat /etc/systemserialnumbers/xsan
```

and end with **^D^D** (where **^D^D** is Command-D Command-D)

i Note: If you are unable to browse to the systemserialnumbers directory, use the cat or echo commands to insert information into the Xsan file under that directory.

4. Create a **/Library/FileSystems/Xsan/config/config.plist** file using the xml template below:

i Note: Note: Items in **red** indicate data you should enter which applies to your configuration. Do not enter the literal red text shown in the template.

For example, for **<stringMy IP Address</string>** you would enter your system metadata IP address or the regular system IP address, not the words "My IP Address."

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN"
"http://www.apple.com/DTDs/PropertyList-1.0.dtd">
<plist version="1.0">
<dict>
  <key>computers</key>
  <array/>
  <key>metadataNetwork</key>
  <string>My IP Address</string>
  <key>ownerEmail</key>
  <string>me@mycompany.com</string>
  <key>ownerName</key>
  <string>My Name</string>
  <key>role</key>
  <string>CLIENT</string>
  <key>sanName</key>
  <string>My SAN name</string>
  <key>serialNumbers</key>
  <array>
    <dict>
      <key>license</key>
      <string>xsan client license number</string>
      <key>organization</key>
      <string>organization name</string>
      <key>registeredTo</key>
      <string>registered to name</string>
    </dict>
  </array>
</dict>
</plist>
```

5. From the StorNext MDC, copy the **fsnameservers** file to the **/Library/Filesystems/Xsan/config/** directory on the Macintosh client. This file should contain the IP addresses of the name server machines.

On Unix: the **fsnameservers** file is located at **/usr/cvfs/config/**.

On Windows: the **fsnameservers** file is located at **%cvfsroot%\config** (where **%cvfsroot%** is the directory where the StorNext software is installed). This directory is usually located in **C:\Program Files\Stornext\config**.

i Note: The content of the **fsnameservers** file should be an IP address, not a machine name or fully-qualified domain name (FQDN).

6. Run **RegisterSeRV** in Terminal to ensure that the serial number is recognized.
7. Run the following in Terminal to update Xsan with the new file system information:

```
launchctl unload /System/Library/LaunchDaemons/com.apple.xsan.plist
launchctl load /System/Library/LaunchDaemons/com.apple.xsan.plist
```

i Note: If you are using Xsan 2.3, you can use the Preference Pane to disable and re-enable Xsan.

8. Run **cvadmin** to verify the file systems are present.

9. Run **cvlabel -l** to verify the all the luns used for file systems are displayed.
10. In the Terminal type **Xsanctl mount <fsname>**.
Where **<fsname>** is the file system name displayed in cvadmin.
11. Verify the **/Library/Filesystems/Xsan/config/automount.plist** file is created.
12. Verify the StorNext file system is now mounted on the Xsan client.

Xsan 2.3 and later

There are notable differences between earlier Xsan version 2.2 and Xsan 2.3 or later. Before performing the procedures in these section you should determine which Xsan version you have and make adjustments as appropriate.

For example, file locations differ between earlier Xsan versions and Xsan 2.3 or later, as noted in the following table:

Table 1: Xsan File Locations

Xsan File Type	Xsan 2.2 File Locations	Xsan 2.3 and later File Locations
Bin Files	/Library/Filesystems/Xsan/bin	/System/Library/Filesystems/acfs.fs/Contents/bin And a symlink to /usr/sbin/
Config Files	/Library/Filesystems/Xsan/config	/Library/Preferences/Xsan
Debug Logs	/Library/Filesystems/Xsan/debug	Xsan Debug logs are can be viewed via Console in this location: /Library/Logs/Xsan/debug
Man Pages	/Library/Filesystems/Xsan/man	/System/Library/Filesystems/acfs.fs/Contents/man
RAS Logs	/Library/Filesystems/Xsan/ras	Xsan RAS logs are can be viewed via Console in this location: /Library/Logs/Xsan/ras

Other Xsan 2.3 and later Changes

Xsan 2.3 or later is built into the Macintosh operating system. Consequently, for 2.3 there is no serial number and nothing additional to install. (However, a StorNext Server license is still required for a StorNext Metadata Controller.)

Viewing a Fibre Channel Device

Use this procedure to add a fibre channel (FC) device. Before adding a FC device, first configure the Host Bus Adapter (HBA) card so you can view the device. Use the **fs_scsi -p** command to make sure you can view your devices over FC. FC devices include tape libraries, individual drives, or RAID disk.

1. Type the **/usr/cvfs/bin/fs_scsi -p** command to make sure that the necessary devices can be viewed over FC.
 - To view tape libraries, access the StorNext GUI to view your tape libraries.
 - To view individual drives or RAID LUNs, access either the StorNext or SNFS GUI.

To add a disk, see [File System Tasks](#) in the *StorNext User's Guide*. To add a tape drive to a configured library, see [Setting Up Libraries](#) in the *StorNext User's Guide*.

StorNext Log Rolling Administration

Use the following procedures to configure StorNext log rolling options.

Changing Log Rolling Times

Use this procedure to change the frequency of rolling the StorNext logs. This process requires that you edit the **tdlm crontab** to set log times. Use this procedure to edit **tdlm crontab**.

1. Log on as **root**.
2. Edit the **tdlm crontab** and update the **sn_log_update script**.

Below is an example crontab:

```
0 1,7,13,19 * * * /usr/adic/guib/bin/cmdwrap /usr/adic/util/sn_log_update /usr/adic
```

where **0 1,7,13,19 * * *** designates the times when logs run.

Log Rolling Options

You can change these options to optimize log rolling.

- **-s**: This option sets the directory where logs are saved (copied) to as they are rolled. This directory is typically a managed directory. For example:

```
sn_log_update [-s <dir>]
```

where **<dir>** is the directory where you want the logs to reside.

- **\$DEF_SIZE = 2000000**: This is the default size at which logs are rolled. Edit this entry in the `/usr/adic/util/sn_log_update.cfg` file if you want the log sizes to be larger or smaller.
- **\$DEF_LOGS = 28**: This is the default number of logs that are saved before they are deleted. Edit this entry in the `/usr/adic/util/sn_log_update.cfg` file if you want to save less than 28 logs or are saving the logs to a managed directory.

Avoiding Poor System Performance

Most systems run administrator scripts to rebuild namespace databases and/or to remove certain files. Unfortunately, running these scripts can degrade StorNext performance. It is recommended that you review administrator scripts to determine if they may adversely affect your StorNext installation and its performance.

For example, many UNIX systems have a `find` command in the **root crontab** that traverses the entire directory hierarchy while searching for old temporary and core files. Typically, the **find** commands are configured only to run on the local file system. However by default, these commands do not skip StorNext file systems because they are considered to be local, even though the file system manager may be running remotely. StorNext performance can be dramatically degraded when these commands visit a StorNext file system if the system contains a large number of files.

If StorNext performance is degraded to an unacceptable level due to the operation of administrator scripts, you can modify them to skip StorNext file systems. A sample command (original and modified is shown below:

On IRIX, by default, the **root crontab** contains the following `find` command:

```
find / -local -type f '(' -name core -o -name dead.letter ')' -atime +7 -mtime + 7 -exec rm -f '{}'
```

To prevent the `find` command from searching in StorNext file systems, modify it as shown:

```
(' -type d -fstype cvfs -prune ')' -o
```

The modified `find` command looks like this:

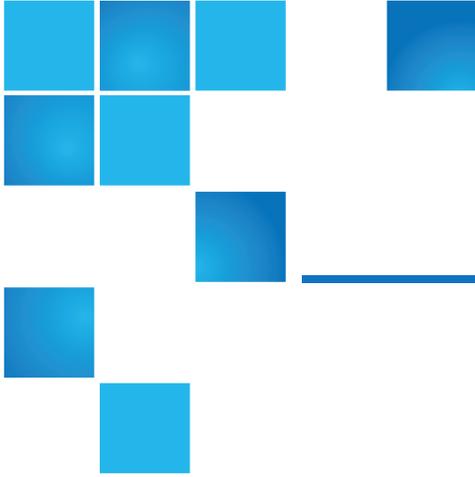
```
find / -local '(' -type d -fstype cvfs ')' -o -type f '(' -name core -o -name dead.letter ')' -atime +7 -mtime +7 -exec rm -f '{}'
```

Avoiding Not Saving cvmkfs Coredump Files

Both RHEL and CentOS systems enable a service called **abrt** by default. This service intercepts StorNext core files and tries to handle them. To avoid this situation, implement either one of these options:

- Add `/usr/adic/*/bin/*` and `/usr/cvfs/bin/*` to the **abrt** blacklist path.
- Disable the **abrt** service using the **chkconfig** command:

```
# chkconfig abrttd off
```



Appendix C: StorNext Files

This appendix contains the following topics:

StorNext Files

StorNext creates a series of files that are used and modified to configure a file system. This section includes an expanded configuration file, a cluster-wide central control file, and a listing of the most commonly used StorNext files with descriptions and locations for each.

Example FSM Configuration File

On Linux, the StorNext configuration file uses an XML format (.cfgx). On Windows, the configuration file uses a text format (.cfg). However, the values contained in both files are similar.

You can locate an example StorNext configuration file in the following directory:

- Linux - **`/usr/cvfs/examples/example.cfgx`**
- Windows - **`C:\Program Files\Stornext\config\example.cfg`**

If you installed StorNext in a location other than the default installation directory, the example configuration file is located in **`C:\<install_directory>\config\example.cfg`**

For additional information about the snfs.cfgx and snfs.cfg files, refer to the “snfs_config” entry in the *Man Pages Reference Guide*.

Linux Example Configuration File

Below are the contents of the StorNext example configuration file for Linux (**example.cfgx**):

```
<?xml version="1.0" encoding="UTF-8"?>
<configDoc xmlns="http://www.quantum.com/snfs" version="1.0">
  <config configVersion="0" name="example" fsBlockSize="16384"
    journalSize="16777216">
    <globals>
      <abmFreeLimit>>false</abmFreeLimit>
      <allocationStrategy>round</allocationStrategy>
      <haFsType>HaUnmonitored</haFsType>
      <bufferCacheSize>33554432</bufferCacheSize>
      <cvRootDir>/</cvRootDir>
      <storageManager>>false</storageManager>
      <dataMigrationThreadPoolSize>128</dataMigrationThreadPoolSize>
      <debug>00000000</debug>
      <dirWarp>>true</dirWarp>
      <extentCountThreshold>49152</extentCountThreshold>
      <enableSpotlight>>false</enableSpotlight>
      <enforceAcls>>false</enforceAcls>
      <fileLocks>>false</fileLocks>
      <fileLockResyncTimeout>20</fileLockResyncTimeout>
      <forcePerfectFit>>false</forcePerfectFit>
      <fsCapacityThreshold>0</fsCapacityThreshold>
      <globalSuperUser>>true</globalSuperUser>
      <inodeCacheSize>32768</inodeCacheSize>
      <inodeExpandMin>0</inodeExpandMin>
      <inodeExpandInc>0</inodeExpandInc>
      <inodeExpandMax>0</inodeExpandMax>
      <inodeDeleteMax>0</inodeDeleteMax>
      <inodeStripeWidth>0</inodeStripeWidth>
      <maxConnections>32</maxConnections>
      <maxLogs>4</maxLogs>
      <remoteNotification>>false</remoteNotification>
      <reservedSpace>>true</reservedSpace>
      <fsmRealTime>>false</fsmRealTime>
      <fsmMemLocked>>false</fsmMemLocked>
      <opHangLimitSecs>180</opHangLimitSecs>
      <perfectFitSize>131072</perfectFitSize>
      <quotas>>false</quotas>
      <restoreJournal>>false</restoreJournal>
      <restoreJournalDir/>
      <restoreJournalMaxHours>0</restoreJournalMaxHours>
      <restoreJournalMaxMb>0</restoreJournalMaxMb>
      <stripeAlignSize>0</stripeAlignSize>
      <trimOnClose>0</trimOnClose>
      <threadPoolSize>32</threadPoolSize>
      <unixDirectoryCreationModeOnWindows>644</unixDirectoryCreationModeOnWindows>
      <unixIdFabricationOnWindows>>false</unixIdFabricationOnWindows>
      <unixFileCreationModeOnWindows>755</unixFileCreationModeOnWindows>
    </globals>
  </config>
</configDoc>
```

```
<unixNobodyUidOnWindows>60001</unixNobodyUidOnWindows>
<unixNobodyGidOnWindows>60001</unixNobodyGidOnWindows>
<windowsSecurity>true</windowsSecurity>
<eventFiles>true</eventFiles>
<eventFileDir/>
<allocSessionReservation>false</allocSessionReservation>
</globals>
<diskTypes>
  <diskType typeName="MetaDrive" sectors="99999999" sectorSize="512"/>
  <diskType typeName="JournalDrive" sectors="99999999" sectorSize="512"/>
  <diskType typeName="VideoDrive" sectors="99999999" sectorSize="512"/>
  <diskType typeName="AudioDrive" sectors="99999999" sectorSize="512"/>
  <diskType typeName="DataDrive" sectors="99999999" sectorSize="512"/>
</diskTypes>
<stripeGroups>
  <stripeGroup index="0" name="MetaFiles" status="up"
    stripeBreadth="262144" read="true" write="true" metadata="true"
    journal="false" userdata="false" realTimeIOs="200"
    realTimeIOsReserve="1" realTimeMB="200" realTimeMBReserve="1"
    realTimeTokenTimeout="0" multipathMethod="rotate">
    <disk index="0" diskLabel="CvfsDisk0" diskType="MetaDrive"/>
  </stripeGroup>
  <stripeGroup index="1" name="JournFiles" status="up"
    stripeBreadth="262144" read="true" write="true" metadata="false"
    journal="true" userdata="false" realTimeIOs="0" realTimeIOsReserve="0"
    realTimeMB="0" realTimeMBReserve="0" realTimeTokenTimeout="0"
    multipathMethod="rotate">
    <disk index="0" diskLabel="CvfsDisk1" diskType="JournalDrive"/>
  </stripeGroup>
  <stripeGroup index="2" name="VideoFiles" status="up"
    stripeBreadth="4194304" read="true" write="true" metadata="false"
    journal="false" userdata="true" realTimeIOs="0" realTimeIOsReserve="0"
    realTimeMB="0" realTimeMBReserve="0" realTimeTokenTimeout="0"
    multipathMethod="rotate">
    <affinities exclusive="true">
      <affinity>Video</affinity>
    </affinities>
    <disk index="0" diskLabel="CvfsDisk2" diskType="VideoDrive"/>
    <disk index="1" diskLabel="CvfsDisk3" diskType="VideoDrive"/>
    <disk index="2" diskLabel="CvfsDisk4" diskType="VideoDrive"/>
    <disk index="3" diskLabel="CvfsDisk5" diskType="VideoDrive"/>
    <disk index="4" diskLabel="CvfsDisk6" diskType="VideoDrive"/>
  </stripeGroup>
</stripeGroups>
```

```
<disk index="5" diskLabel="CvfsDisk7" diskType="VideoDrive"/>
<disk index="6" diskLabel="CvfsDisk8" diskType="VideoDrive"/>
<disk index="7" diskLabel="CvfsDisk9" diskType="VideoDrive"/>
</stripeGroup>
<stripeGroup index="3" name="AudioFiles" status="up"
stripeBreadth="1048576" read="true" write="true" metadata="false"
journal="false" userdata="true" realTimeIOs="0" realTimeIOsReserve="0"
realTimeMB="0" realTimeMBReserve="0" realTimeTokenTimeout="0"
multipathMethod="rotate">
  <affinities exclusive="true">
    <affinity>Audio</affinity>
  </affinities>
  <disk index="0" diskLabel="CvfsDisk10" diskType="AudioDrive"/>
  <disk index="1" diskLabel="CvfsDisk11" diskType="AudioDrive"/>
  <disk index="2" diskLabel="CvfsDisk12" diskType="AudioDrive"/>
  <disk index="3" diskLabel="CvfsDisk13" diskType="AudioDrive"/>
</stripeGroup>
<stripeGroup index="4" name="RegularFiles" status="up"
stripeBreadth="262144" read="true" write="true" metadata="false"
journal="false" userdata="true" realTimeIOs="0" realTimeIOsReserve="0"
realTimeMB="0" realTimeMBReserve="0" realTimeTokenTimeout="0"
multipathMethod="rotate">
  <disk index="0" diskLabel="CvfsDisk14" diskType="DataDrive"/>
  <disk index="1" diskLabel="CvfsDisk15" diskType="DataDrive"/>
  <disk index="2" diskLabel="CvfsDisk16" diskType="DataDrive"/>
  <disk index="3" diskLabel="CvfsDisk17" diskType="DataDrive"/>
</stripeGroup>
</stripeGroups>
</config>
</configDoc>
```

Windows Example Configuration File

Below are the contents of the StorNext example configuration file for Windows (**example.cfg**):

```
# Globals

ABMFreeLimit no
AllocationStrategy Round
HaFsType HaUnmonitored
FileLocks No
BrlResyncTimeout 20
BufferCacheSize 32M
CvRootDir /
DataMigration No
DataMigrationThreadPoolSize 128
Debug 0x0
DirWarp Yes
ExtentCountThreshold 48K
EnableSpotlight No
ForcePerfectFit No
FsBlockSize 16K
GlobalSuperUser Yes
InodeCacheSize 32K
InodeExpandMin 0
InodeExpandInc 0
InodeExpandMax 0
InodeDeleteMax 0
InodeStripeWidth 0
JournalSize 16M
MaxConnections 32
MaxLogs 4
PerfectFitSize 128K
RemoteNotification No
ReservedSpace Yes
FSMRealtime No
FSMMemlock No
OpHangLimitSecs 180
Quotas No
RestoreJournal No
RestoreJournalMaxHours 0
RestoreJournalMaxMB 0
StripeAlignSize -1
TrimOnClose 0
ThreadPoolSize 32
UnixDirectoryCreationModeOnWindows 0755
UnixIdFabricationOnWindows No
UnixFileCreationModeOnWindows 0644
UnixNobodyUidOnWindows 60001
UnixNobodyGidOnWindows 60001
WindowsSecurity Yes
EventFiles Yes
AllocSessionReservation No
```

```
# Disk Types

[DiskType MetaDrive]
Sectors 99999999
SectorSize 512
[DiskType JournalDrive]
Sectors 99999999
SectorSize 512
[DiskType VideoDrive]
Sectors 99999999
SectorSize 512
[DiskType AudioDrive]
Sectors 99999999
SectorSize 512
[DiskType DataDrive]
Sectors 99999999
SectorSize 512
# Disks

[Disk CvfsDisk0]
Type MetaDrive
Status UP
[Disk CvfsDisk1]
Type JournalDrive
Status UP
[Disk CvfsDisk2]
Type VideoDrive
Status UP
[Disk CvfsDisk3]
Type VideoDrive
Status UP
[Disk CvfsDisk4]
Type VideoDrive
Status UP
[Disk CvfsDisk5]
Type VideoDrive
Status UP
[Disk CvfsDisk6]
Type VideoDrive
Status UP
[Disk CvfsDisk7]
Type VideoDrive
Status UP
[Disk CvfsDisk8]
Type VideoDrive
Status UP
[Disk CvfsDisk9]
Type VideoDrive
```

```
Status UP
[Disk CvfsDisk10]
Type AudioDrive
Status UP
[Disk CvfsDisk11]
Type AudioDrive
Status UP
[Disk CvfsDisk12]
Type AudioDrive
Status UP
[Disk CvfsDisk13]
Type AudioDrive
Status UP
[Disk CvfsDisk14]
Type DataDrive
Status UP
[Disk CvfsDisk15]
Type DataDrive
Status UP
[Disk CvfsDisk16]
Type DataDrive
Status UP
[Disk CvfsDisk17]
Type DataDrive
Status UP
# Stripe Groups

[StripeGroup MetaFiles]
Status Up
StripeBreadth 256K
Metadata Yes
Journal No
Exclusive Yes
Read Enabled
Write Enabled
Rtmb 0
Rtios 0
RtmbReserve 0
RtiosReserve 0
RtTokenTimeout 0
MultiPathMethod Rotate
Node CvfsDisk0 0

[StripeGroup JournFiles]
Status Up
StripeBreadth 256K
Metadata No
Journal Yes
```

```
Exclusive Yes
Read Enabled
Write Enabled
Rtmb 0
Rtios 0
RtmbReserve 0
RtiosReserve 0
RtTokenTimeout 0
MultiPathMethod Rotate
Node CvfsDisk1 0

[StripeGroup VideoFiles]
Status Up
StripeBreadth 4M
Metadata No
Journal No
Exclusive No
Read Enabled
Write Enabled
Rtmb 0
Rtios 0
RtmbReserve 0
RtiosReserve 0
RtTokenTimeout 0
MultiPathMethod Rotate
Node CvfsDisk2 0
Node CvfsDisk3 1
Node CvfsDisk4 2
Node CvfsDisk5 3
Node CvfsDisk6 4
Node CvfsDisk7 5
Node CvfsDisk8 6
Node CvfsDisk9 7
Affinity Video

[StripeGroup AudioFiles]
Status Up
StripeBreadth 1M
Metadata No
Journal No
Exclusive No
Read Enabled
Write Enabled
Rtmb 0
Rtios 0
RtmbReserve 0
RtiosReserve 0
RtTokenTimeout 0
```

```
MultiPathMethod Rotate
Node CvfsDisk10 0
Node CvfsDisk11 1
Node CvfsDisk12 2
Node CvfsDisk13 3
Affinity Audio

[StripeGroup RegularFiles]
Status Up
StripeBreadth 256K
Metadata No
Journal No
Exclusive No
Read Enabled
Write Enabled
Rtmb 0
Rtios 0
RtmbReserve 0
RtiosReserve 0
RtTokenTimeout 0
MultiPathMethod Rotate
Node CvfsDisk14 0
Node CvfsDisk15 1
Node CvfsDisk16 2
Node CvfsDisk17 3
```

Cluster-Wide Central Control

The purpose of this feature is to provide cluster-wide central control. (Currently the central control file is supported on the Linux platform only.) A central control file called **nss_ctl.xml** provides a way to restrict the behavior of SNFS cluster nodes (fsm, file system client, cvadmin client) from a central place: an NSS server.

This feature currently supports the following controls that allow you to specify:

1. Whether a client is allowed to mount as a proxy client.
2. Whether a client is allowed to mount as read/write or read-only.
3. Whether a user (especially a local administrator on Windows clients,) is allowed to take ownership of a file or directory on a StorNext file system.
4. Whether **cvadmin** running on a certain client is allowed to have super admin privilege to run destructive commands such as starting/stopping the file system, refreshing disks, changing quota settings, and so on.
5. Whether **cvadmin** running on certain client is allowed to connect to other fsms via the **-H** option.

6. Whether binary executable files on the StorNext file system are allowed to be executed.
7. Whether the **setuid** bit of a file is allowed to take effect.

The control file is in xml format and has a hierarchical structure. The top level element, **snfsControl**, contains control elements with the **securityControl** label for certain file systems. If you have different controls for different file systems, each file system should have its own control definition. A special virtual file system, **#SNFS_ALL#**, is used as the default control for file systems not defined in this control file. It is also used to define the **cvadmin**-related control on clients.

i Note: You cannot have a file system named **#SNFS_ALL#**.

Each file system-related element (indicated by the label **securityControl**) has a list of **controlEntry** items. Each **controlEntry** item defines the client and the controls. The client type can be either **host** or **netgrp**. A host can be the IP address or the host name. (Both IP V4 and IP V6 are supported.) Netgrp specifies a group of consecutive IP addresses and has a network IP address (either IP V4 or V6,) and network mask bits. It is possible for there to be overlapping in IP address between an individual host and netgrp, but the individual host should be defined before the netgrp. If a client node has more than one IP address, then define the controls for each IP address.

The following controls are currently supported:

1. **mountReadOnly:** Control whether a client should mount as read-only. The default is read/write.
2. **mountDlanClient:** Control whether a client can mount as a proxy client. The default is not allowed.
3. **takeOwnership:** Control whether users on a Windows client are allowed to take ownership of a file or directory in a StorNext file system.
4. **snfsAdmin:** Controls whether **cvadmin** running on a host is allowed to have super admin privilege to run privileged commands such as start/stop fs.
5. **snfsAdminConnect:** Controls whether **cvadmin** running on a client is allowed to connect to other fsm via the **-H** option.
6. **exec:** Controls whether binary executable files on the file system are allowed to be executed. The default value is “true” (that is, the execution is allowed).
7. **suid:** Controls whether the **setuid** bit is allowed to take effect. (The default value is “true”.)

If no match is found for a given client's IP address, the client has no privileges. If a file system has been defined but the client is not defined in that file system's control section (**securityControl**), the client has no access privileges to the specified file system.

Cluster-Wide Control File Example

The control file called **nss_cct1.xml** provides a feature overview and describes how to configure the central control file. The values entered in the following sample file are for example purposes only and should not necessarily be entered in your own control files.

```
<?xml version="1.0" encoding="UTF-8"?>

<!-- Cluster-Wide Central Control File -->

<!-- The nss_ctl.xml file provides a way to restrict the behavior of -->
<!-- SNFS cluster nodes (fsm, file system client, cvadmin client) from -->
<!-- a central place, i.e on nss server. As for SNFS 3.5, we support -->
<!-- the following controls: -->
<!-- 1. Whether a client is allowed to mount as a proxy client -->
<!-- 2. Whether a client is allowed to mount as read/write or read-only. -->
<!-- 3. Whether a user especially local admin on windows is allowed to -->
<!-- take ownership of file or directory on a Stornext file system. -->
<!-- 4. Whether cvadmin running on certain client is allowed to have -->
<!-- super admin privilege to run destructive commands such as -->
<!-- start/stop file system, refresh disks, and change quota setting, -->
<!-- etc. -->
<!-- 5. whether cvadmin running on certain client is allowed to connect -->
<!-- to other fsm via "-H" option. -->
<!-- 6. whether an executable file on the file system can be executed. -->
<!-- 7. whether to allow set-user-identifier bit to take effect. -->

<!-- The control file is in xml format and has hierarchical structure. -->
<!-- The top level element is "snfsControl", it contains control element -->
<!-- "securityControl" for certain file system. If you have different -->
<!-- controls for different file systems, then each file system should -->
<!-- has its own control definition. A special virtual file system -->
<!-- "#SNFS_ALL#" is used as the default control for file systems not -->
<!-- defined in this control file. It is also used to define the cvadmin -->
<!-- related control on clients. Note: you cannot have a real file -->
<!-- system named as "#SNFS_ALL#". -->

<!-- Each file system related control element (securityControl) has a -->
<!-- list of "controlEntry", each "controlEntry" defines the client and -->
<!-- the controls. A client can be of type "host" or "netgrp". A "host " -->
<!-- can be ip address or host name. Both IP V4 and IP V6 are supported. -->
<!-- "netgrp" specifies a group of consecutive ip addresses. It has -->
<!-- network ip address (either IP V4 or V6) and network mask bits. It -->
<!-- is possible that there is overlapping in ip addresses between -->
<!-- individual host and netgrp, but the individual host should be -->
<!-- defined before the netgrp. In this case, the netgrp control is -->
<!-- considered to be generic case, while the controls for individual is -->
<!-- considered to be special case. A special case takes precedence. -->

<!-- Currently there are seven controls supported: -->
<!-- 1. mountReadOnly: control whether a client should mount as -->
<!-- readonly. The default is read/write. -->
<!-- 2. mountDlanClient: control whether a client can mount as proxy -->
<!-- client, the default is "mount not allowed". -->
```

```
<!-- 3. takeOwnership: control whether users on a windows client is -->
<!-- allowed to take ownership of file or directory of a stornext -->
<!-- file system. The default is "take ownership not allowed". -->
<!-- 4. snfsAdmin: whether cvadmin running on a host is allowed to have -->
<!-- super admin privilege to run privileged commands such as -->
<!-- start/stop fs. The default is that super admin privilege is not -->
<!-- honored. -->
<!-- 5. snfsAdminConnect: whether cvadmin running on a client is allowed-->
<!-- to connect to other fsm via "-H" option. The default is "-H" is -->
<!-- not allowed. -->
<!-- 6. exec: whether binary files on the file system is allowed to -->
<!-- be executed. -->
<!-- 7. suid: whether set-user-identifier bit is allowed to take effect.-->

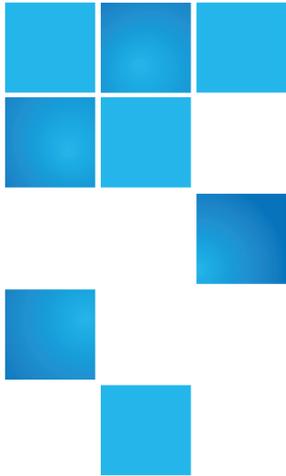
<!-- If no match is found for a given client's ip address, then the -->
<!-- client has no privilege to access a SNFS cluster. If a file system -->
<!-- has been defined but the client is not defined in that file -->
<!-- system's control (securityControl), then the client has no access -->
<!-- privilege to the specified file system. -->

<!-- Currently only Linux platform is supported to be a nss server -->
<!-- capable of parsing this xml file. -->

<!-- The following is an example to define the nss_ctl.xml. It defines -->
<!-- the control of file system "snfs", and also the special virtual -->
<!-- file system "#SNFS_ALL#". -->

<snfsControl xmlns="http://www.quantum.com/snfs/cctl/v1.0">
  <securityControl fileSystem="snfs">
    <controlEntry>
      <client type="host">
        <hostName value="192.168.230.132"/>
      </client>
      <controls>
        <mountReadOnly value="true"/>
        <mountDlanClient value="true"/>
        <takeOwnership value="false"/>
        <exec value="true"/>
        <suid value="false"/>
      </controls>
    </controlEntry>
    <controlEntry>
      <client type="netgrp">
        <network value="192.168.1.0"/>
        <maskbits value="24"/>
      </client>
      <controls>
        <takeOwnership value="true"/>
      </controls>
    </controlEntry>
  </securityControl>
</snfsControl>
```

```
<mountReadOnly value="true"/>
</controls>
</controlEntry>
</securityControl>
<securityControl fileSystem="#SNFS_ALL#">
<controlEntry>
<client type="host">
<hostName value="linux_ludev"/>
</client>
<controls>
<snfsAdmin value="true"/>
<snfsAdminConnect value="true"/>
</controls>
</controlEntry>
</securityControl>
</snfsControl>
```



Appendix D: Quality of Service Feature

This appendix contains the following topics:

Quality of Service Feature

This topic describes how to configure and use the StorNext File System (SNFS) Quality of Service (QOS) feature. QOS allows real-time applications to reserve some amount of bandwidth on the storage system. This is known as real-time I/O (RTIO). SNFS gates (that is, throttles) non-real-time applications so their I/O accesses do not interfere with the real-time application.

QOS is a *passive* implementation in that it does not actively monitor a process' activity and then schedule the process so that it receives the bandwidth it has requested. It is up to real-time applications to gate their own I/O requests to the desired rate. SNFS QOS provides a “get out of the way” gating for non-real-time I/O requests so they do not hinder the real-time requests.

The remainder of this document explains the client and server configuration settings for QOS; describes the use of tokens and callbacks for gating non-real-time I/O; describes setting real-time I/O on a file; and discusses the performance monitoring tools that are available for diagnosis.

Overview

QOS is stripe-group centric; all configuration and operations act on a specific stripe group. This allows stripe groups with differing access characteristics to use different real-time settings. When a client requests a certain amount of real-time I/O, the FSM informs all connected clients of the amount remaining and available for non-real-time I/O accesses.

This information is encapsulated in a token. Think of the token as a capability that enables the client to perform I/O without contacting the FSM. When the amount of real-time I/O on a stripe group changes, the FSM informs all connected clients about the change via a callback.

In both the client and the server, QOS is implemented as a state machine. Each state has a set of events and allowable actions. In this document, the term *state* thusly refers to the internal state machine.

Active vs. Passive

QOS is a passive, not active implementation of real-time I/O. In an active implementation, guaranteed rate I/O known as GRIO), the scheduler is tightly coupled with the I/O subsystem. The qualities of the disk subsystem are well known so the scheduler can guarantee that a process will be scheduled such that it will receive the required amount of bandwidth. Since SNFS is a cross-platform file system that does not have hooks in the operating system scheduler, it cannot provide such a guarantee.

In a passive implementation, a real-time process gates its I/O according to some outside metric (such as a frame rate for specific video formats). The file system then gates all other non-real-time I/O so they do not interfere.

It is very important that the differences between Active and Passive OOS operation are understood by the user. It is a misconception to think that QOS, despite its name, guarantees a specific amount of real-time I/O to a process.

Supported Platforms

QOS has been tested on Windows XP, Windows 2008, Linux, and Solaris. In Windows, an application gets a handle to a file to perform I/O, usually via the **Win32 CreateFile() API**. In UNIX, an application receives a file descriptor (**fd**) via the **open(2)** system call. In this document, “handle” is synonymous with **fd**.

Non-Realtime Operation

Beginning with StorNext release 3.5, QOS has been enhanced to reserve bandwidth for non-realtime I/O clients. Differentiating between realtime and non-realtime I/O clients should result in better bandwidth utilization and overall performance.

During the mounting process, there is now provision to specify the amount of bandwidth to be reserved. Applications that do not have awareness of the external API can leverage the bandwidth amount. Also, clients with different load characteristics can be differentiated.

Non-realtime I/O support is provided through a central configuration file on the FSM server side, which defines the bandwidth reservation for non-realtime I/O requests on certain clients. This bandwidth reservation (RVIO) has higher priority than normal non-realtime clients, but lower priority over the realtime application (RTIO). FSM will always attempt to first satisfy realtime requests, and then follow the bandwidth reservation request. The remaining bandwidth is evenly distributed to all active non-realtime clients (excluding RVIO reserved clients).

To summarize, bandwidth priority is allocated in the following order:

- Realtime applications (RTIO)
- Bandwidth reservation (RVIO)
- Non-realtime I/O requests

i Note: If there is not sufficient bandwidth to accommodate the bandwidth reservation request (RVIO), the client receives whatever bandwidth remains after RTIO requests have been granted. If there are multiple RVIO clients, then each client is allocated a RVIO bandwidth directly proportional to their requested bandwidth.

Configuration

The primary configuration for QOS is in the FSM configuration file. No client configuration is required, although there is a QOS tuning parameter that can be specified when the file system is mounted.

Unit of I/O

Real-time I/O is based on well-formed I/O. This means that for the purposes of determining bandwidth rates, well-formed I/O is characterized as being a stripe width in size. This makes the best utilization of the disks in the stripe group and maximizes the transfer rate. Internally, non-real-time I/O is tracked by number of I/O operations per second. An I/O operation is a minimum of a file system block size, and a maximum of the file system block size multiplied by the stripe breadth.

(FsBlockSize * StripeBreadth).

FsBlockSize <= I/O <= (FsBlockSize * StripeBreadth)

Converting MB/sec to I/O/sec

Typically, it is easier to qualify an I/O subsystem in terms of MB/sec that can be sustained. However, internally the file system tracks everything on an I/O/sec basis. Note that the file system tracks only non-real-time I/O (that is, it gates only non-real-time I/O). An I/O is a minimum of the file system block size, and is

typically the point at which the file system hands the request off to the disk driver (**IoCallDriver** in Windows, or a **strategy** call in UNIX).

The file system counts the number of I/Os that have taken place during a given second. If the number exceeds that which is allotted, the request is pended until I/O becomes available (typically in the next second). I/O is honored in FIFO fashion; no priority is assigned.

To convert between I/Os and MB/sec, SNFS uses a somewhat unique formula that quantifies I/O as well-formed. The rationale behind this is due to the way in which many video applications make real-time I/O requests. To optimize the disk subsystem, real-time I/Os are well-formed so they saturate the disks. In SNFS terminology, this would be an I/O that covers all of the disks in a stripe.

This can be expressed as follows:

$$\text{ios_sec} = \text{mb_sec} / (\text{stripe_breadth} * \text{stripe_depth} * \text{fs_blocksize})$$

For example, with a file system blocksize of 4k, a **stripe_breadth** of 384, and a **stripe_depth** of four, the equivalent number of I/Os/sec for each well-formed I/O would be 216 Mb/sec / (384 * 4 * 4k). This is equivalent to 221184 k/sec / 6144k = 36 I/O/sec.

Server Configuration

All storage subsystems are different, so users must qualify the I/O subsystem and determine the maximum amount of I/O bandwidth available. SNFS relies on the correct setting in the configuration file; if the storage system changes (for example, because of a new disk array,) the user must re-qualify the I/O subsystem to determine the amount of bandwidth available. This amount will be specified in the FSM configuration file. The user can also specify the minimum amount of bandwidth to be provided to non-real-time applications.

There are five keywords controlling QOS that can be specified in the stripe group section of the FSM configuration file. Not all keywords need be present. Typically, the user specifies the RTIO bandwidth in terms of either number of I/O operations per second (**rtios**) or megabytes per second (**rtmb**). Keywords are not case sensitive.

For a minimum configuration, only the real-time limit (either **rtios** or **rtmb**) need be specified. All other configuration variables default to reasonable values.

Table 1: QOS Configuration Keywords

Name	Description	Default
Rtios	The maximum number of real-time I/Os allowed in a stripe group during any one-second period.	0 (no real-time)
Rtmb	Maximum amount of real-time MB/sec allowed on the stripe group during any one-second period.	0 (no real-time)
RtiosReserve	Amount of reserve in I/Os/sec from the maximum allowed for non-real-time I/Os. Must be greater than the equivalent to 1MB/sec or the amount that can be transferred to a single stripe line.	Equivalent to 1MB/sec

Name	Description	Default
RtmbReserve	Amount to reserve in MB/sec from the maximum allowed for non-real-time I/O.	Must be greater than 1. 1MB/sec
RtTokenTimeout	Time in seconds to wait for clients to respond to a token callback.	1.5 seconds

RTIO Upper Bound

The limit will be specified in terms of I/Os per second (parameter **Rtios**) or in terms of MB/sec (parameter **Rtmb**). Case is not sensitive. Note that I/Os per second are I/Os of any size to the disk subsystem. Either or both may be specified. If both are specified, the lower limit is used to throttle I/O. If neither is specified, no real-time I/O is available on the stripe group. These parameters are applied to a stripe group definition.

Example (Linux)

```
<stripeGroup> index="1" name="MyStripeGroup" realTimeIOs="2048"  
realTimeMB="10"  
</stripeGroup>
```

Example (Windows)

```
[StripeGroup MyStripeGroup]  
Rtios 2048  
Rtmb 10
```

The above example specifies that the storage system can support a maximum of 2048 I/Os per second at any instant, aggregate among all the clients, or 10 MB/sec, whichever is lower.

Most real-time I/O requests will be a stripe line at a time to maximize performance. Non-real-time I/Os will be a minimum of a file system block size.

i Note: It is important to realize that the **rtios** and **rtmb** settings refer to the total amount of sustained bandwidth available on the disk subsystem. Any I/O, either real-time or non-real-time, will ultimately be deducted from this overall limit. The calculations of available real-time and non-real-time are discussed later.

Specifying **rtmb** in the FSM configuration file is only recommended if all I/Os are well formed (that is, a full stripe width). Otherwise, the conversion between MB/sec and I/Os/sec using the well-formed I/O calculation could lead to unexpected results.

Modify

To change the RTIO parameters on the MDC, modify the `/usr/cvfs/config/<fsname.cfgx>` file, and restart StorNext services. Refer to the examples above for the Linux and Windows RTIO parameter names. You can also use the StorNext GUI.

Figure 94: Modifying RTIO Settings in a Linux MDC

For a file system on a Linux MDC, select a Stripe Group and modify the QOS, as shown:

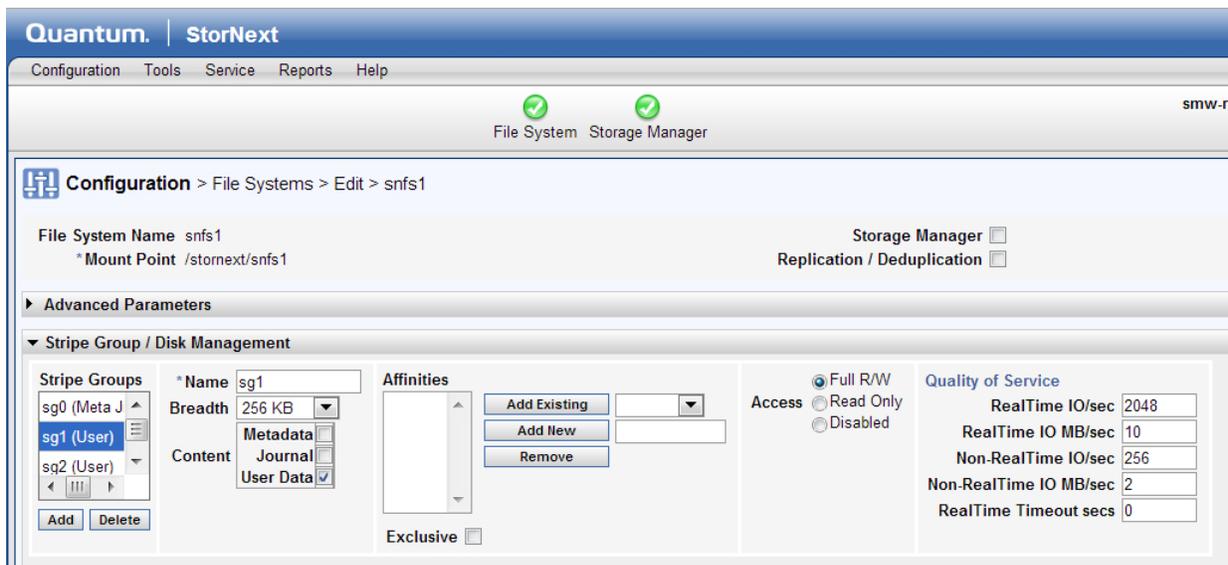
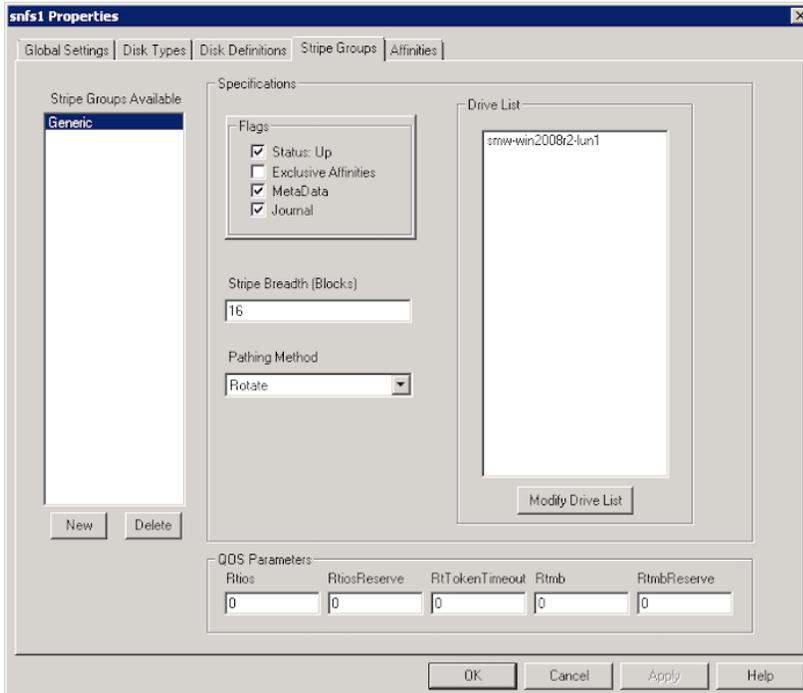


Figure 95: Modifying RTIO Settings in a Windows MDC

In a Windows MDC, you can modify these values with the **File System Cfg(Advanced)** tool. To change the QOS parameters, select File system and then click Stripe Groups Tab, as shown:



Reserve

To prevent deadlock, the QOS implementation never allows zero I/O/sec for non-real-time I/O. Otherwise, a system could block with many critical file system resources held waiting for I/O to become available. This is especially true via flush-on-close I/O via the buffer cache. It becomes extremely difficult to diagnose system hangs because no I/O is available. For this reason, QOS always reserves some amount of I/O for non-real-time I/O.

The minimum amount of non-real-time I/O reserved for non-real-time applications is one MB/sec. This can be changed via the stripe group section parameters (again, case is not sensitive). If both are specified, the lower of the two amounts is chosen. This amount is shared by all non-real-time applications on each client.

Example (Linux)

```
<stripeGroup> index="1" name="MyStripeGroup" realTimeIOsReserve="256"  
realTimeMBReserve="2"  
</stripeGroup>
```

Example (Windows)

```
[StripeGroup MyStripeGroup]
    RtiosReserve 256
    RtmbReserve 2
```

Token Timeouts

The **RtTokenTimeout** parameter controls the amount of time the FSM waits for clients to respond to callbacks. In most normal SANs, the default two-second setting is sufficient. This value may need to be changed for a SAN that has a mixture of client machine types (Linux, Windows NT, etc.) that all have different TCP/IP characteristics. Also, large numbers of clients (greater than 32) may also require increasing the parameter.

For example, if the FSM should ever fail, the clients will attempt to reconnect. When the FSM comes back online, the amount of time the clients take to re-establish their TCP/IP connection to the FSM can differ wildly. To avoid unnecessary timeouts, the **RtTokenTimeout** parameter can be increased, meaning the FSM waits longer for callback responses.

If a client times out on a token retraction, the original requestor receives an error from the FSM that includes the IP address of the offending client. This error is logged to **syslog**, and alternatively to the desktop on Windows clients. This can help in diagnosing reconnect failures, and in determining if the token time value should be increased.

Client Configuration

When a client obtains a non-real-time I/O token from the FSM, the token allows the client a specific amount of non-real-time I/O. If the client is inactive for a period of time, the token is relinquished and the non-real-time I/O released back to the FSM for distribution to other clients. The timeout period is controlled by the **nrtiotokenhold** mount option on UNIX platforms, and the **QOS Token Hold Time** parameter in the mount options tab of the SNFS control panel on Windows platforms. The default is sixty (60) seconds.

This means that after sixty seconds without non-real-time I/O on a stripe group, the non-real-time token for that stripe group is released. The parameter should be specified in five (5) second increments. If it is not, it will be silently rounded up to the next five-second boundary. If the **syslog** level is set to **debug**, the file system dumps out its mount parameters so the value can be seen.

Real-time I/O

A process requests real-time (ungated) I/O by using the SNFS External API **SetRtio** call (**F_SETRIO ioctl**). A library function is included in the External API sample source code that provides all the required cross-platform handling.

As an example, assume that a video playback application requires a constant rate of 186 MB/sec to correctly display images without dropping any frames. The application gates itself; that is, it requests I/O at a rate to

satisfy the requirements of correctly displaying an image. QOS provides a mechanism so other I/O requests do not perturb the real-time display.

In the following example, assume the I/O subsystem has been qualified at 216 MB/sec. The file system block size is 4k. The disk subsystem is actually a large RAID array that internally maps many drives to a single LUN. There are four LUNs in the stripe group; each LUN is optimized for a 1.5 MB transfer. This corresponds to the following in the fsm configuration file:

Example (Linux)

```
<stripeGroup index="1" name="MyStripeGroup" stripeBreadth="384"
realTimeMB="216">
  <disk index="0" diskLabel="CvfsDisk0" diskType="VideoDrive"/>
  <disk index="0" diskLabel="CvfsDisk1" diskType="VideoDrive"/>
  <disk index="0" diskLabel="CvfsDisk2" diskType="VideoDrive"/>
  <disk index="0" diskLabel="CvfsDisk3" diskType="VideoDrive"/>
</stripeGroup>
```

Example (Windows)

```
[StripeGroup MyStripeGroup]
StripeBreadth 384
Node CvfsDisk0 0
Node CvfsDisk1 1
Node CvfsDisk2 2
Node CvfsDisk3 3
Rtmb 216
```

Also, assume there is only one stripe group for user data in the file system. As recommended by Quantum, there may be other stripe groups for metadata and journal that are not shown.

SetRtio

Initially, all stripe groups in the file system are in non-real-time mode. Clients make their requests directly to the I/O subsystem without any gating. In our example, the process requires 186 MB/sec and the system designers know there will never be a need to support more than one stream at 216 MB/sec.

The **SetRtio** request has a number of flags and parameters to control its operation. These are all documented in the **external_api.pdf** file that describes the external API in detail. For this example, set the handle for the indicated stripe group using the **RT_SET** parameter.

Oversubscription

In most cases, system designers ensure that the amount of **RTIO** is not oversubscribed. This means that processes will not ask for more **RTIO** than is specified in the configuration file. However, it is possible to request more **RTIO** than is configured. The API uses the **RT_MUST** flag to indicate that the call must succeed with the specified amount. If the flag is clear, the call allocates as much as it can. In both cases, the amount allocated is returned to the caller.

Handles

The **SetRtio** call accepts two different types of handles. The first is a handle to the **root** directory. In this mode the stripe group is put into real-time mode, but no specific file handle is tagged as being **ungated**. Real-time I/O continues on the stripe group until it is explicitly cleared with a **SetRtio** call on the **root** directory that specifies the **RT_CLEAR** flag; the file system is unmounted; or the system is rebooted. It is up to the application to make a subsequent call to **EnableRtio** (**F_ENABLERTIO**) on a specific handle.

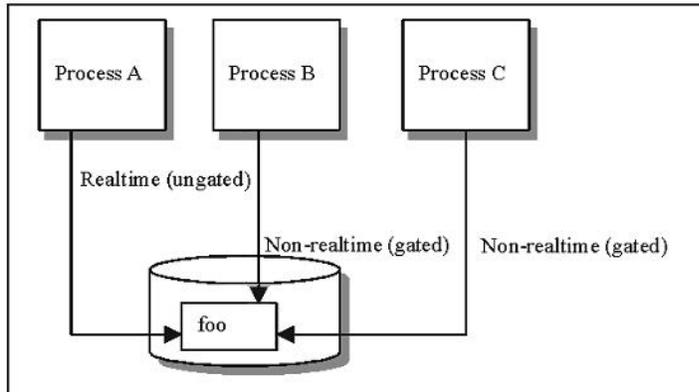
If the handle in the **SetRtio** call refers to a regular file, it is the equivalent of a **SetRtio** call on the root directory followed by an **EnableRtio** call. The file handle will be ungated until it is closed, cleared (**RT_CLEAR** in a **SetRtio** call), or disabled (**DisableRtio**). When the handle is closed, the amount of real-time I/O is released back to the system. This causes the FSM to readjust the amount of bandwidth available to all clients by issuing a series of callbacks.

The client automatically issues a call to the FSM with the **RT_CLEAR** flag specifying the amount of real-time I/O set on the file. If multiple handles are open on the file—each with a different amount of real-time I/O—only the last file close triggers the releasing action; all aggregate **RTIO** are released.

This automatic clearing of real-time I/O is carried out in the context of the process that is closing the file. If the FSM cannot be reached for some reason, the request is enqueued on a daemon and the process closing the file is allowed to continue. In the background, the daemon attempts to inform the FSM that the real-time I/O has been released.

Different processes can share the same file in real-time and non-real-time mode. This is because the level of gating is at the handle level, not the file level. This allows a real-time process to perform ingest of material (video data) at the same time as non-real-time processes are performing other operations on the file.

Figure 96: Sharing Access to Files



In [Figure 96 above](#), Process A has ungated access to file **foo**. Processes B and C also are accessing file **foo**, but the client gates their I/O accesses. If multiple handles are open to the same file and all are in real-time mode, only the last close of the handle releases the real-time I/O back to the system. This is because on most platforms the file system is informed only on the last close of a file.

Ungated files

It is also possible to denote using the **RT_NOGATE** flag that a handle should not be gated without specifying any amount of real-time I/O. This is useful for infrequently accessed files (such as index files) that should not be counted against the non-real-time I/O. System designers typically allow for some amount of overage in their I/O subsystem to account for non-gated files.

Calculating Available RTIO

When the FSM receives a request for RTIO, it takes the amount reserved into consideration. The reserve amount functions as a soft limit beyond which the FSM will not traipse. The calculation for **RTIO** is as follows:

$$\text{available_rtio} = (\text{rtio_limit}) - (\text{rtio_current}) - (\text{rtio_reserve})$$

In the above calculation, **rtio_limit** is the stripe group's maximum number of IOs (the value of parameter **Rtios**), **rtio_current** is the total number of currently reserved real-time IOs, and **rtio_reserve** is the minimum IOs reserved for non-realtime IOs (the value of **RtiosReserve**).

All internal calculations are done in terms of I/O/sec.

Non-Realtime I/O Configuration

In order to reserve bandwidth for non-realtime I/O (RVIO) operations on certain clients, you must specify the amount in the QOS central configuration file. This file is located under **\$CVFSROOT/config/** (for example, **/usr/cvfs/config**). The configuration file name consists of the file system name and the suffix **_rvio.opt**. For example, the central configuration file name for a file system called **fs1** would be **fs1_rvio.opt**.

The configuration doesn't affect the normal RTIO requests; it affects only the bandwidth allocation to non-RTIO requests. Note the following characteristics of RVIO:

1. RTIO has higher priority and is always satisfied first. RVIO uses whatever bandwidth is left.
2. RVIO reservation is not guaranteed. Instead, it is adjusted dynamically. When there are new RVIO or RTIO requests, the bandwidth reserved for clients with previous RVIO requests is readjusted. Each RVIO client will get the RVIO bandwidth reserved proportional to its request amount.
3. The RVIO bandwidth allocated for a client is the total bandwidth for non-RTIO requests on the client. The bandwidth (token) will not return like a normal non-RTIO client does if it's been idle for a hold time. Non-RTIO requests on clients with an RVIO reservation is subject to the same throttling mechanism as non-RTIO requests on normal clients.
4. Other active non-RTIO clients equally share the bandwidth left over after the possible RTIO and RVIO allocations. If no bandwidth is left, the minimal reserved bandwidth (defined in the stripe group section of the file system configuration file) is used.

A central configuration file has multiple entries, and each entry defines the RVIO reservation for a client. Following are the fields of an entry:

`host bw-type sg=yy,[sg=yy]`

- **host** is the host name, IP address (either V4 or V6), or FQDN, etc. of the client. The host name should be able to be resolved (converted to a valid IP address) by the FSM server. If there are multiple IPs on the host, use the IP that is used to communicate with the FSM.
- **bw-type** is the type of bandwidth to be specified. There are two bandwidth type options:
 - **qosmb** means the subsequent value for bandwidth reservation uses MB/s (megabytes per second) as the unit of measure.
 - **qosios** means the subsequent value for bandwidth reservation uses IOs/s (inputs/outputs per second) as the unit of measure.
- **sg** stands for stripe group. You may specify a stripe group by entering the stripe group name, or by stripe group number starting from 0 for the first stripe group. If you'd like to specify the same RVIO bandwidth reservation for all eligible stripe groups, you can use the asterisk wildcard in the format ***=yy**.

Any line in the configuration file starting with the pound sign (#) is considered a comment line and is not executed.

For additional information about entering the configuration file for QOS, see the man page called **qos_config**.

Configuration File Examples

Following are some example configuration file entry examples:

```
box1.xyz.com qosios 2=200,4=50,sg5=45  
10.10.1.8 qosmb *=60
```

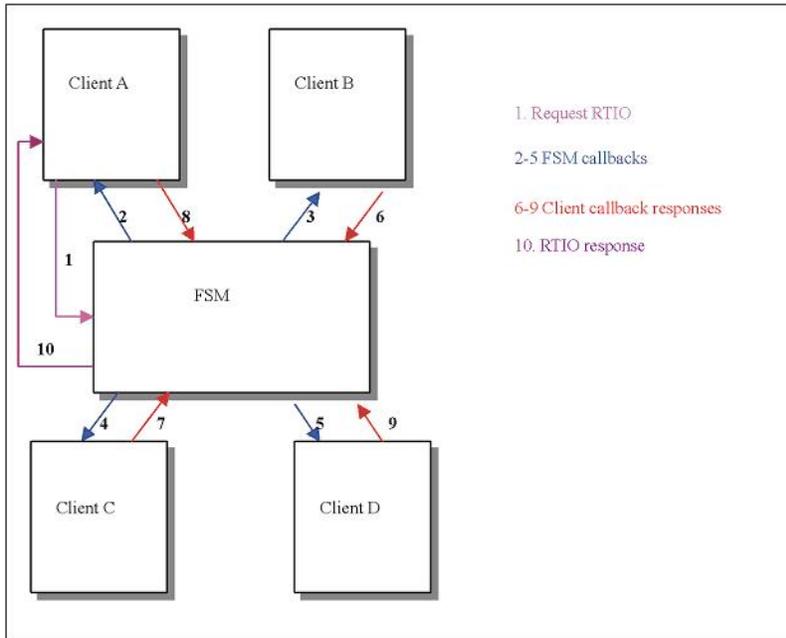
Callbacks

The cornerstones of the communications between the FSM and the client are callbacks and tokens. A callback is an unsolicited message from the FSM to the client requesting that the client adjust its real-time I/O parameters. The callback contains a token that specifies the amount of non-real-time I/O available on a stripe group.

Initially, all stripe groups in a file system are in non-real-time (ungated) mode. When the FSM receives the initial request for real-time I/O, it first issues callbacks to all clients informing them that the stripe group is now in real-time mode. The token accompanying the message specifies no I/O is available for non-real-time I/O. Clients must now obtain a non-real-time token before they can do any non-real-time I/O.

After sending out all callbacks, the FSM sets a timer based on the **RtTokenTimeout** value, which by default is set to 1.5 seconds. If all clients respond to the callbacks within the timeout value the **RTIO** request succeeds, and a response is set to the requesting client.

Figure 97: Callback Flow for Initial RTIO Request



In the above diagram, a process on client A requests some amount of **RTIO** in Step 1. Since this is the first request, the FSM issues callbacks to all connected clients (Steps 2-5) informing them that the stripe group is now in real-time mode. The clients respond to the FSM in Steps 6-9. After all the clients have responded, the FSM responds to the original requesting client in Step 10.

If the timer expires and one or more clients have not responded, the FSM must retract the callbacks. It issues a response to the requesting client with the IP number of the first client that did not respond to the callback. This allows the requesting client to log the error with the IP number so system administrators have a chance of diagnosing the failure. It then sends out callbacks to all the clients to which it first sent the callbacks, retracting them to the original state. In our example, it would set the stripe group back to non-real-time mode.

After sending out the callbacks, the FSM waits for a response using the **RtTokenTimeout** value as before. If a client again does not respond within the timeout value, the callbacks are retracted and sent out again. This repeats until all clients respond. During this time of token retractions, real-time requests cannot be honored and will only be enqueued.

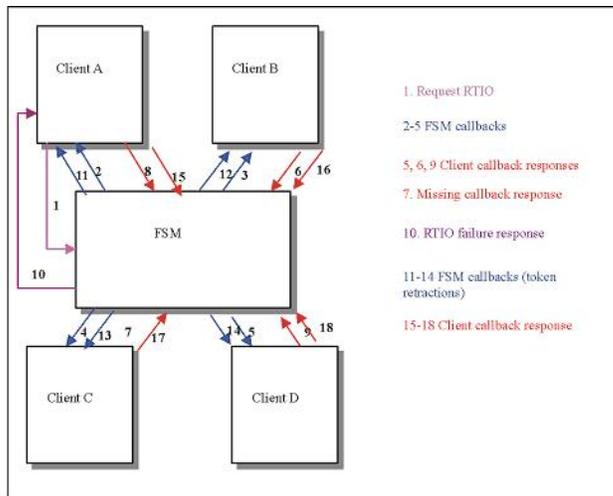
Callback Failures

The FSM must handle a case where a client does not respond to a callback within the specified timeout period (**RtTokenTimeout**). If a client does not respond to a callback, the FSM must assume the worst: that it is a rogue that could wreak havoc on real-time I/O. It must retract the tokens it just issued and return to the previous state.

As mentioned earlier, the original requestor will receive an error (**EREMOTE**) and the IP address of the first client that did not respond to the callback. The FSM enters the token retraction state, and will not honor any

real-time or token requests until it has received positive acknowledgement from all clients to which it originally sent the callbacks.

Figure 98: Callback Retraction Example



In [Figure 98 above](#), Client A requests some amount of RTIO as in [Figure 97 on the previous page](#). However, assume that Client C did not respond to the initial callback in time (step 7). The FSM will return a failure to Client A for the initial RTIO request, then send out callbacks to all clients indicating the stripe group is no longer real-time (steps 11-14). In the example, Client C responds to the second callback, so the FSM will not send out any more callbacks. The stripe group is back in non-real-time mode.

Note that this can have interesting repercussions with file systems that are soft mounted by default (such as Windows). When the caller times out because other clients are not responding and then gives up and returns an error to the application, if at some point the FSM is able to process the **RTIO** request it may result in the stripe group being put into real-time mode after the original caller has received an error code. Both the FSM and clients log their actions extensively to **syslog**, so if this situation arises it can be detected.

In [Figure 98 above](#), if the stripe group were already in real-time mode the FSM would only send out callbacks to those clients that already have tokens. Once all clients responded to the token callbacks, the stripe group would be back in its original state.

Tokens

A token grants a client some amount of non-real-time I/O for a stripe group. Tokens are encapsulated in callback messages from the FSM. Initially, no tokens are required to perform I/O. Once a stripe group is put into real-time mode, the FSM sends callbacks to all clients informing them that they will need a token to perform any non-real-time I/O. The first I/O after receiving the callback will then request a non-real-time I/O token from the FSM.

The FSM calculates the amount of non-real-time bandwidth using the following formula:

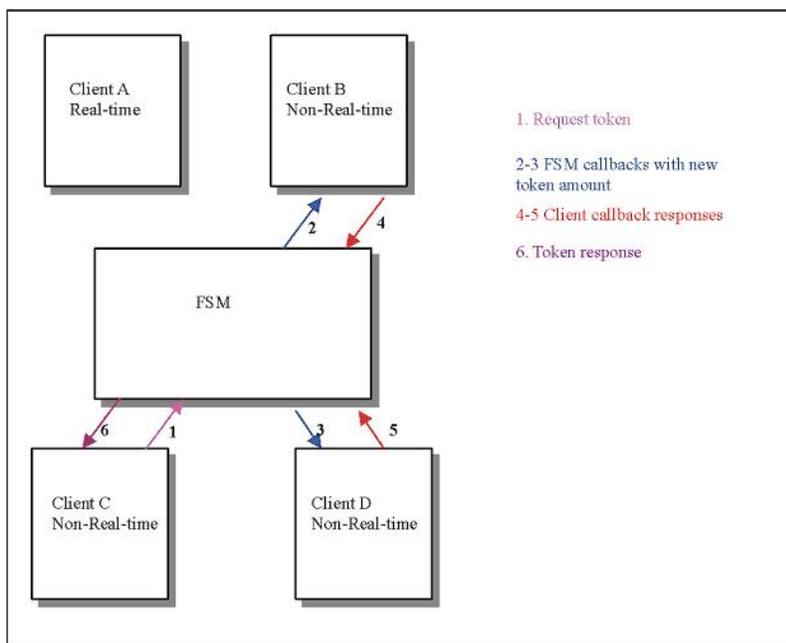
$$\text{available_nrtio} = \frac{(\text{rtio_limit}) - (\text{rtio_current}) - (\text{rvio_current})}{(\text{current_num_nrtio_clients}) + 1}$$

In the above calculation, **rvio_current** is the total bandwidth reserved by current RVIO clients. The amount of existing real-time I/O (**rtio_current**) has already been adjusted with the reserve parameter. As each client requests a non-real-time I/O token, the number of clients increases (**current_num_nonrtio_clients** in the above formula) and the amount of available non-real-time I/O decreases.

Each time there is a change in the amount of non-real-time I/O available, the FSM sends callbacks to the clients with tokens. It is important to note that unlike the initial set of callbacks where the FSM sent callbacks to all connected clients, it is now only necessary to send callbacks to those clients that have an existing token.

Once a client has a token, it can perform as much I/O per second as is allowed by that token. It does not need to contact the FSM on every I/O request. The FSM will inform the client whenever the token changes value.

Figure 99: Non-Real-time Token Adjustments



In [Figure 99 above](#), assume the stripe group is already in real-time mode as a result of an **RTIO** request from client A. Clients B and D are doing non-real-time I/O to the stripe group and have a token that specifies the amount of non-real-time I/O available. Client C then requests a non-real-time I/O token in Step 1. The FSM calls back to Clients B and D and specifies the new token amount in Steps 2-3. The clients respond in Steps 4-5, acknowledging the new token amount. The FSM then responds to Client C with the new token in Step 6.

Failure Semantics

There are two major failures that affect QOS: FSM crashes and client crashes. These can also be loss of communication (network outages). For client and server failures, the system attempts to readjust itself to the pre-failure state without any manual intervention.

FSM Failures

If the FSM crashes or is stopped, there is no immediate affect on real-time (ungated) I/O. As long as the I/O does not need to contact the FSM for some reason (attribute update, extent request, etc.), the I/O will continue. From the standpoint of QOS, the FSM being unavailable has no affect.

Non-real-time I/O will be pended until the FSM is re-connected. The rationale for this is that since the stripe group is in real-time mode, there is no way to know if the parameters have changed while the FSM is disconnected. The conservative design approach was taken to hold off all non-real-time I/O until the FSM is reconnected.

Once the client reconnects to the FSM, the client must re-request any real-time I/O it had previously requested. The FSM does not keep track of QOS parameters across crashes; that is, the information is not logged and is not persistent. Therefore, it is up to the clients to inform the FSM of the amount of required **RTIO** and to put the FSM back into the same state as it was before the failure.

In most cases, this results in the amount of real-time and non-real-time I/O being exactly the same as it was before the crash. The only time this would be different is if the stripe group is oversubscribed. In this case, since more **RTIO** had been requested than was actually available, and the FSM had adjusted the request amounts, it is not deterministically possible to re-create the picture exactly as it was before. Therefore, if a deterministic picture is required across reboots, it is advisable to not over-subscribe the amount of real-time I/O.

The process of each client re-requesting **RTIO** is exactly the same as it was initially; once each client has reestablished its **RTIO** parameters, the non-real-time I/O is allowed to proceed to request a non-real-time token. It may take several seconds for the SAN to settle back to its previous state. It may be necessary to adjust the **RtTokenTimeout** parameter on the FSM to account for clients that are slow in reconnecting to the FSM.

Client Failures

When a client disconnects either abruptly (via a crash or a network partition,) or in a controlled manner (via an unmount), the FSM releases the client's resources back to the SAN. If the client had real-time I/O on the stripe group, that amount of real-time I/O is released back to the system. This causes a series of callbacks to the clients (all clients if the stripe group is transitioning from real-time to non-real-time,) informing them of the new amount of non-real-time I/O available.

If the client had a non-real-time I/O token, the token is released and the amount of non-real-time I/O available is recalculated. Callbacks are sent to all clients that have tokens informing them of the new amount of non-real-time I/O available.

Client Token Releases

While it is not a failure case, the handling of a client token release is exactly the same as in the case where the client disconnected. All clients retain non-real-time tokens for a fixed amount of time. The default is 60 seconds. This can be controlled via the **nrtiotokentimeout** mount option. After the specified period of inactivity (i.e., no non-real-time I/O on the stripe group), the client will release the token back to the FSM.

The FSM will re-calculate the amount of non-real-time bandwidth available, and send out callbacks to other clients.

Therefore, if a situation exists where a periodic I/O operation occurs every 70 seconds, it would be beneficial to set the **nrriotokentime** mount option to something greater than or equal to 70 seconds to cut down on system and SAN overhead.

Monitoring

The current real-time statistics are available via the **cvadmin** utility. The **show long** command has been enhanced to provide information as to the current limit, the minimum amount reserved for non-real-time I/O, the number of active clients, the amount currently committed, and the amount a non-real-time application could hope to get when requesting I/O.

Whenever the stripe group status changes (such as from non-real-time to real-time mode), an event is logged to **syslog** (system event log on Windows platforms).

On the Windows platform, real-time performance is also available via the **perfmon** utility. There are counters for both the client (SNFS Client) and FSM (SNFS File System Server [FSS]). In the client, a number of **rtio_xxx** counters are available to track the number of real-time I/Os/sec, number of non-real-time I/O requests, non-real-time I/O starvation, and other counters. A full explanation of each counter is provided with the **perfmon** utility by clicking Explain. In the FSM, information about the number of outstanding non-real-time clients, available **RTIO**, and other QOS information is available.

Performance counters are not enabled by default in the client. To enable them, you must execute **cvdb -P** ; this toggles the state of collection. To turn off the **perfmon** counters, do another **cvdb -P**. To re-enable, again do **cvdb -P**, and so on. To clear all client counters to zero, disable, then re-enable the counters with **cvdb -P**.

Sharing Disk Resources

As a final example, consider the case of a full-featured disk subsystem (Redundant Array of Very Expensive Disks, or RAVED) using a very high speed interconnect. Many clients can share these disk arrays, but it is sometimes desirable to limit a client's access to the array. QOS provides a mechanism for political bandwidth management so that no one client can consume all the bandwidth of the channel interconnects.

In such a scenario, the stripe group would always be in real-time mode. Each client would have a token specifying the number of I/Os/sec permissible. If there is need to assign different reserved bandwidth for non-real-time clients, specify the client's bandwidth reservation in the RVIO config file.

The foundation of such an approach is a simple program that puts the stripe group into real-time mode as soon as the FSM is up and servicing requests. An example of such a program is included in the source code for the External API.

Once the stripe group is in real-time mode, the bandwidth as specified in the FSM configuration file is shared by all clients. In cases such as this, the real-time limit (**rtios** or **rtmb**) is calculated to be the total bandwidth desired to each client times the number of possible clients.

As each client attempted to access the disk subsystem, it would obtain a token. The FSM would send out callbacks adjusting down the amount of bandwidth available. No one client would be allowed to exceed the threshold specified in the non-realtime token. This assures fairness among all the clients.