QES 2.2.x

User Guide

Document version: 2
09/04/2025

Contents

4. System Settings

5. Privilege

6. Network and File Services Settings

1. Preface

Audience

This document is intended for consumers and storage administrators. This guide assumes that the user has a basic understanding of storage and backup concepts.

Document Conventions

Symbol	Description
	Notes provide default configuration settings and other supplementary information.
	Important notes provide information on required configuration settings and other critical information.
	Tips provide recommendations or alternative methods of performing tasks or configuring settings.
	Warnings provide information that, when ignored, may result in potential loss, injury, or even death.

2. Overview

NAS Access

Method	Description	Requirements
Web browser	You can access the NAS using any computer on the same network if you have the following information: • NAS name (Example: http://example123/) or IP address • Logon credentials of a valid user account	• Computer that is connected to the same network as the NAS • Web browser
Qfinder Pro	Qfinder Pro is a desktop utility that enables you to locate and access QNAP NAS devices on a specific network. The utility supports Windows, macOS, Linux, and Chrome OS. To download Qfinder Pro, go to https://www.qnap.com/utilities.	• Computer that is connected to the same network as the NAS • Web browser • Qfinder Pro
Explorer (Windows)	You can map a NAS shared folder as a network drive to easily access files using Explorer.	Windows computer that is connected to the same network as the NAS
Finder (macOS)	You can mount a NAS shared folder as a network drive to easily access files using Finder.	Mac computer that is connected to the same network as the NAS

Accessing the NAS Using a Browser

You can access the NAS using any computer on the network if you know its IP address and the logon credentials of a valid user account.

Tip

- By default, you can access the NAS using the NAS management interface, which usually supports 1 Gbps. To access the NAS using a different interface (for example, one that supports 10 Gbps), enable service binding and then configure **NAS Web Management Interface**. For details, see Service Binding.
- If you do not know the IP address of the NAS, you can locate it using Qfinder Pro. For details, see Accessing the NAS Using Qfinder Pro.

1. Verify that your computer is connected to the same network as the NAS.

2. Open a web browser on your computer.
3. Type the IP address of the NAS in the address bar.
   The QES login screen appears.
4. Specify your username and password.
   The default username is `admin`.
   The default admin password depends on the QES version:
   - Before QES 2.1.1 build 20200424: `admin`
   - QES 2.1.1 build 2020424: The NAS serial number in lowercase
   - QES 2.1.1 build 20200515 or later: The NAS serial number in uppercase
5. Click **Login**.
   The QES desktop appears.

Accessing the NAS Using Qfinder Pro

1. Install Qfinder Pro on a computer that is connected to the same network as the NAS.

   Tip
   To download Qfinder Pro, go to https://www.qnap.com/en/utilities.

2. Open Qfinder Pro.
   Qfinder Pro automatically searches for all QNAP NAS devices on the network.
3. Locate the NAS in the list, and then double-click the name or IP address.
   The QES login screen opens in the default web browser.
4. Specify your username and password.
5. Click **Login**.
   The QES desktop appears.

Accessing the NAS Using myQNAPcloud

The myQNAPcloud service allows you to use the internet to access a NAS device outside a local area network (LAN).

1. Optional: Verify that myQNAPcloud is enabled.
   a. Go to **Control Panel** > **System** > **myQNAPcloud**.
      The **myQNAPcloud** window opens.
   b. Locate the device URL.
      The default URL format is `<device name>.myqnapcloud.com`.

> **Important**
> The device URL is only available if myQNAPcloud is enabled.
> For details, see Enabling myQNAPcloud.

2. On your web browser, type the URL and then press **Enter**.

Enabling myQNAPcloud

The myQNAPcloud service allows you to use the internet to access a NAS device outside a local area network (LAN).

1. Go to **Control Panel** > **System** > **myQNAPcloud**.
   The **myQNAPcloud** window opens.
2. Click **Get Started**.
   The **myQNAPcloud wizard** opens.
3. Perform the following steps.
   a. Click **Start**.
   b. Type your QID and password.
      For details on creating a myQNAPcloud account, see https://support.myqnapcloud.com/features?&focus=howto.
   c. Click **Next**.
   d. Type a device name.
   e. Click **Next**.

   myQNAPcloud generates the device URL.
   The default URL format is `<device name>.myqnapcloud.com`.

Enabling My DDNS

The My DDNS service allows you to connect to network services on the NAS using the myQNAPcloud device URL.

1. Go to **Control Panel** > **System** > **myQNAPcloud**.
2. Verify that myQNAPcloud is enabled.
   For details, see Enabling myQNAPcloud.
3. Go to **Control Panel** > **System** > **myQNAPcloud** > **Remote Access Services**.
   The **myQNAPcloud** window opens.
4. Click **My DDNS**.
   The **My DDNS** tab appears.
5. Select **Enable myQNAPcloud DDNS service** and then click **Apply**.
   myQNAPcloud generates the device URL.
   The default URL format is `<device name>.myqnapcloud.com`.

Accessing Shared Folders on the NAS

To access a shared folder on a NAS, you must first map the folder as a network drive.

For details on drive mapping, see the following:

- Mapping a Shared Folder on a Windows Computer
- Mounting a Shared Folder on a Mac Computer
- Mounting a Shared Folder on a Linux Computer

To access a mapped drive, use a file manager on your computer.

- On a Windows computer, open **Windows Explorer** and then locate the mapped drive.
- On a Mac computer, open **Finder** and then locate the mapped drive.
- On a Linux computer, open your preferred file manager and then locate the mapped drive.

About QES

QNAP Enterprise System (QES) is an operating system that is based on FreeBSD Kernel and ZFS to provide the stability and functionality of traditional Linux operating systems and native file systems.

Features and Benefits

QES provides the following features and benefits.

Feature	Description
Remote data synchronization	Block-level SnapSync provides remote backup and disaster recovery at any time.
Application consistent snapshots	Snapshot Agent provides data consistency when taking snapshots.
Higher-capacity efficiency	Block-level deduplication, real-time data compression, and thin provisioning provide increased efficiency.
High availability, high reliability, and high serviceability	QES supports dual active controllers and dual Mini-SAS channel backups, and tolerates single-node failure to ensure uninterrupted mission-critical enterprise tasks and productivity.
Minimal backup configuration	The minimum requirements for a QNAP Snapshot Agent and VSS Hardware Provider operating environment include a QNAP ES NAS and a server. You can deploy all applications, including VSS Service, Requestor, Provider and QNAP Snapshot Agent, on the same server.

Feature	Description
Excellent random write performance	QES uses a battery-protected DRAM write cache with cache data protection, and flash read acceleration.
Well-rounded networking support	QES supports 10 Gigabit Ethernet and iSCSI to provide storage deployment flexibility.

Note

The “high availability” and “battery-protected DRAM write-cache” features are only available on dual-controller ES NAS devices.

Changes in QES 2.2.0

Important Notes

- For instructions on updating QES to the latest version, open the following link. https://www.qnap.com/en/how-to/faq/article/my-nas-is-running-an-older-version-of-qes-can-i-update-to-the-latest-version-directly-what-sequence-should-i-follow-when-updating-qes
- For release note history, open the following link. https://www.qnap.com/en/releasenotes_qes/

New Features

- Added support for Fibre Channel.
- Added support for NFS 4.1.
- Added schedule for storage pool scrubbing. Scrubbing tasks are suspended outside of the scheduled times.
- Added deduplication table recycling schedule. The deduplication table is cleaned periodically according to a schedule, in order to reduce memory use.
- Added SnapSync performance test. You can test SnapSync data transfer speeds between two NAS devices.
- Added SnapSync latency monitoring for real-time jobs. You can set alerts and view graphs of SnapSync latency over time.

Enhancements

- Improved file system performance.
- QES now alerts you if the storage controller databases are inconsistent.

Fixed Issues

- Several minor bug fixes.

QES Installation

You can install QES using any of the following methods.

Method	Description	Requirements
Qfinder Pro installation	If the NAS is connected to your local area network, you can do the following: • Locate the NAS using Qfinder Pro. • Complete the steps in the Smart Installation Guide wizard. For details, see Installing QES Using Manual Setup.	• Computer • Network cable • Qfinder Pro installer
Switch from QTS	If the NAS is currently installed with QTS, you can switch to QES. For details, see System Reset and Restore to Factory Default.	N/A

Installing QES Using Manual Setup

Warning
Installing QES deletes all data on the drives. Back up your data before proceeding.

1. Power on the NAS.
2. Connect the NAS to your local area network.
3. Run Qfinder Pro on a computer that is connected to the same local area network.

   Tip
   To download Qfinder Pro, go to https://www.qnap.com/utilities.

4. Locate the NAS in the device list, and then double-click the name or IP address.
   The setup wizard opens.
5. Click **Manual Setup**.
   The **Enter the NAS name and administrator's password** screen appears.

6. Specify a NAS name and password.

Field	Requirements
NAS name	• Length: 1-14 characters • Valid characters: A-Z, a-z, 0-9 • Valid special characters: Hyphen (-) • Not allowed: The last character is a hyphen (-)
Password	• Length: 5-64 characters • Valid characters: All ASCII characters

7. Click **Next**.
   The **Set the date and time** screen appears.
8. Specify the time zone, date, and time.

   Tip
   QNAP recommends connecting to an NTP server to ensure that the NAS follows the Coordinated Universal Time (UTC) standard.

9. Click **Next**.
   The **Configure the network settings** screen appears.
10. Select **Obtain an IP address automatically (DHCP)**.
11. Click **Next**.
    The **Cross-platform file transfer service** screen appears.
12. Select the types of devices that you will use to access shared folders on the NAS.
13. Click **Next**.
    The **Check system disk status** screen appears.
14. Select a storage pool to install QES on.

    Important
    Once the installation process starts, the selected storage pool cannot be modified. Reinitialize the NAS before selecting a different disk group.

15. Click **Next**.
    The **Summary** screen appears.
16. Review the settings.
17. Click **Apply**.
    A confirmation message appears.

Warning
Clicking **Confirm** deletes all data on the drive before installing QES.

18. Click **Confirm**.
The wizard installs QES and restarts the NAS.

Note
You must initialize any unused disks upon your next login.

QES Navigation

Task Bar

No.	Element	User Actions
1	**Main Menu**	Click the button to open the **Main Menu** panel on the left side of the desktop.
2	**Search**	• Type key words to locate settings, applications, and help content. • Click an entry in the search results to open the application or system utility.

3	**Background Tasks**	• Hover the mouse pointer over the button to see the number of background tasks that are running. Examples of background tasks include file backup and multimedia conversion.
		• Click the button to see the following details for each background task:
		  • Task name
		  • Task description
		  • Progress (percentage of completion)
		• Click ◙ to stop a task.

No.	Element	User Actions
4	**External Devices**	• Hover the mouse pointer over the button to view the number of external storage devices and printers that are connected to the USB and SATA ports on the NAS. • Click the button to view the details for each connected device. • Click a listed device to open File Station and view the contents of the device. • Click **Settings** to open the **UPS** screen.

5	**Event Notifications**	• Hover the mouse pointer over the button to see the number of recent errors and warnings.
		• Click the button to view the following details for each event:
		  • Event type
		  • Description
		  • Timestamp
		  • Number of instances
		• Click a list entry to view the related utility or application screen.
		• Clicking a warning or error log entry opens the **System Event Log** window.
		• Click **More>>** to open the **System Event Log** window.
		• Click **Clear All** to delete all list entries.

6	**Options**	Click your profile picture to open the **Options** screen.

No.	Element	User Actions
7	**[USER_NAME]**	Click the button to view the last login time and the following menu items: • **Options**: Opens the **Options** window • **Sleep**: Keeps the NAS powered on but significantly reduces power consumption This feature is only available on models with certain hardware specifications. • **Restart**: Restarts the NAS • **Shutdown**: Shuts down QES and then powers off the NAS **Note** You can also power off the NAS using one of the following methods: • Press and hold the power button for 1.5 seconds. • Open Qfinder Pro, locate the device in the list. Right click on the device and select **Shut down Device**. • Open Qmanager, and then go to **Menu** > **System Tools** > **System**. Tap **Shutdown**. • **Logout**: Logs the user out of the current session

No.	Element	User Actions

8	**More**	Click the button to view the following menu items:
		• **Help**: Displays links to the Quick Start Guide, Virtualization Guide, QES Help, and online tutorials page
		• **Language**: Opens a list of supported languages and allows you to change the language of the operating system
		• **Desktop Preferences**: Opens a list of display modes and allows you to select the mode based on your device type
		• **Feedback**: Opens the QNAP Feature Request / Bug Report web page
		• **Data & Privacy**: Opens the **QNAP Privacy Policy** page
		• **About**: Displays the following information:
		  • Operating system
		  • Hardware model
		  • Operating system version
		  • Number of installed drives
		  • Number of empty drive bays
		  • System volume name
		  • Used disk space
		  • Available disk space

9	**Dashboard**	Click the button to display the dashboard.

Options

#	Tab	User Actions

1	**Profile**	• Specify the following optional information:
		  • Profile picture
		  • E-mail
		  • Phone number
		• Click **View** to open the **System Connection Logs** screen.
		• Click **Edit login screen** to open the **Login Screen** configuration screen in the **Control Panel** window.
		• Click **Apply** to save all changes.

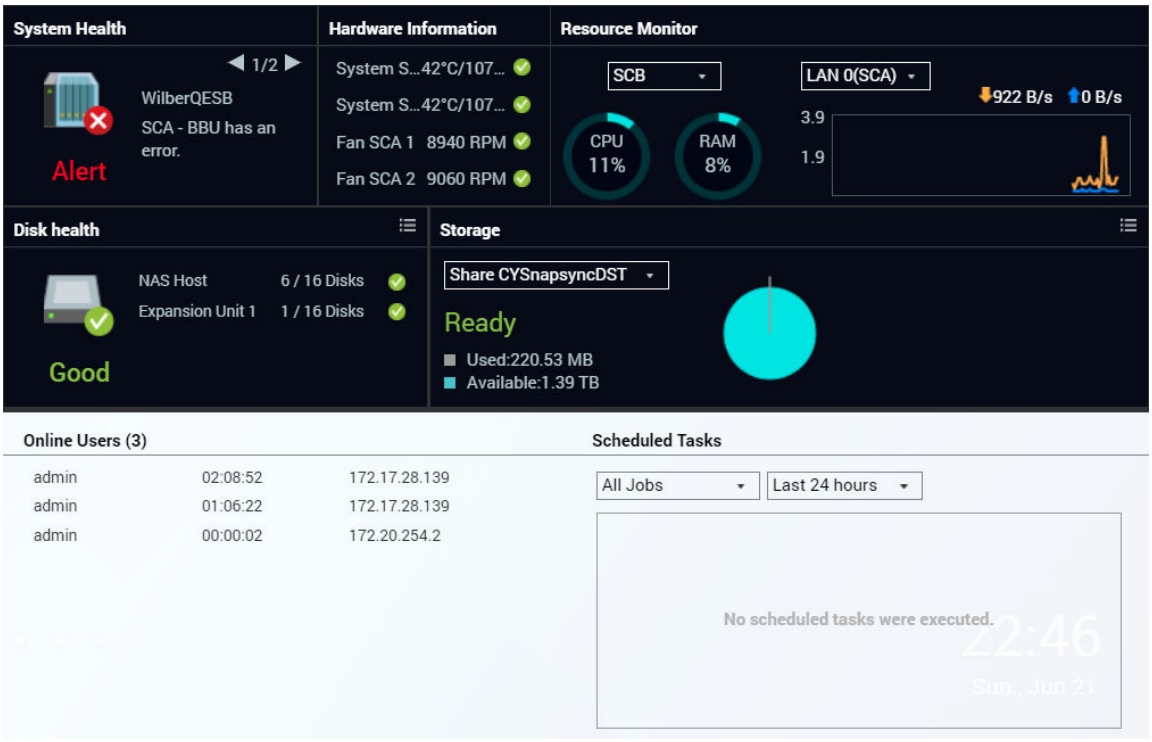
2	**Wallpaper**	• Select a wallpaper from the built-in options or upload a photo. • Click **Apply** to save all changes.

3	**Change Password**	• Specify the following information:
		  • **Old password**
		  • **New password**: Specify a password with a maximum of 64 characters. QNAP recommends using passwords with at least 6 characters.
		  • Click **Apply** to save all changes.

#	Tab	User Actions

4	**Miscel-laneous**	• Enable the following settings.
		  • **Auto logout after an idle period of**: You can specify the duration of inactivity after which the user is automatically logged out.
		  • **Warn me when leaving QES**: When enabled, QES prompts users for confirmation whenever they try to leave the desktop (by clicking the Back button or closing the browser). QNAP recommends enabling this setting.
		  • **Reopen windows when logging back into QES**: When enabled, the current desktop settings (including all open windows) are retained until the next session.
		  • **Show the desktop switching button**: When enabled, QES displays the desktop switching buttons **< >** on the left and right sides of the desktop.
		  • **Show the link bar on the desktop**: When enabled, QES displays the link bar on the bottom of the desktop.
		  • **Show the Dashboard button**: When enabled, QES displays the **Dashboard** button on the task bar.
		  • **Show the NAS time on the desktop**: When enabled, QES displays the server date and time on the desktop.
		• **Keep Main Menu open after selection**: When enabled, QES keeps the main menu pinned to the desktop after you open it.
		• Click **Apply** to save all changes.

Dashboard



The dashboard opens in the lower right corner of the desktop.

> **Tip**
> You can click and drag a section onto any area of the desktop.

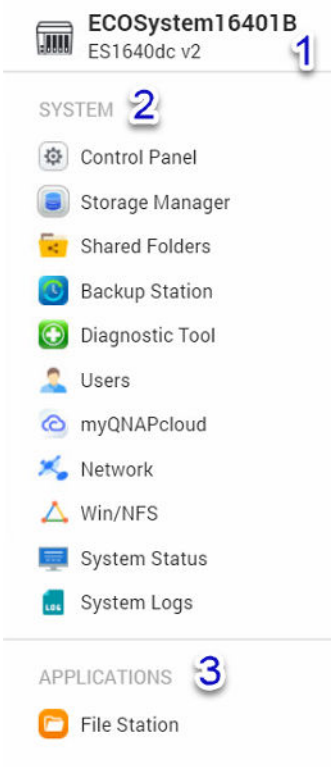
Section	Displayed Information	User Actions
System Health	• NAS name • Health status	Click the heading to open **Control Panel** > **System** > **System Status** > **System Information**. If disk-related issues occur, click the heading to open **Storage Manager**. If a hardware issue occurs, click the heading to open **High Availability**.
Hardware Information	For each storage controller: • CPU temperature • System fan speed	Click the heading to open **Control Panel** > **System** > **System Status** > **Hardware Information**.

Section	Displayed Information	User Actions
Resource Monitor	For each storage controller: • CPU usage in % • Memory usage in % • Network upload and download speeds for each adapter.	Click the heading to open **Control Panel** > **System** > **Resource Monitor** > **Overview**.

Disk Health	• Number of installed disks
	• Health status of installed disks
		• Click the heading to open the **Disk Health** screen in **Storage Manager**.
		• Click to switch between disk and NAS information.
		• Click a disk name to view the following information for each installed disk:
		  • Capacity/size
		  • Temperature
		  • Health status
		• Click **Details** to open **Storage Manager** > **Overview**.

Section	Displayed Information	User Actions
Storage	For each shared folder: • Status • Used space • Available space • Folder size For each storage pool: • Status • Used space • Available space • Shared folder size For each LUN: • Status • Used space • Available space	• Click the heading to open **Storage Manager** > **Storage** > **Storage Space**. • Click  to switch between shared folder and storage pool information.
Online Users	• Username • Total connection time • IP address	Click the heading to open **Control Panel** > **System** > **QuLog Center** > **Online Users**.
Scheduled Tasks	• Task type • Task summary • Task name • Timestamp • Status	Use the filters to view tasks that were executed within a specific period.

Main Menu



No.	Section	Description	User Actions
1	NAS Information	Displays the NAS name and model number.	N/A

No.	Section	Description	User Actions

2	System	Displays a list of system utilities and other programs that enable you to manage the NAS.
		The following are the default system utilities:
		• Control Panel
		• Storage Manager
		• Shared Folders
		• Diagnostic Tool
		• Users
		• myQNAPcloud
		• Network
		• Win/NFS
		• System Status
		• System Logs
			• Open a system utility or application in the QES desktop
			  • Click a menu item.
			  • Right-click a menu item and then select **Open**.
			• Create a shortcut on the desktop
			  • Right-click a menu item and then select **Create shortcut**.
			  • Click and drag a menu item to the desktop.

3	Applications	Displays a list of applications developed by QNAP or third-party developers. When an app is installed, it is automatically added to the applications list. The following are the default applications: • File Station	

Desktop

#	Element	Description	User Actions
1	Wallpaper	This is a digital image that is used as a background for the QES desktop. Users can either select from one of the provided wallpapers or upload an image	Change the wallpaper in the **Options** window.

2	Shortcut icons	Each icon opens an app or a utility. When you install an application, QES automatically creates a desktop shortcut. The following are the default shortcuts:
		• Control Panel
		• File Station
			• Click an icon to open the application window.
			• Right-click an icon and then select one of the following:
			  • **Open**: Opens the application window
			  • **Open in a new browser tab**: Opens the application in a a new tab
			  • **Remove**: Deletes the icon from the desktop
			• Click and drag an icon to another desktop.

3	Desktop	This area contains open system utilities and applications. The desktop consists of three separate screens.	Click **<** or **>** to move to another desktop.

#	Element	Description	User Actions
4	Date and time	This displays the date and time that the user configured during system installation.	N/A
5	Notifications	This notifies the user about important system events that may or may not require user action. When there is more than one group of notifications, the notices will be arranged according to the notification type on a notice board. You can also view notifications in **Notifications Board**.	Click the notification to open the corresponding utility or app.

QES Utilities

QES is compatible with the following QNAP utilities.

Tip
To download QNAP utilities that are compatible with your NAS model, go to https://www.qnap.com/download.

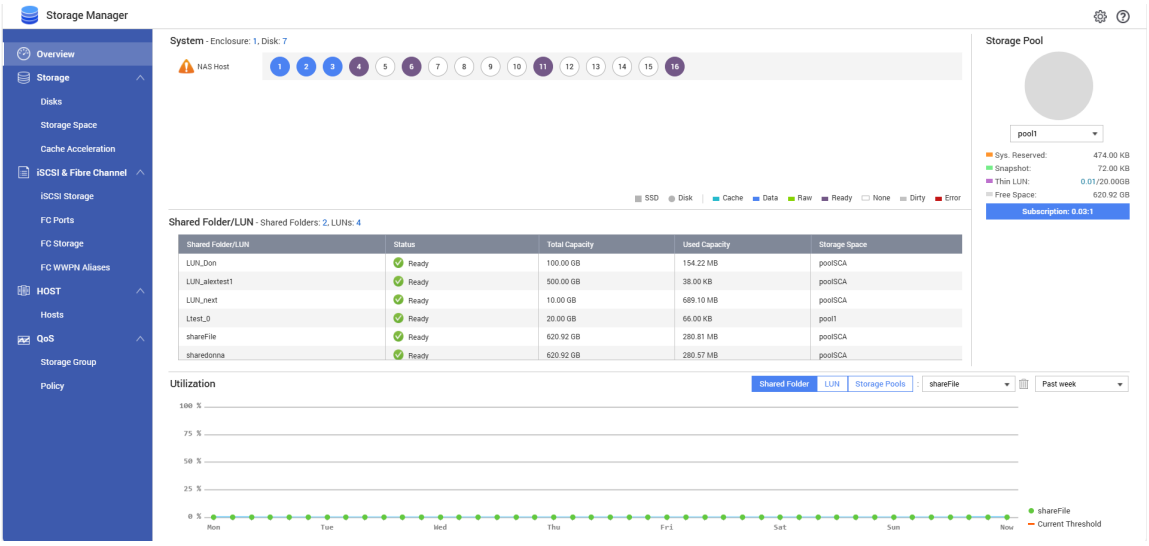
Utility	Description	Supported Operating System or Platform
Qfinder Pro	Locate and access QNAP NAS devices on a local area network (LAN).	• Windows • MacOS • Ubuntu • Chromebook
QNAP VMware Storage Replication Adapter (SRA)	Deploy a VMware remote backup and disaster recovery solution with QNAP NAS and VMware Site Recovery Manager (SRM).	VMware ESXi
QNAP SMI-S Provider	Enable communication between System Center Virtual Machine Manager (SCVMM) and QES NAS devices.	Windows
QNAP Snapshot Agent	Create application-consistent LUN snapshots for data backup and restoration.	• Windows • VMware ESXi

Utility	Description	Supported Operating System or Platform
Qmanila (QNAP Manila driver)	Use a QNAP NAS as part of a shared filesystem for OpenStack. The driver supports CIFS, NFS, and advanced features such as snapshots, compression, deduplication, and thin provisioning.	Manila
QNAP Cinder Driver	Use a QNAP NAS to provide block-storage to OpenStack. The driver supports advanced features such as snapshots, compression, deduplication, and thin provisioning.	Cinder
Qutil	Configure a Windows server connected to a dual-controller QES NAS using MPIO to handle events such as data delays, data loss, and storage controller failover, and apply MPIO load balancing policies to iSCSI LUNs.	Windows
QNAP VAAI NFS Plugin	Allow ESXi hosts to access the following VAAI features when connected to a QES NAS using NFS: Full File Clone, Space Reserve, Extended Statistic.	VMware ESXi
myQNAPcloud Connect	Access published NAS services over the internet using a VPN.	Windows
vSphere (Web) Client plug-in	Directly manage VMware datastores on the NAS from the vSphere client console.	Windows

3. Storage Manager

Storage Manager is a QES utility that helps you create, manage, and monitor storage on your NAS. With Storage Manager you can perform the following tasks:

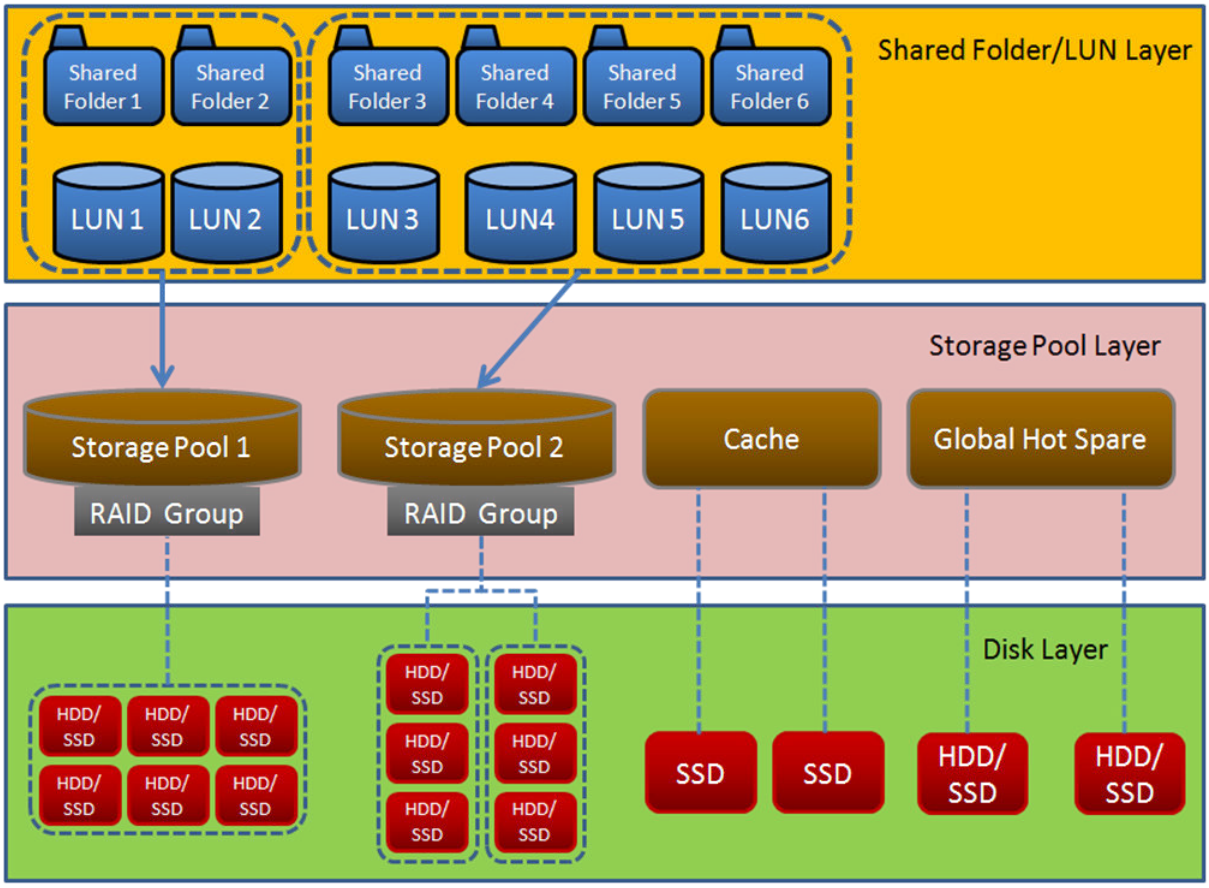
- Create RAID groups, storage pools, and shared folders.
- Monitor storage usage and access speeds.
- Back up data using snapshots.
- Accelerate the performance of your NAS by creating an SSD cache.
- Share NAS storage space with other storage devices using iSCSI.
- Specify which hosts (computers, servers, other NAS devices) are allowed to access the NAS.
- Allocate I/O resources to specific LUNs and shared folders by creating QoS policies.



QNAP Flexible Storage Architecture

QNAP flexible storage architecture consists of three layers, which combine to offer storage flexibility and data protection.

- Disks
- Storage pools
- Shared folders and LUNs



Tip

You can expand the storage capacity of your NAS by connecting a QNAP expansion unit. For details on compatible models, see www.qnap.com/compatibility or your NAS hardware user guide.

Storage Manager Global Settings

You can access the global settings screen by clicking  in the upper-right corner of the Storage Manager window.

Setting	Description
Predictive S.M.A.R.T. Migration	If S.M.A.R.T. errors are detected on a disk, or if an SSD has exceeded its endurance limit, QES issues a warning notification and then starts migrating data from the disk to a spare disk. After the migration is finished, the healthy disk replaces the faulty disk in the RAID group.
Disk S.M.A.R.T polling time	Specify how often QES checks disks for S.M.A.R.T. errors, in minutes.

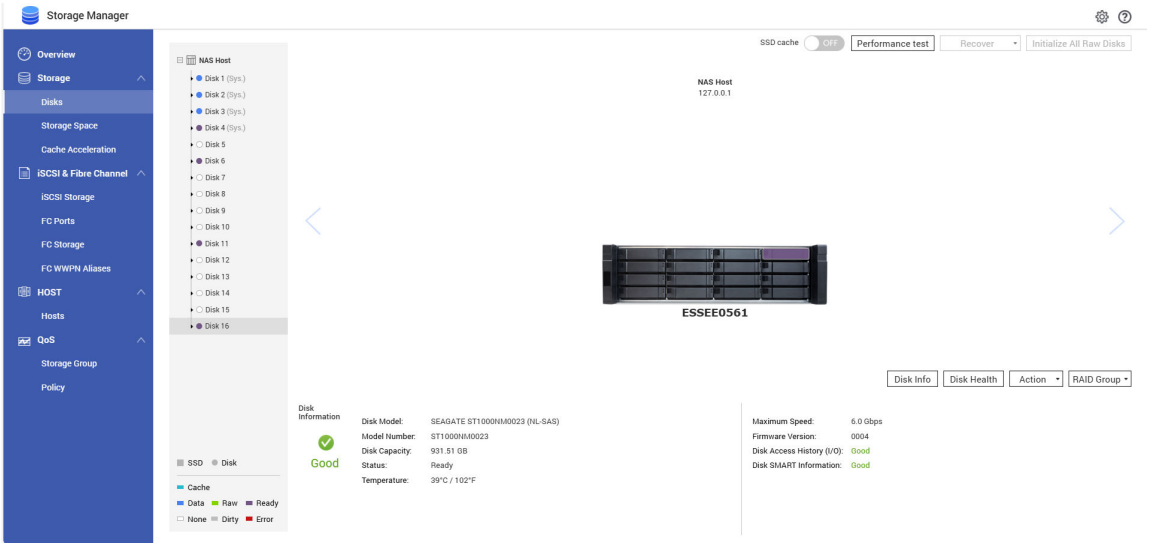
Setting	Description
TLER/ERC timer (seconds)	When a disk encounters a read or write error, it may become unresponsive while the disk firmware attempts to correct the error. QES might interpret this unresponsiveness as a disk failure. Enabling this feature ensures that a disk has sufficient time to recover from a read or write error before QES marks it as failed and initiates a RAID group rebuild. **Tip** • This setting is also known as Error recovery control (ERC), Time-limited error recovery (TLER) or Command completion time limit (CCTL). • You should specify values according to the disk manufacturer's recommendations.
Delete the oldest snapshots when a storage pool is full	When enabled, QES automatically deletes old snapshots when no storage pool space is available. You can choose to delete snapshots taken on a schedule, snapshots taken manually by a user, or both.
Enable Scrub Pool schedule	Pool scrubbing detects and automatically repairs damaged data blocks in the ZFS file system. **Important** • While the scrubbing task is running, the read and write performance of the storage pool may be reduced. You should schedule pool scrubbing to run during times of low NAS usage. • If you set an end time, then scrubbing will pause at the end time and resume at the next start time. For details on manually scrubbing a pool, see Scrubbing a Storage Pool.
Clean deduplication table	Clean the deduplication table of every storage pool according to a schedule. When deduplication is enabled in a storage pool, ZFS records duplicate data in a deduplication table. Cleaning removes unused entries from the pool's deduplication table.
Enable temperature alarm for hard disk drives	Enable this feature to monitor HDD temperatures. QES issues a warning notification when the temperature of a HDD exceeds the specified threshold. To set disk temperature alarms on individual disks, see Disk Health Information.

Setting	Description
Enable temperature alarm for solid state drives	Enable this feature to monitor SSD temperatures. QES issues a warning notification when the temperature of a SSD exceeds the specified threshold. To set disk temperature alarms on individual disks, see Disk Health Information.
Enable SSD Life	When enabled, QES monitors the remaining lifespan of SSDs in the NAS.

Storage

Disks

This screen enables you to monitor and manage disks and connected expansion units.



Disk Types

QES restricts which types of disks can be used to create an SSD cache.

Important

- For compatibility reasons, PCIe form-factor SSDs and M.2 SSDs cannot be used to create SSD cache on dual-controller ES NAS devices.

Disk Type	Installation Method	SSD Cache	Storage Pools
SATA/SAS/NL-SAS 3.5" HDD	NAS drive bay	No	Yes
SATA/SAS 2.5" HDD	NAS drive bay	No	Yes
SATA/SAS 2.5" SSD	NAS drive bay	Yes	Yes
PCIe NVMe M.2 SSD	QM2 card	Dual-controller NAS: No Single-controller NAS: Yes	No
PCIe NVMe M.2 SSD	Third-party M.2 to PCIe adapter card	Dual-controller NAS: No Single-controller NAS: Yes	No
SATA M.2 SSD	QM2 card	Dual-controller NAS: No Single-controller NAS: Yes	No
SATA M.2 SSD	NAS internal M.2 slot	Dual-controller NAS: No Single-controller NAS: Yes	No
PCIe form-factor SSD	PCIe slot	Dual-controller NAS: No Single-controller NAS: Yes	Yes

Disk Management

Disk Information

Information	Description
Disk Health Status	The general health status of the disk. • Good: The disk is healthy. • Warning: QES has detected an error. Run a full S.M.A.R.T. test and a disk scan. • Error: QES has detected a critical error. You must replace the disk immediately.
Disk Model	The manufacturer and model of the disk.
Disk Capacity	The storage capacity of the disk.
Status	The hardware status of the disk.

Information	Description
Temperature	The current temperature of the disk. Disk temperature is retrieved from the disk's firmware using S.M.A.R.T.
Maximum Speed	The maximum transfer speed supported by the drive bay or slot that the disk is installed in.
Firmware Version	The firmware version of the disk.
Disk Access History (I/O)	• Good: QES has not detected any errors on the disk. • Warning: QES has detected and recovered errors on the disk. • Error: QES has detected unrecoverable errors on the disk.
Disk SMART Information	The S.M.A.R.T. status of the disk. If any of the S.M.A.R.T. attribute values reach the threshold set by the disk manufacturer or a predefined threshold determined by QES, this field changes to `Warning`.
Life Remaining	The remaining life of the disk, as calculated by the disk's firmware. When the value reaches 0, you should replace the disk. This information is only available for solid-state drives (SSDs).
SSD life indicator	The value that QES is using to estimate remaining SSD life. For details, see Disk Health Information.

Disk Status Information

Status	Color	Description
Cache		The disk is used as an SSD cache.
Data		The disk contains data and is part of a storage pool.

Status	Color	Description
Raw		The disk is uninitialized due to one of the following reasons: • The disk is new and has not been initialized yet. • The disk was removed from a storage pool. • The disk was removed from the SSD cache. • The disk had the status `Dirty` and then Disk Clean was used to erase it. To initialize a disk, see Initializing Raw Disks.
Ready		The disk is not in use. **Note** QES uses all ready disks as global RAID hot spares.
None		There is no disk in the drive bay.
Dirty		The disk was removed from a storage pool and was then replaced by a spare disk. This occurred due to one of the following reasons: • QES detected I/O errors on the disk and automatically removed it from the storage pool. • Someone physically removed the disk from the NAS. • Someone manually removed the disk from the storage pool using the **Replace Disk** feature. To use this disk again, you must run Disk Clean. For details, see Disk Actions.
Error		QES has detected bad sectors or I/O errors. You should replace the disk immediately.

Disk Actions

Select a disk to perform one of the following actions.

Action	Description
Disk Info	View disk details, including the disk model, model number, serial number, disk capacity, firmware version, ATA version and ATA standard.

Action	Description
Disk Health	View disk S.M.A.R.T. information, check SSD life, run disk tests, set temperature alerts. For more information, see Disk Health Information.
Scan Now	Scan the disk for bad blocks. **Tip** Run this scan if the disk's status changes to `Warning` or `Error`. If QES does not detect any bad blocks, it will change the disk's status back to `Ready`. To view the number of bad blocks, go to **Disk Health** > **Summary**.
Locate	Prompt the drive LEDs to blink so that you can locate the drive in a NAS or expansion unit.
RAID Group	Select a RAID group to view its capacity, RAID type, and member disks.
Disk Clean	Delete all stored data on a disk that has the status `Dirty`. You can also choose to delete partition data.

NAS and Enclosure Actions

On the disk screen, select a NAS or expansion unit to perform one of the following actions.

Action	Description
Enclosure Info	View full hardware details of the NAS or expansion unit, including the model, serial number, firmware version, BUS type, CPU temperature, system temperature, power status, and fan speeds.
Action > **Locate**	Prompt the expansion unit or NAS chassis LEDs to blink, so that you can locate the device in a server room or rack.
Action > **Rename Enclosure**	Rename the selected expansion unit.
RAID Group	View details about each RAID group on the expansion unit, including its RAID type, capacity, and member disks.

Action	Description
Recover > **Reinitialize enclosure ID**	Reset all expansion unit IDs, and then give each unit a new ID number starting from 1 based on the order that they are physically connected. **Tip** Use this action if the expansion unit IDs appear out of sequential order in the enclosure list.

Initializing Raw Disks

Initializing a disk allows it to be used in a storage pool or SSD cache. When initializing an SSD, QES uses SSD Trim to indicate which data blocks are safe to erase. This helps maintain SSD write performance and life span.

1. Go to **Storage Manager** > **Storage** > **Disks**.
2. Click **Initialize All Raw Disks**.
   A confirmation message appears.
3. Click **Yes**.

QES initializes all raw disks on the NAS. The status of the disks changes from `Raw` to `Ready`.

Disk Health

Disk Health Information

S.M.A.R.T. (Self-Monitoring, Analysis and Reporting Technology) is a disk health monitoring system built into all modern disks. QES uses S.M.A.R.T. to continuously monitor all NAS disks for problems.

Tab	Description	Actions
Summary	View S.M.A.R.T. disk information and the results of the last disk test	No actions

Tab	Description	Actions
SSD Life	QES displays the estimated remaining life of the SSD formatted as both a number of days and a percentage. SSD life is estimated by the following: • If the SSD's TBW (Terabytes written) rating is available, QES uses the formula Estimated Life Remaining = (TBW - Total Data Written) / Average Data Written Per Day. • If the TBW rating is unavailable, QES estimates life using the disk's S.M.A.R.T. life remaining attribute. The ID of this attribute varies by disk manufacturer. • If the TBW rating and S.M.A.R.T. life remaining attributes are both unavailable, QES uses an Opcode such as `NVME_ADMIN_GET_LOG_PAGE` to get the health information of the disk. • If the TBW rating and S.M.A.R.T. life remaining attribute are both unavailable, and it is not possible to get disk health information using an Opcode, then QES cannot estimate SSD life.	Enter the disk's TBW (Terabytes written) rating for a more accurate life estimate. **Tip** You can find the TBW rating in the disk's hardware specifications.
Disk Information	View disk hardware information, including model, capacity, serial number, firmware version, ATA version, and ATA standard	No actions
SMART Information	Displays S.M.A.R.T. disk information and supported attributes.	No actions

Tab	Description	Actions
Test	Run a S.M.A.R.T. disk self-test.	Select one of the following options, and the click **Test**. • **Rapid Test**: Test the electrical and mechanical properties of the disk, and a small portion of the disk surface. The test takes approximately one minute. • **Complete Test**: Test the electrical and mechanical properties of the disk, and the full disk surface. The test duration varies depending on the capacity of the disk and the storage environment.
Settings	Apply disk settings to this disk or all disks.	Configure the following settings: • **Enable temperature alarm**: QES issues a warning notification when the disk temperature is above the specified threshold. • **S.M.A.R.T. Test schedule**: Schedule periodic rapid and complete S.M.A.R.T. disk tests. The results are displayed on the **Summary** screen. **Tip** You can apply these settings to the current disk, all disks, or to disks with the same type as the current disk (HDD or SSD).

Testing Disk Performance

1. Go to **Storage Manager** > **Storage** > **Disks**.
2. Click **Performance Test**.
   The **Performance Test** screen appears.
3. Select one or more disks.

4. Click **Performance Test** and then select a test type.

Test Type	Description	Test Results Format
Sequential read	Test sequential read speed.	MB/s

   A confirmation message appears.

5. Click **OK**.

6. Optional: Schedule a weekly sequential read test for all disks. The weekly test runs every Monday at 6:30 AM.

   a. Click **Weekly Test**.

   b. Click **OK**.

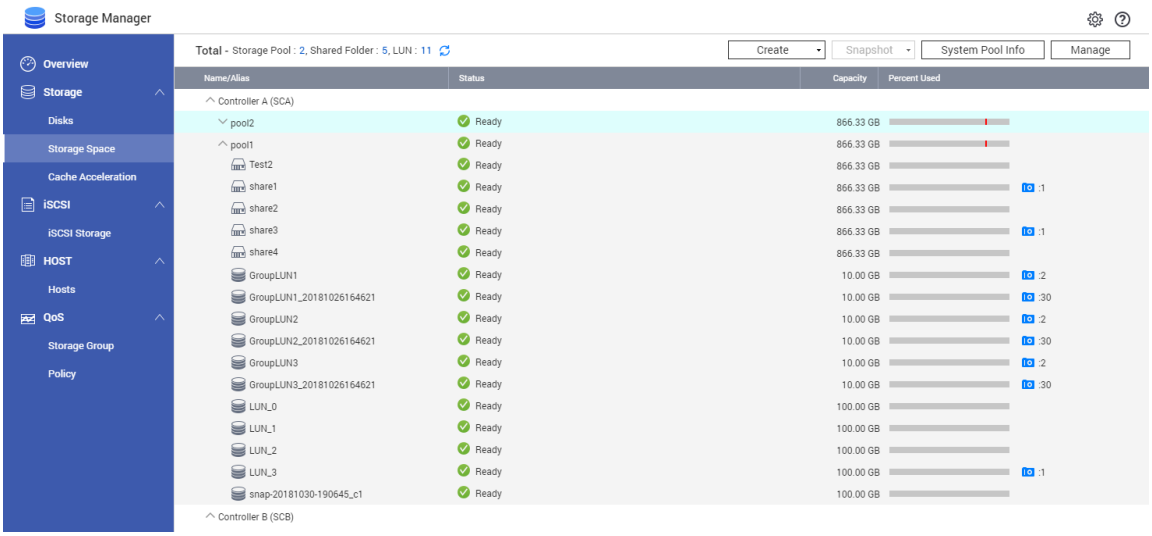
QES runs the test and then displays the results on the **Performance Test** screen.

Drive Bay Compatibility and Expansion

- QNAP dual-controller ES NAS models only support SAS disks. To install a SATA disk in an ES NAS with full S.M.A.R.T. compatibility, use a QNAP QDA-SA SATA-to-SAS adapter. You can check the hardware status, health, and temperature of disks that are using QNAP QDA-SA adapters on the **Disks** screen.
- TES-x85U series NAS devices running on QES support the QNAP QM2-4P-384 cards. Installing a QMP-4P-384 card adds four more M.2 SSD slots.

Storage Pools

A storage pool is designed to aggregate multiple disks into one large storage space. Disks are joined together using RAID technology to form a RAID group. Storage pools may contain more than one RAID group.



Storage Pool Creation

Creating a Storage Pool

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Perform one of the following actions.

NAS State	Action
No volumes or storage pools	Click **New Storage Pool**.
One or more storage pools.	Click **Create**, and then select **New Storage Pool**.

   The **Create Storage Pool** window opens.

3. Specify a pool name.
   The must consist of 1 to 31 characters from any of the following groups:
   - Letters:, a-z, A-Z
   - Numbers: 0-9
   - Special characters: dash -, underscore _, period
4. Optional: Select an expansion unit from the **Enclosure Unit** list.

   Important
   - You cannot select disks from multiple expansion units.
   - If the expansion unit is disconnected from the NAS, the storage pool becomes inaccessible until it is reconnected.
5. Select one or more disks.

   Warning
   All data on the selected disks will be deleted.
6. Select a RAID type.
   QES displays all available RAID types and automatically selects the most optimized RAID type.

   Tip
   For details, see RAID Types.
7. Click **Next**.

8. Optional: Configure SSD over-provisioning.

Setting	Description
SSD over-provisioning	QES reserves the specified percentage of space on each SSD to increase random write performance and to extend SSD lifespan. **Tip** You should set this value according to the SSD manufacturer's recommendation.
Pool over-provisioning	QES reserves the specified percentage of space in the storage pool to ensure consistent random write performance when the pool is nearly full. **Tip** For best results, set pool over-provisioning to 20% or higher.
Enable Write Coalescing	Write Coalescing optimizes the pool for SSD storage, which improves pool random write performance and extends SSD lifespan. **Important** You cannot modify this setting after storage pool creation.

For more information, see QES SSD Features.

Warning
SSD over-provisioning and pool over-provisioning both reduce the total storage capacity of the storage pool.

9. Click **Next**.
10. Verify the storage pool information.
11. Click **Create**.
    A confirmation message appears.
12. Click **OK**.

QES creates the storage pool and then displays the information on the **Storage Space** screen.

Creating a RAID 50 or RAID 60 Storage Pool

RAID 50 and RAID 60 groups are created by adding two or more RAID 5 or 6 sub-groups to a storage pool. QES stripes the sub-groups using RAID 0.

1. Go to **Storage Manager** > **Storage** > **Storage Space**.

2. Perform one of the following actions.

NAS State	Action
No volumes or storage pools	Click **New Storage Pool**.
One or more storage pools.	Click **Create**, and then select **New Storage Pool**.

The **Create Storage Pool** window opens.

3. Click **Create** > **New Storage Pool**.
The **Create Storage Pool** window opens.

4. Specify a pool name.
The must consist of 1 to 31 characters from any of the following groups:

- Letters:, a-z, A-Z
- Numbers: 0-9
- Special characters: dash -, underscore _, period

5. Optional: Select an expansion unit from the **Enclosure Unit** list.

Important
If the expansion unit is disconnected from the NAS, the storage pool becomes inaccessible until it is reconnected.

6. Create the first sub-group.

a. Select disks.
For information on the minimum and maximum allowed number of disks, see RAID Types.

Warning
All data on the selected disks will be deleted.

b. Select a RAID type of `RAID 50` or `RAID 60`.

c. Click **Next**.

7. Create the second sub-group.

a. Select disks.
For the best performance, the number of disks should be the same as the first sub-group.

Warning
All data on the selected disks will be deleted.

b. Click **Next**.

8. Optional: Configure SSD over-provisioning.

Setting	Description
SSD over-provisioning	QES reserves the specified percentage of space on each SSD to increase random write performance and to extend SSD lifespan. **Tip** You should set this value according to the SSD manufacturer's recommendation.
Pool over-provisioning	QES reserves the specified percentage of space in the storage pool to ensure consistent random write performance when the pool is nearly full. **Tip** For best results, set pool over-provisioning to 20% or higher.
Enable Write Coalescing	Write Coalescing optimizes the pool for SSD storage, which improves pool random write performance and extends SSD lifespan. **Important** You cannot modify this setting after storage pool creation.

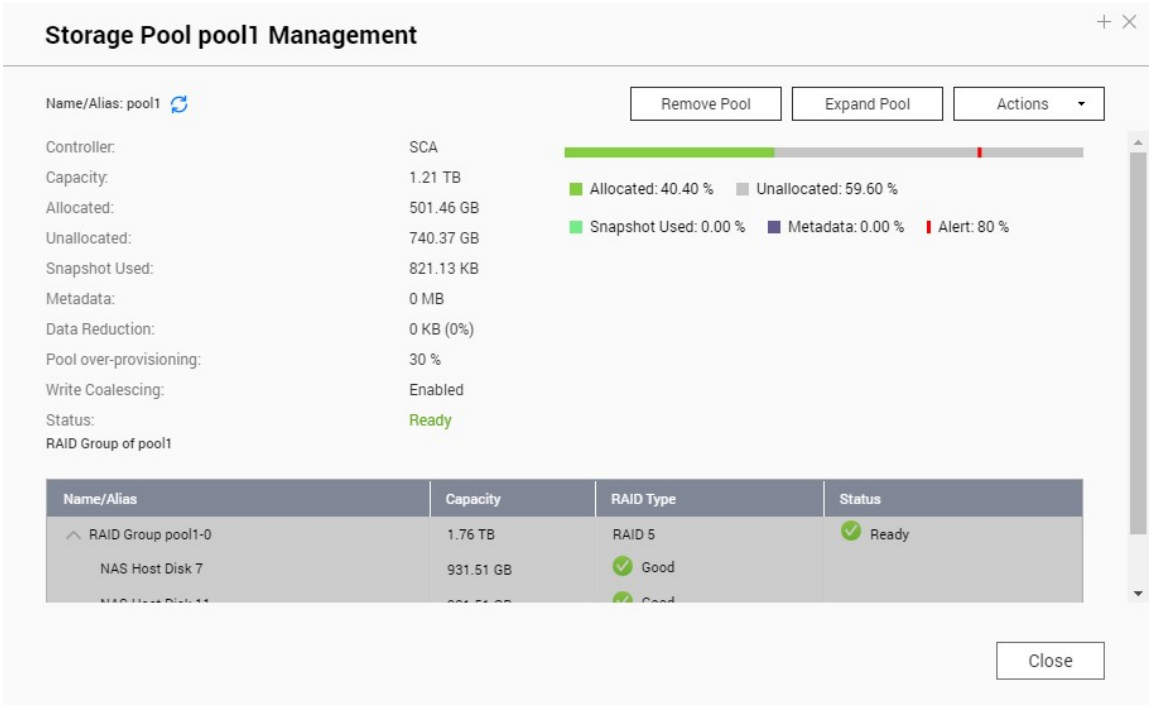
For more information, see QES SSD Features.

Warning
SSD over-provisioning and pool over-provisioning both reduce the total storage capacity of the storage pool.

9. Click **Next**.
10. Verify the storage pool information.
11. Click **Create**.
    A confirmation message appears.
12. Click **OK**.
    QES creates the storage pool and then displays the information on the **Storage Space** screen.
13. Optional: Add more RAID 5 or RAID 6 sub-groups to the storage pool.
    You can add additional using the **Expand Storage Pool** wizard. For details, see Expanding a Storage Pool.

Storage Pool Management

Storage Pool Management Screen



Storage Manager > Storage > Storage Space > Manage

UI Element	Description
Name/Alias	The name of the storage pool. This name is automatically generated by QES.
	Refreshes all of the information on this screen.
Controller	The storage controller that is currently managing the storage pool.
Capacity	The usable capacity of the storage pool. Usable capacity = Raw capacity - Pool Over-Provisioning Space.
Allocated	The amount of storage pool space allocated to shared folders and LUNs.
Unallocated	The amount of storage pool space not allocated to shared folders and LUNs.
Snapshot Used	The amount of storage pool space used for storing snapshots.
Metadata	The amount of storage pool space used for storing system, file system, snapshot, and storage pool metadata.

UI Element	Description
Data Reduction	The amount of storage pool space saved by compression and deduplication.
Pool over-provisioning	The amount of storage pool space reserved for over-provisioning. For details, see QES SSD Features.
Write Coalescing	The status of write coalescing in the storage pool. For details, see QES SSD Features.
Status	The status of the storage pool.

Removing a Storage Pool

Important

Before removing a storage pool you must remove all shared folders and LUNs from the pool.

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Select a storage pool.
3. Click **Manage**.
   The **Storage Pool Management** window opens.
4. Click **Remove Pool**.
   The **Storage Pool Removal Wizard** window opens.
5. Click **Apply**.

Expanding a Storage Pool

You can expand the capacity of a storage pool by creating a new RAID group and adding it to the pool. QES combines the new group with the other RAID groups in the storage pool using striping (RAID 0).

Important

- The new RAID group must have the same RAID type as all existing RAID groups in the pool.
- Adding a RAID group to a pool may change the RAID type of the pool.
- You cannot add HDDs and SSDs to the same storage pool.
- To ensure performance and data integrity, QES limits the maximum number of disks allowed in a group for certain RAID types. For details, see RAID Types.

The number of required disks for expansion depends on the current RAID type of the specified pool.

Pool RAID Type	Disks Required to Expand Pool	Pool RAID Type After Expansion
RAID 0	≥ 1	RAID 0
RAID 1	2	RAID 10
RAID 5	≥ 3	RAID 50
RAID 6	≥ 5	RAID 60
RAID-TP	≥ 8	RAID-TP
Triple Mirror	Can't be expanded	N / A
RAID 10	Multiple of 2	RAID 10
RAID 50	≥ 3 for each additional RAID 5 group	RAID 50
RAID 60	≥ 5 for each additional RAID 6 group	RAID 60

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Select a storage pool.
3. Click **Manage**.
   The **Storage Pool Management** window opens.
4. Click **Expand Pool**.
   The **Expand Storage Pool Wizard** window opens.
5. Optional: Select an expansion unit from the **Enclosure Unit** list.

   Important

   - You cannot select disks from multiple expansion units.
   - If the expansion unit is disconnected from the NAS, the storage pool becomes inaccessible until it is reconnected.

6. Select one or more disks.

   Warning
   All data on the selected disks will be deleted.

7. Click **Expand**.
   A confirmation message appears.
8. Click **OK**.

Scrubbing a Storage Pool

Scrubbing a storage pool scans the file system of each RAID group in the pool. QES automatically attempts to repair bad blocks to maintain data consistency.

Important

- While the scrubbing task is running, the read and write performance of the storage pool may be reduced. You should schedule pool scrubbing to run during times of low NAS usage.
- To perform storage pool scrubbing automatically on a schedule, see Storage Global Settings.

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Select a storage pool.
3. Click **Manage**.
   The **Storage Pool Management** window opens.
4. Click **Actions**, and then select **Storage Pool Scrubbing**.
   The **Storage Pool Scrubbing** window opens.
5. Click one of the following buttons.

Button	Description
Edit	Run pool scrubbing periodically, according to a schedule.
Start	Run pool scrubbing immediately.

Taking a Storage Pool Offline

Taking a pool offline enables you to perform maintenance, such as changing SAS cables, without powering off the NAS or losing data.

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Select a storage pool.
   The storage pool must be online.
3. Click **Manage**.
   The **Storage Pool Management** window opens.
4. Select **Actions** > **Offline Pool** .
   The **Take Storage Pool Offline** window opens.

5. Click **Take Offline**.
   A confirmation message appears.
6. Click **Yes**.

The status of the storage pool changes to `Offline`. The status of each RAID group in the storage pools changes to `Unmounted`.

Bringing a Storage Pool Online

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Select a storage pool.
   The storage pool must be offline.
3. Click **Manage**.
   The **Storage Pool Management** window opens.
4. Select **Actions** > **Online Pool**.
   A confirmation message appears.
5. Click **Yes**.

The statuses of the storage pool and all RAID groups in the pool change to `Ready`.

Configuring a Pool Space Alert Threshold

QES issues a warning when the percentage of used storage pool space reaches the specified value.

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Select a storage pool.
3. Click **Manage**.
   The **Storage Pool Management** window opens.
4. Select **Actions** > **Set Threshold**.
   The **Alert Threshold** window opens.
5. Select **Please input the alert threshold [1-100]**.
6. Specify a space alert threshold.
   The default threshold is 80.
7. Click **Apply**.
   A confirmation message appears.

Replacing a Disk in a Storage Pool

You can replace a disk in a storage pool with a spare disk. QES will then initiate a rebuild of the disk's RAID group. Requirements:

- The RAID type of the storage pool cannot be RAID 0.

- The spare disk must have the status `Ready`.
- The capacity of the spare disk must be greater than or equal to the capacity of the disk it is replacing.
- The spare disk must be of the same type (HDD, SSD, SAS) as the disk it is replacing.

> **Note**
> After performing this task, the disk that was replaced will have the status `Dirty`. To use this disk again, you need to run **Disk Clean**. For details, see Disk Actions.

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Select a storage pool.
3. Click **Manage**.
   The **Storage Pool Management** window opens.
4. Click **Actions**, and then select **Replace Disk**.
5. Select a disk to be replaced.
6. Optional: Select an enclosure.
7. Select a spare disk.
8. Click **Apply**.
   A confirmation message appears.
9. Click **OK**.

QES replaces the disk in the RAID group, and then starts a RAID group rebuild. The status of the RAID group changes to `Rebuilding`.

Suspending RAID Rebuilding on a Schedule

You can configure a storage pool to suspend automatic RAID rebuilding during specific time periods. For example, during work hours or when backup jobs are running. If a RAID rebuild job is running when the scheduled time starts, the job is suspended and resumes when the scheduled time ends.

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Select a storage pool.
3. Click **Manage**.
   The **Storage Pool Management** window opens.
4. Click **Actions**, and then select **Set Suspend Rebuild Schedule**.
   The **Suspend Rebuild Schedule** window opens.
5. Select **Suspend storage pool rebuilding during the times specified** .
6. Select the days of the week that you want to suspend RAID rebuilding.
7. Select the times when you want to suspend RAID rebuilding.

8. Click one of the following buttons.

Button	Description
Apply	Applies the schedule to the current storage pool.
Apply to all Pools	Applies the schedule to all storage pools.

Cleaning the Deduplication Table

When deduplication is enabled in a storage pool, ZFS records duplicate data in a deduplication table. Cleaning removes unused entries from the pool's deduplication table.

Note

- This process might take a long time.
- To perform this task automatically on a schedule, see Storage Global Settings.

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Select a storage pool.
3. Click **Manage**.
   The **Storage Pool Management** window opens.
4. Click **Actions**, and then select **Clean Deduplication Table**.
   The **Clean Dedup Table** window opens.
5. Click **OK**.

Storage Pool Status

Status	Description
Ready	The storage pool is working normally. All RAID groups in the pool have the status `Ready`.
Degraded	One or more RAID groups in the storage pool have the status `Degraded`. There are not enough spare disks available to QES to rebuild all of the RAID groups.
Degraded (Rebuilding)	One or more RAID groups in the storage pool have the status `Degraded (Rebuilding)`. QES is currently rebuilding them due to disk failure.
Error	One or more RAID groups in the storage pool have the status `Not Active`.

The System Pool

The system pool is a hidden storage pool that QES uses to store application data and settings. QES creates the system pool when the NAS is initialized by combining 13 GB from each system disk in a four-way mirror RAID configuration.

Important

- The system disks are usually located in the first four drive bays of your NAS. For details, see the NAS hardware user guide.
- Using the system disks for general data storage may affect system pool performance. For ES NAS containing both SSDs and HDDs, QNAP recommends installing four SSDs as system disks and then configuring them as the SSD read cache.
- To view the status of the system pool, go to **Storage Manager** > **Storage** > **Storage Space** and then click **System Pool Info**.

RAID

RAID Types

Important

- To ensure best performance and data integrity, QES limits the maximum number of disks allowed in a group for certain RAID types.
- For best performance and space efficiency, you should use disks of the same brand and capacity when creating a RAID group.
- Increasing the number of disks in a RAID group increases the risk of simultaneous disk failure and lengthens rebuild times. When creating a storage pool with a large number of disks, you should split the disks into sub-groups using RAID 50 or RAID 60.

RAID Type	Number of Disks	Disk Failure Tolerance	Overview
RAID 0	≥ 1	0	• Disks are combined together using striping. • RAID 0 offers the fastest read and write speeds, and uses the total capacity of all the disks. • Provides no disk failure protection. This RAID type must be paired with a data backup plan.

RAID Type	Number of Disks	Disk Failure Tolerance	Overview
RAID 1	2	1	• An identical copy of data is stored on each disk. • Half of the total disk capacity is lost, in return for a high level of data protection. • Recommended for storing important data.
RAID 5	3–16	1	• Data and parity information are striped across all disks. • The capacity of one disk is lost to store parity information. • Striping means read speeds are increased with each additional disk in the group. • Recommended for a good balance between data protection, capacity, and speed. • Ideal for running databases and other transaction-based applications.
RAID 6	5–16	2	• Data and parity information are striped across all disks. • The capacity of two disks are lost to store parity information. • Recommended for critical data protection, business and general storage use. It provides high disk failure protection and read performance.
RAID 10	4–16 (Creating) 2–16 (Expanding)	1 per pair of disks	• Every two disks are paired using RAID 1 for failure protection. Then all pairs are striped together using RAID 0. • Excellent random read and write speeds and high failure protection, but half the total disk capacity is lost. • Recommended for applications that require high random access performance and fault tolerance, such as databases.

RAID Type	Number of Disks	Disk Failure Tolerance	Overview
RAID 50	3–16 per subgroup	1 per disk subgroup	• Multiple small RAID 5 groups are striped to form one RAID 50 group. • Better failure protection and faster rebuild times than RAID 5. More storage capacity than RAID 10. • Recommended for applications that require high fault tolerance, capacity, and random access performance.
RAID 60	5–16 per subgroup	2 per disk subgroup	• Multiple small RAID 6 groups are striped to form one RAID 60 group. • Better failure protection and faster rebuild time than RAID 6. More storage capacity than RAID 10. • Recommended if you need higher fault tolerance than RAID 50.
Triple Mirror	3	2	• An identical copy of data is stored on three disks. • There is also no degradation in performance while the RAID group is being rebuilt. • Read performance is increased, but capacity is greatly decreased. • Triple Mirror is suitable for storing critical data.
RAID-TP	8–16	3	• Data and parity information are striped across all disks. • The capacity of three disks are lost to store parity information. • RAID-TP adds an extra level of redundancy over RAID 6.

RAID Group Capacity

QES uses the ZFS RAID scheme RAID-Z. RAID-Z capacity is calculated differently from normal RAID. To estimate the storage capacity of a RAID group in QES, use our online calculator at https://enterprise-nas.qnap.com/en/calculator.

RAID Disk Failure Protection

All RAID types except for RAID 0 can tolerate a specific number of disk failures without losing data. When a disk in a RAID group fails, the RAID group status changes to `degraded` and then QES performs one of the following actions.

Spare Disk Available	Actions
Yes	• QES automatically replaces the failed disk with a spare disk and then starts rebuilding the RAID group. **Note** QES considers all ready disks to be spare disks. • The status of the RAID group changes to `rebuilding`, and then changes back to `Ready` after rebuilding has finished.
No	You must replace the failed disk manually. QES starts rebuilding the RAID group after you have installed a working disk.

RAID Group Status

Status	Description
Ready	The RAID group is working normally.
Degraded	One or more disks in the RAID group have failed. The number of disk failures are within the disk failure tolerance of the RAID group. There are not enough spare disks available to QES to replace all the failed disks.
Degraded (Rebuilding)	One or more disks in the RAID group have failed. The number of disk failures are within the disk failure tolerance of the RAID group. QES has replaced the failed disks with spare disks, and is now rebuilding the RAID group.
Not active	One or more disks in the RAID group have failed. The number of disk failures exceeds the disk failure tolerance of the RAID group.

Shared Folders

A shared folder is a portion of storage space created from the space of a storage pool. Shared folders enable users to store data on the NAS and allow connected clients to access that data.

Tip

- To create and configure shared folders, go to **Storage Manager** > **Storage** > **Storage Space**.
- A QES shared folder is the same as a QTS volume that contains one shared folder.

Creating a Shared Folder

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Click **Create**, and then select **New Shared Folder**.
3. Specify a shared folder name.
   - The name can be in any Unicode language.
   - The maximum length is 64 bytes. In English, this equals 64 characters.
   - The following special characters are not allowed: @ " + = / \ : | * ? < > ; [ ] % , ` ' non-breaking space
   - The last character cannot be a period (.) or space.
   - The first characters cannot be a space.
4. Optional: Specify a description.
5. Select a storage pool.
   The shared folder is created using storage space from this pool.

   Tip

   SMB Path and **NFS Path** show you how to access the folder using SMB and NFS. These paths are for reference only and cannot be modified. On dual controller ES-NAS, there will be separate paths for storage controller A and B.

6. Optional: Configure any of the following storage settings and services.

Setting	Description
Thin provision	In thin provisioning, QES allocates storage pool space for the shared folder on demand, while data is being written, instead of during shared folder creation. **Important** • A thin provisioned folder can be over-allocated, which means that its maximum capacity can be 20 times larger than the amount of free space in the parent storage pool. • Enabling thin provisioning may affect shared folder access speeds.
Folder quota	The folder quota determines the amount of data that the folder can store. If folder quota is not enabled, the maximum capacity of the shared folder will be equal to that of the parent storage pool.
Compression	QES compresses the data in the shared folder to reduce the size of stored data. Enabling compression also reduces the total number of blocks that QES needs to read and write, increasing read and write speeds. **Tip** • Compression is enabled by default for all new shared folders and LUNs. • Compression does not impact read/write and processor performance on ZFS filesystems. Only disable this setting when necessary.

Setting	Description
Deduplication	QES reduces the amount of storage needed by eliminating duplicate copies of repeated data. You can select one of the following hash algorithms. • SHA256: A common algorithm which belongs to the NIST SHA-2 family. • SHA512: This algorithm can take advantage of 64-bit architecture. Performance is 50% faster than SHA-256 on 64-bit hardware. • Skein: A high-performance algorithm which belongs to the NIST SHA-3 family. Performance is 80% faster than SHA256. This is the default option. **Warning** • Before QES 1.1.3, the default deduplication algorithm was SHA256. If you update a pre-QES 1.1.3 NAS to QES 1.1.3 or later and then change the deduplication algorithm to SHA512 or Skein, data might become inaccessible. • Deduplication is only available if **Performance profile** is set to **VDI** or **Custom**, and **Thin provision** is selected.
Enable Fast Clone	Fast Clone enables QES to create copies of files faster. It also saves storage space by modifying file metadata, allowing original and copied files to share the same data blocks. **Important** • To enable this setting, **Thin provision** must be selected. • Fast Clone only works when the copied file is created in the shared folder containing the original file. • Fast Clone does not improve the speed of snapshot restoration operations such as restoring files from a snapshot, snapshot revert, and snapshot clone.
SSD cache	QES adds data from this folder to the SSD cache to improve read performance. **Important** Shared folders and LUNs created in an all-SSD storage pool cannot use the SSD cache.

Setting	Description
Performance profile	Specify how the shared folder will be used. Each option results in a different record size, optimizing performance for the specified application. • Generic (Default, 64k) • VMware (32k) • Custom (Choose from: 8k, 16k, 32k, 64k, 128k) **Tip** Select **Generic** if you are unsure of which option to choose.
CIFS/SMB	Allow Windows, Max, and Linux clients to access this shared folder using CIF or SMB.
NFS	Allow clients to access this shared folder using NFS.
FTP/FTPS	Allow clients to access this shared folder using FTP or FTPS.

7. Configure user access permissions.
   You can grant users read-only access, read/write access, or deny access. By default, only the QES admin account can access the shared folder.
8. Optional: Configure advanced settings.

Setting	Description
Hidden Folder	Hide the shared folder from Microsoft Windows clients. The folder can still be accessed using its full path, for example: \\NAS_IP\share_name.
Lock File (Oplocks)	Opportunistic lock (Oplocks) is a Windows file locking mechanism that facilitates caching and access control to improve performance. This feature is enabled by default and should only be disabled in networks where multiple users simultaneously access the same files.

Setting	Description
Synchronous I/O	Select the ZFS Intent Log I/O mode to improve data consistency or performance. There are three modes: • Always: All I/O transactions are treated as synchronous and are always written and flushed to a non-volatile storage (such as a SSD or HDD). This option gives the best data consistency, but might have a small impact on performance. • Standard: QES uses synchronous I/O or asynchronous I/O based on the application and the type of I/O request. • Disabled: All I/O transactions are treated as asynchronous. This option gives the highest performance, but has a higher risk of data loss in the event of a power outage. Ensure that a UPS (uninterrupted power supply) is installed when using this option. **Tip** • The default option on dual-controller NAS devices is `Always`. • The default option on single-controller NAS devices is `Standard`.
Enable recycle bin	Enable the network recycle bin for this shared folder. Files can be recovered from the recycle bin after being deleted. If **Restrict the access of Recycle Bin to administrators only for now** is enabled, only NAS administrators can recover deleted files. **Tip** • To enable this option you must first enable the network recycle bin at **Control Panel** > **Network Services** > **Network Recycle Bin** > **Enable Network Recycle Bin**. • For more details, see Network Recycle Bin.
Path	This shows the UNIX file system path to the folder. It is for reference only and cannot be modified.

9. Optional: Configure WORM (Write Once Read Many).
WORM prevents anyone from modifying or deleting files or folders in the shared folder.

Important
This setting cannot be modified after shared folder creation.

a. Select **WORM**.

b. Configure any of the following settings.

Setting	Description
WORM type	Select a WORM type. • Enterprise Users can delete the shared folder. • Compliance Users cannot delete the shared folder. An administrator must remove the storage pool to delete the WORM shared folder.
Lock delay	When enabled, a file added to the folder can be modified within the lock delay time period. After this time has passed, the file automatically becomes locked and unmodifiable. **Note** • The maximum lock delay is 168 hours and 59 minutes. • You cannot modify lock delay after folder creation. • The time a file becomes locked might vary from the specified time by +/- 1 minute.
Retention	Limit how long WORM applies to each file and folder. Files and folders can be modified after the specified time period.

10. Configure folder encryption.
QES encrypts the folder using 256-bit AES encryption. Encrypted folders can be locked and unlocked using a password or an encryption key file.

Important
You cannot change the folder path if encryption is enabled.

a. Select **Encryption**.

b. Specify an encryption password.
The password must contain 8 to 16 characters, and can be any combination of letters, numbers and special characters. Spaces are not allowed.

> **Warning**
> If you forget this password, the shared folder will become inaccessible and all data will be lost.

c. Optional: Select **Save encryption key**.
Saving a local copy of the encryption key enables QES to automatically unlock and mount the encrypted shared folder when the NAS starts up. If the encryption key is not saved, you must specify the encryption password whenever the NAS restarts.

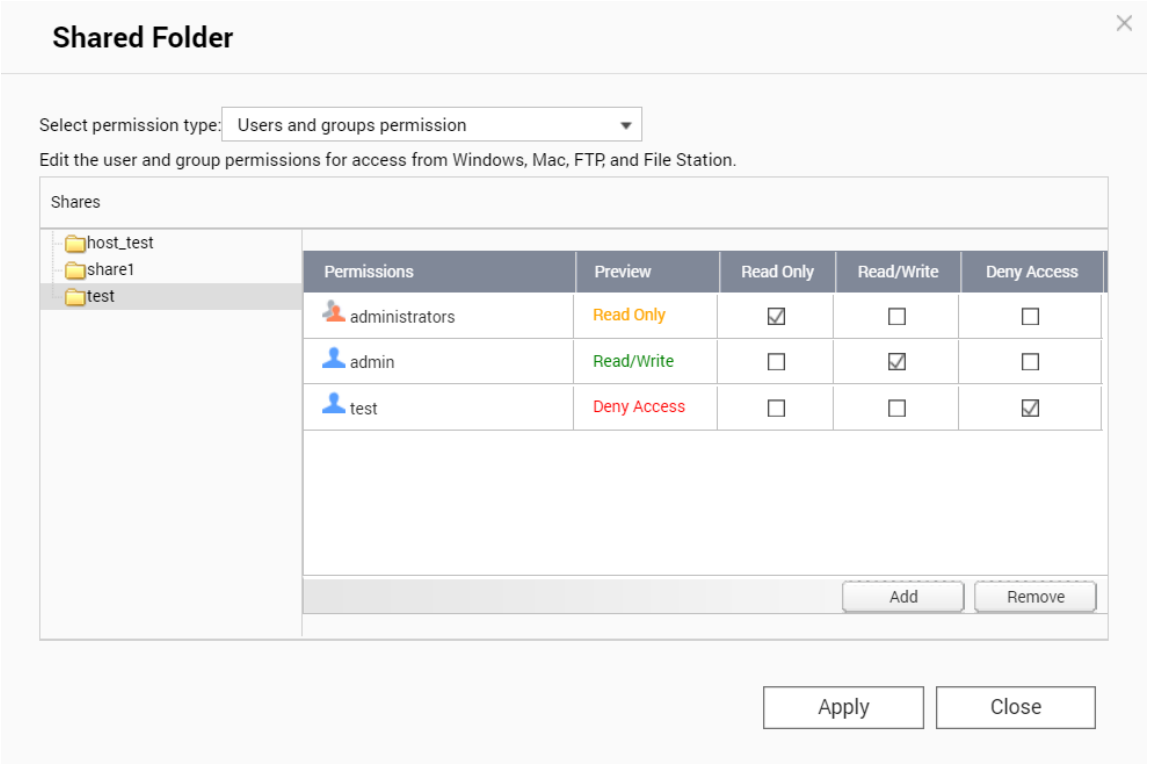
> **Warning**
> Storing the encryption key on the NAS can result in unauthorized access to data if the entire NAS is stolen.

11. Click **Create**.

Shared Folder Permissions

This screen enables you to assign folder access permissions for three different sets of users.

Permissions	Applies To
User and group permissions	All NAS users
NFS host access	Users accessing the NAS using NFS
Microsoft networking host access	Users accessing the NAS using SMB



Configuring User and Group Permissions

1. Go to **Storage Manager** > **Storage Space**.
2. Select a shared folder.
   The **Shared Folder Manager** window opens.
3. Click **Permissions**.
   The **Shared Folder Permissions** window opens.
4. Ensure **Users and groups permission** is selected in **Select permission type**.
5. Select a shared folder.
6. Specify shared folder access permissions for each user and group.

Permissions	Abbreviation	Description
Read/Write	RW	Users can view, modify, add and delete files and folders.
Read Only	RO	Users can view files and folders.
Deny Access	Deny	Users cannot access the folder.

Shared folder user and group permissions override permissions set at the file system level. Setting deny access permissions on this screen will prevent a user from accessing any sub-folders even if you set read/write permissions on the sub-folders in File Station.

Tip
To specify read-only permissions on the root of a shared folder and read/write permissions on its sub-folders, first set the user and group permissions to read/write. Then set the root folder to read-only at the file system level using File Station.

7. Optional: Click **Add** to add a new user or group permission.
8. Optional: Click **Remove** to remove a user or group permission.

Tip
You can use the following keyboard shortcuts.

- Selecting multiple users: Press and hold the SHIFT key.
- Selecting a range of users: Press and hold the CTRL key.

Configuring NFS Host Access Permissions

1. Go to **Storage Manager** > **Storage Space**.
2. Select a shared folder.
   The **Shared Folder Manager** window opens.
3. Click **Permissions**.
   The **Shared Folder Permissions** window opens.
4. Select **NFS host access**.
5. Select a shared folder.
6. Configure the following permission settings.

Setting	Description
Support NFSv4 ACL Inheritance	Deselecting this option disables NFSv4 ACL inheritance and enables umask settings.
Enable Map_Root and Map_All	Users that access shared folders using NFS can use the permissions associated with their NAS accounts. This can cause security risks, especially if a user has root privileges. Selecting this option allows you to restrict permissions of users that access the folder using NFS. Choose from: • Map_Root: The root user receives the specified user and group permissions. • Map_All: All users receive the specified user and group permissions.

7. Configure security settings.

Setting	Description
AUTH_SYS	The default unencrypted NFS version 3 security mechanism.
Kerberos	Kerberos is a network authentication protocol. It is designed to provide strong authentication for client/server applications by using secret-key cryptography. • **krb5**: Use Kerberos for authentication only. • **krb5i**: Use Kerberos for authentication, and include a hash with each transaction to ensure data integrity. Traffic can still be intercepted and examined, but modifications to the traffic are made apparent. • **krb5p**: Use Kerberos for authentication, and encrypt all traffic between the client and server. This authentication is the most secure mechanism but also incurs the most load.

8. Configure NFS host access permissions.
   a. Select access permissions for all NFS hosts.

Permission	Description
No limit	Users can view, modify, add and delete files and folders.
Read Only	Users can view files and folders.
Deny Access	Users cannot access the folder. This is the default permission for NFS hosts.

   b. Optional: Add a new NFS host.
   c. Select an NFS host in the table.
   d. Optional: Select **All hosts can access the shared folder**.
   QES applies the selected permission to all NFS hosts that attempt to access the folder.
9. Click **Apply**.

Configuring SMB Host Access Control

Windows and Mac hosts use SMB to access shared network folders. Linux hosts can also use SMB using Samba. By default all SMB hosts can access all SMB shared folders.

1. Go to **Storage Manager** > **Storage Space**.
2. Select a shared folder.
   The **Shared Folder Manager** window opens.
3. Click **Permissions**.
   The **Shared Folder Permissions** window opens.

4. Select **Microsoft Networking host access**.
5. Deselect **All hosts can access the shared folder**.
6. Optional: Click **Create Host** to add a new host IP address or IP range.
7. Select the hosts that are allowed to access this folder.
8. Click **Apply**.

Shared Folder Management

Deleting a Shared Folder

> **Note**
> If an application such as SnapSync is using the shared folder, then you need to stop the application from using the folder before deleting it.

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Select a shared folder.
3. Click **Manage**.
   The **Shared Folder Management** window opens.
4. Click **Remove**.
   A confirmation message appears.

   > **Warning**
   > All data in the shared folder will be deleted.

5. Click **Apply**.

Editing Shared Folder Properties

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Select a shared folder.
3. Click **Manage**.
   The **Shared Folder Management** window opens.
4. Click **Actions**.
5. Select **Edit Properties**.
   The **Shared Folder Properties** window opens.
6. Modify shared folder settings.
   For details on folder settings, see Creating a Shared Folder.

Important

- Disabling compression only affects new data. Existing data in the folder remains compressed.
- Disabling deduplication only affects new data. Existing data in the folder remains deduplicated.

7. Click **Apply**.

Shared Folder Encryption

QES can encrypt shared folders with 256-bit AES encryption, which protects data from unauthorized access if individual drives or the entire NAS are stolen. Users must specify the encryption password to access encrypted shared folders.

Important

You can only enable encryption during the folder creation process. For details, see Creating a Shared Folder.

Shared Folder Access

Mapping a Shared Folder on a Windows Computer

1. Perform the following actions, depending on your Windows version.

Windows Version	Action
Windows 7	**a.** Click **Start**. **b.** Click **Computer**.
Windows 10	**a.** Press `Windows Key + E`. **b.** Select **This PC** from the left pane.

2. Click **Map Network Drive**.
   The **Map Network Drive** window opens.
3. Select a drive letter.
4. Specify the SMB path to the shared folder.
   The path will be either `\\NAS_NAME\FOLDER_NAME` or `\\NAS_IP_ADDRESS\FOLDER_NAME`.

Tip

To get the SMB path to a shared folder:

a. Go to **Storage Manager** > **Storage** > **Storage Space**.

b. Select a shared folder.

c. Click **Manage**.

d. Click **Actions**, and then select **Edit Properties**.

e. In the **Shared Folder Properties** window under **SMB Path**, click **Copy Link**.

5. Click **Finish**.
6. Optional: Specify your NAS user name and password if prompted.

Windows maps the shared folder to the specified drive letter. The drive can be accessed using Windows Explorer.

Mounting a Shared Folder on a Mac Computer

1. Open **Finder**.
2. Select **Go** > **Connect to Server**.
3. Specify your NAS address.
   The address must include the sharing protocol followed by the NAS data interface IP address.

Sharing Protocol	Address Format
SMB	smb://NAS IP Address
NFS	nfs://NAS IP Address

4. Click **Connect**.
5. Specify your NAS user name and password.
6. Select a shared folder.
7. Click **OK**.

MacOS mounts the shared folder.

Mounting a Shared Folder on a Linux Computer

1. Open a terminal with root privileges.
2. Run the following command.
   ```
   mount <NAS Ethernet Interface IP>:/share/<Shared Folder Name>
   <Directory to Mount>
   ```

Example: If the NAS Ethernet interface IP address is 192.168.0.42 and you want to connect to a shared folder "public" under the /mnt/pub directory, enter the following command: `mount -t nfs 192.168.0.42:/share/public /mnt/pub`

Note

A dual controller QES NAS has two kinds of network interface:

- Management interface
- Ethernet interface (dedicated to data transfer)

You can connect to the Ethernet interface on either controller.

Tip

To get the NFS path to a shared folder:

a. Go to **Storage Manager** > **Storage** > **Storage Space**.

b. Select a shared folder.

c. Click **Manage**.

d. Click **Actions**, and then select **Edit Properties**.

e. In the **Shared Folder Properties** window under **NFS Path**, click **Copy Link**.

3. Specify your NAS username and password.

You can connect to the shared folder using the mounted directory.

SSD Over-Provisioning

When the blocks in an SSD are full with old data, the disk's firmware frees up space in a process called garbage collection. Garbage collection results in an effect called write amplification, which reduces the lifespan and random write performance of the SSD. Write amplification can be reduced by over-provisioning, which means reserving space on the disk for garbage collection. Most SSDs are manufactured with 7% or more of their capacity reserved for over-provisioning.

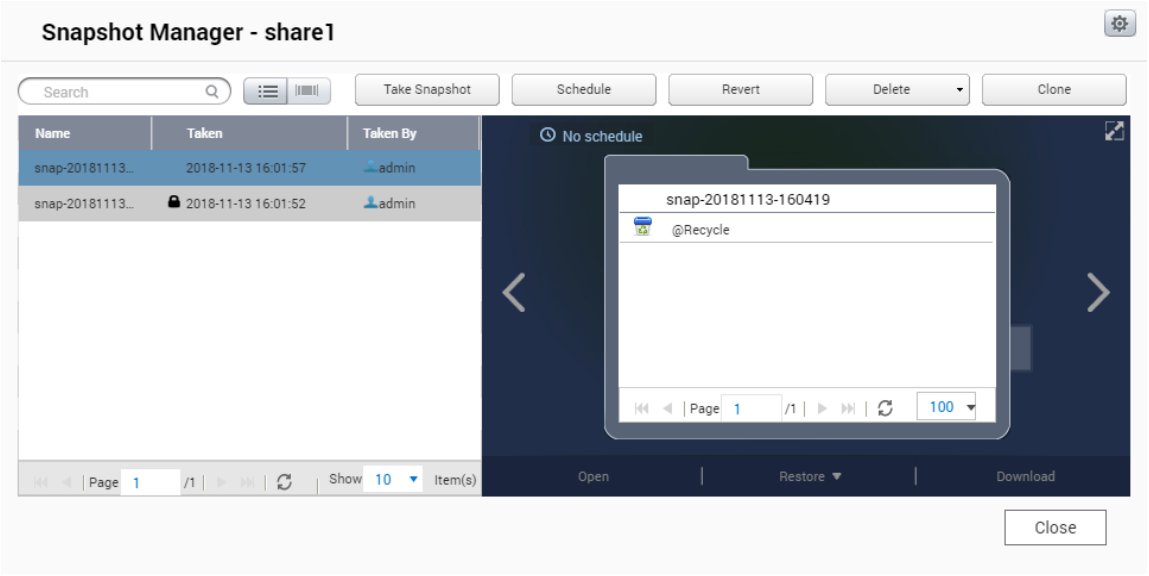
QES SSD Features

QES has the following features to improve the performance of all-SSD storage pools.

Feature	Description	Benefits	Recommended Settings	Reduces Storage Capacity
SSD over-provisioning	QES reserves a percentage of space on each SSD by issuing a command to the disk's firmware.	• Increases SSD random write performance • Extends SSD lifespan	Follow the SSD manufacturer's recommen-dations	Yes
Write Coalescing	Write Coalescing optimizes a storage pool for SSD storage by converting random writes into sequential writes, and reducing the total number of I/O requests.	• Increases storage pool random write performance • Extends SSD lifespan	Enable this feature on all-SSD storage pools.	No
Pool over-provisioning	QES reserves a percentage of space in the storage pool to ensure consistent random write performance when the pool is nearly full.	• Ensures consistent random write performance when a storage pool is nearly full • Lowers the total number of SSD writes • Extends SSD lifespan	Pool over-provisioning should be set to 20-30%.	Yes

Snapshots

Snapshots protect data by recording the state of a shared folder at a specific point in time. You can restore data to a previous state if it is unintentionally modified or deleted. You can also use snapshots to back up data to another NAS using SnapSync.



Snapshot Creation

Taking a Snapshot

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Select a shared folder or LUN.
3. Click **Snapshot** and then select **Take a Snapshot**.
   The **Take a Snapshot** window opens.
4. Optional: Specify a name.
   The name must consist of 1 to 24 characters from the following groups:
   - Letters: A-Z, a-Z
   - Numbers: 0-9
   - Special Characters: Dash (-), period (.), underscore (_)
5. Specify a retention time.

Option	Description
Keep For	QES retains the snapshot for the specified time period.

Option	Description
Keep this snapshot permanently	QES retains the snapshot indefinitely. **Important** QES will still delete the snapshot when the following two conditions are met: • **Delete the oldest snapshots when a storage pool is full** is enabled at **Storage Manager** > **Global Settings**. • Storage space is low.

6. Select the LUN snapshot type.
   This setting is only available when taking a snapshot of a block-based LUN.

Type	Description
Crash consistent	The snapshot records the state of the data on the LUN.
Application consistent	The snapshot records the state of data and applications on the LUN. The iSCSI host flushes data in memory to the LUN before QES takes a snapshot. If VMware vCenter is using the LUN, vCenter takes a virtual machine snapshot. **Important** This option is only available for VMware vCenter, or for Volume Shadow Copy Service (VSS) aware applications running on a Windows server. You must install QNAP Snapshot Agent on the iSCSI initiator.

7. Click **OK**.

QES takes the snapshot. The snapshot appears in **Snapshot Manager**.

Configuring a Snapshot Schedule

Tip
You can configure a separate snapshot schedule for each shared folder and LUN.

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Select a shared folder or LUN.
3. Click **Snapshot**, and then select **Snapshot Manager**.
   The **Snapshot Manager** window opens.

4. Click **Schedule**.
   The **Schedule Snapshot** window opens.
5. Select **Enable schedule**.
6. Specify how often QES will take a snapshot.
7. Select the LUN snapshot type.
   This setting is only available when taking a snapshot of a block-based LUN.

Type	Description
Crash consistent	The snapshot records the state of the data on the LUN.
Application consistent	The snapshot records the state of data and applications on the LUN. The iSCSI host flushes data in memory to the LUN before QES takes a snapshot. If VMware vCenter is using the LUN, vCenter takes a virtual machine snapshot. **Important** This option is only available for VMware vCenter, or for Volume Shadow Copy Service (VSS) aware applications running on a Windows server. You must install QNAP Snapshot Agent on the iSCSI initiator.

8. Specify a retention time.
   QES retains the snapshot for the specified time period. If you deselect **Keep for**, QES retains the snapshot indefinitely.
9. Click **OK**.

QES takes snapshots according to the specified schedule.

Snapshot Management

Deleting Snapshots

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Select a shared folder or LUN.
3. Click **Snapshot**, and then select **Snapshot Manager**.
   The **Snapshot Manager** window opens.
4. Select a snapshot.
5. Click **Delete**.

6. Select an option.

Option	Description
Delete	Delete the selected snapshot.
Delete all	Delete all snapshots for this shared folder or LUN.

A confirmation message appears.

7. Click **OK**.

Configuring Snapshot Global Settings

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Select a shared folder or LUN.
3. Click **Snapshot**, and then select **Snapshot Manager**.
The **Snapshot Manager** window opens.
4. Click  .
The **Snapshot Global Settings** window opens.
5. Select **Make snapshot directory (@Snapshot) visible**.
QES mounts all snapshots in a folder called @Snapshot in the top-level shared folder. All users have read-only access to this snapshot folder.

> **Important**
> This setting only applies to the current shared folder.

6. Click **OK**.

Snapshot Data Recovery

Restoring Files and Folders from a Snapshot

> **Important**
> You cannot restore files and folders from a LUN snapshot.

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Select a shared folder.
3. Select **Snapshot** > **Snapshot Manager**.
The **Snapshot Manager** window opens.
4. Select a snapshot.

5. Select a file or folder.

   Tip

   If the file preview window is not visible, click  .

6. Select a restore action.

Restore	QES restores the file or folder to its original storage location. If the file or folder still exists on the NAS, then it will be overwritten with the older version. **Warning** All changes made after the snapshot was created will be lost.
Restore to	QES restores the file or folder to a different location on the NAS.
Download	You can download the file or folder to your computer. QES packages folders in a ZIP file for downloading.

Reverting a Shared Folder or LUN

Reverting restores a shared folder or LUN to the state at which the snapshot was taken. Restoring data using snapshot revert is faster than restoring individual files and folders.

Important

- QES automatically unmaps an iSCSI LUN before reverting it.
- If Snapshot Agent is installed and the snapshot is application consistent, QES will automatically re-map it to its original target.

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Select a shared folder or LUN.
3. Select **Snapshot** > **Snapshot Manager**.
   The **Snapshot Manager** window opens.
4. Select a snapshot.
5. Click **Revert**.
   A confirmation message appears.

   Warning

   All changes made after the snapshot was taken will be deleted.

6. Click **OK**.

QNAP Snapshot Agent

QNAP Snapshot Agent enables QES to take application-consistent snapshots of iSCSI LUNs on VMware or Microsoft servers. Application-consistent snapshots record the state of running applications, virtual machines, and data. When QES takes a LUN snapshot, QNAP Snapshot Agent triggers the following actions:

- Windows: The server flushes data in memory, logs, and pending I/O transactions to the LUN before the snapshot is created.
- VMware: The server takes a virtual machine snapshot.

For more information on using Snapshot Agent, see the following QNAP application note: https://files.qnap.com/news/pressresource/datasheet/Create_Microsoft_Hyper-V_Backups_Using_QNAP_Snapshot_Agent_and_VSS_Hardware_Provider(English).pdf.

Viewing Registered Snapshot Agent Servers

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.
2. Select **Snapshot** > **Snapshot Agent**.
   The **Snapshot Agent** window opens.
3. Optional: Deregister a server.
   a. Select a server.
   b. Click **Remove**.

Snapshot Clone

Cloning creates a copy of a shared folder or LUN from a snapshot. The copy is stored in the same storage pool as the original shared folder or LUN.

Cloning a Shared Folder

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Select a shared folder.

   Important
   The shared folder must have at least one snapshot.

3. Click **Snapshot**, and then select **Snapshot Manager**.
   The **Snapshot Manager** window opens.
4. Select a snapshot.
5. Click **Clone**.
   The **Clone Snapshot** window opens.

6. Specify a name.
7. Click **OK**.

QES clones the shared folder and then displays a confirmation message.

Cloning a LUN

1. Go to **Storage Manager** > **Storage** > **Storage Space**.
2. Select a block-based LUN.

   Important
   The LUN must have at least one snapshot.

3. Click **Snapshot**, and then select **Snapshot Manager**.
   The **Snapshot Manager** window opens.
4. Select a snapshot.
5. Click **Clone**.
   The **Clone Snapshot** window opens.
6. Specify a name.
7. Optional: Select an iSCSI target.
   QES will map the LUN copy to the target.
8. Click **OK**.

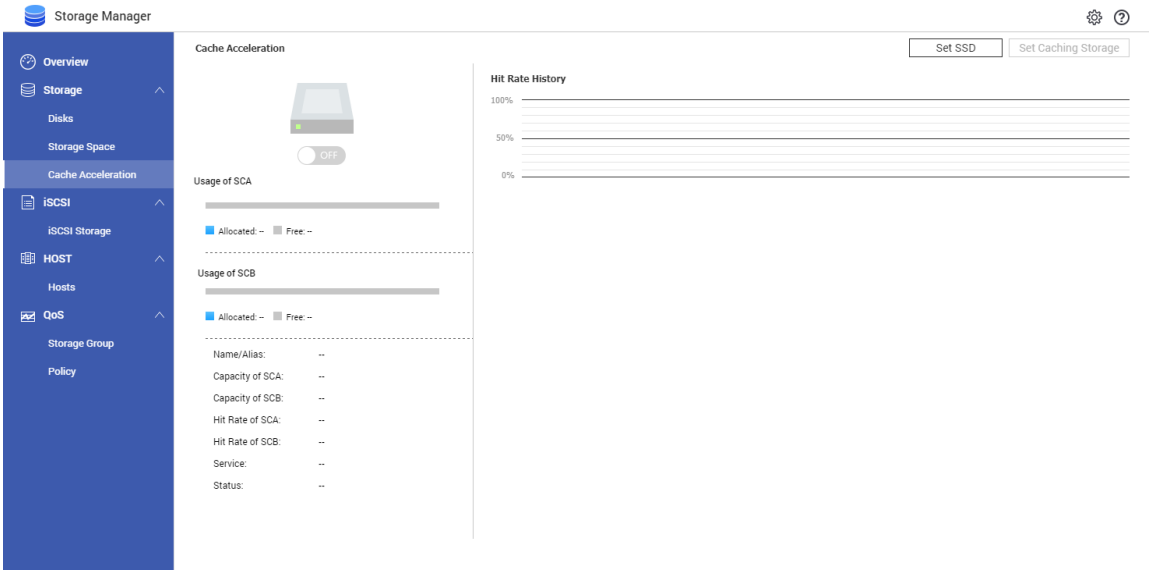
QES clones the LUN and then displays a confirmation message.

Cache Acceleration

Cache Acceleration enables you to create an SSD cache for improving the read performance of the NAS.

Important

- QES only uses the SSD cache for read-cache.
  - On ES series NAS models, QES performs write caching using hardware NVRAM.
  - TES and TDS series NAS models offer RAM write cache protection (write log) when you add an SSD to the SSD cache. The write log ensures data integrity and also helps increase write performance, but it is not technically a write cache.
- Shared folders and LUNs created in an all-SSD storage pool cannot use the SSD cache, as it would provide no additional performance benefits.



Configuring the SSD Cache

For details on compatible SSDs, see www.qnap.com/compatibility.

1. Go to **Storage Manager** > **Storage** > **Cache Acceleration**.
2. Click **Set SSD**.
   The **Set SSD** window opens.
3. Select the SSDs to be included in the cache.
4. Optional: Enable RAM write cache protection (Write Log).
   When enabled, QES copies data from the RAM write cache to the SSD cache for additional data protection.

   Important

   - This feature is only available on TES and TDS series NAS models.
   - Enabling this feature requires an even number of SSDs.
   - If an SSD fails, QES automatically disables the write log.

5. Click **OK**.
   A confirmation message appears.

   Warning

   All data except for system partition data will be deleted.

6. Click **OK**.
   The **Set SSD** window closes.

QES uses the selected drives as an SSD cache. If no SSDs are selected, QES disables the SSD cache.

Enabling the SSD Cache

1. Ensure the SSD cache contains at least one disk.
   For details on adding disks to the SSD cache, see Configuring the SSD Cache.
2. Go to **Storage Manager** > **Storage** > **Cache Acceleration**.
3. Set the **Cache Acceleration** toggle switch to 

.

Disabling the SSD Cache

1. Go to **Storage Manager** > **Storage** > **Cache Acceleration**.
2. Set the **Cache Acceleration** toggle switch to 

.

Configuring Cached Shared Folders and LUNs

1. Go to **Storage Manager** > **Storage** > **Cache Acceleration**.
2. Click **Set Caching Storage**.
3. Select the shared folders and LUNs that are allowed to use the SSD cache.

   Important
   Shared folders and LUNs created in an all-SSD storage pool cannot use the SSD cache.

4. Optional: Enable **Bypass Prefetch Data**.

Setting	Setting
Setting	QES does not copy data from large-block sequential I/O operations such as video streaming to the SSD cache. This is the default SSD cache behavior.
Disabled	QES copies data from large block sequential I/O operations to the SSD cache. This requires more cache space and CPU resources.

5. Click **Finish**.

iSCSI & Fibre Channel

Storage Manager is a QES utility that enables you to configure iSCSI and Fibre Channel storage settings on your NAS.

Storage Limits

iSCSI Storage Limits

iSCSI Storage Limit	Maximum
iSCSI targets per NAS	255
iSCSI LUNs per NAS	1024
iSCSI sessions per target	256
iSCSI sessions per storage controller	512
iSCSI sessions per NAS	• Single controller NAS: 512 • Dual controller NAS: 1024

Fibre Channel Storage Limits

Fibre Channel Storage Limit	Maximum
Fibre Channel ports + port groups	256 (combined)
WWPN aliases	256
LUN masking rules	256
Port binding rules	256
LUNs mapped to 1 Fibre Channel port	256

iSCSI & Fibre Channel Global Settings

You can access global settings by clicking  in the **iSCSI & Fibre Channel** window.

Setting	Description
Enable iSCSI and Fibre Channel services	Enable these services to use iSCSI and Fibre Channel on your NAS.

Setting	Description
iSCSI service port	View and modify the port that iSCSI initiators connect to. **Tip** The default port is 3260.
Enable iSNS	SNS enables the automatic discovery and management of iSCSI initiators and targets within a TCP/IP network. **iSNS server IP**: Specify the IP address of the iSNS server.

LUNs

QNAP NAS devices allow other devices to access their storage space in the form of LUNs over iSCSI and Fibre Channel networks. The LUNs must first be created on the NAS, and then mapped to iSCSI targets or Fibre Channel port groups for access over the network.

LUN Overview

QES supports blocked-based iSCSI LUNs with the following features:

- VAAI full copy
- VAAI block zeroing
- VAAI hardware assisted locking
- Thin provisioning
- Space reclamation (with VAAI or from Windows 2012 or Windows 8)
- Microsoft ODX
- LUN snapshot
- LUN SnapSync

Creating a LUN

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.
2. Click **Create**, and then select **iSCSI Target / LUN**.
3. Select **iSCSI LUN only**.
4. Click **Next**.

5. Configure the following LUN settings.

Setting	Description
LUN name	• Valid characters: 0-9, a-z, A-Z, dash -, underscore (_) • Length: 1 to 32 characters
LUN Allocation	• Thin Provisioning: QES allocates storage pool space to a LUN only when necessary. However, QES cannot save data to the LUN if the storage pool runs out of space. • Instant Allocation: QES allocates storage pool space when creating the LUN. This option is also known as Thick provisioning.
LUN Location	Select the storage pool that this LUN will be created in.
Capacity	Specify the maximum capacity of the LUN. The maximum capacity depends on the LUN allocation method: • Thick provisioning: Equal to the amount of free space in the parent storage pool. Equal to the amount of free space in the parent storage pool. • Thin provisioning: Twenty times the amount of free space in the parent storage pool.
Alert threshold	QES issues a warning notification when the percentage of used LUN space is equal to or above the specified threshold.
Performance profile	Specify how the LUN will be used. Each option results in a different record size, optimizing performance for the specified application. • Generic • Hyper-V • VMware • Database • Custom (Choose from: 8k, 16k, 32k, 64k, 128k) **Tip** Select `Generic` if you are unsure of which option to select.

Setting	Description
Synchronous I/O	Select the ZFS Intent Log (ZIL) sync setting to improve either data consistency or performance. There are three options: • Always: (Default). All I/O transactions are treated as synchronous and are always written and flushed to a non-volatile storage (such as a SSD or HDD). This option gives the best data consistency, but might have a slight impact on performance. • Standard: QES uses synchronous I/O or asynchronous I/O based on the application and the type of I/O request. • Disabled: All I/O transactions are treated as asynchronous. This option gives the highest performance, but has a higher risk of data loss in the event of a power outage. Ensure that a UPS (uninterrupted power supply) is installed when using this option.
SSD Cache	The SSD cache will be used to improve LUN access performance. **Important** Shared folders and LUNs created in an all-SSD storage pool cannot use the SSD cache.
Deduplication	QES eliminates duplicate copies of data to reduce the required amount of storage space. **Warning** • Before QES 1.1.3, the default deduplication algorithm was `SHA256`. If you update a pre-QES 1.1.3 NAS to QES 1.1.3 or later and then change the deduplication algorithm to `SHA512` or `Skein`, data might become inaccessible . • Deduplication is only available if **Performance profile** is set to **VDI** or **Custom**, and **Thin provisioning** is selected.
Compression	QES compresses the data in the LUN to reduce the size of stored data. Enabling compression also reduces the total number of blocks that QES needs to read and write, increasing read and write speeds. **Tip** New shared folders and LUNs have compression enabled by default. Compression does not impact read/write and processor performance on ZFS filesystems. Only disable this setting when necessary.

Setting	Description
Enable Fast Clone	Fast Clone enables QES to create copies of files faster. It also saves storage space by modifying file metadata, allowing original and copied files to share the same data blocks. **Important** • To enable this setting, **Thin provisioning** must be selected. • Fast Clone only works when the copied file is created in the LUN containing the original file. • Fast Clone does not improve the speed of snapshot restoration operations such as restoring files from a snapshot, snapshot revert, and snapshot clone.
Encryption	QES encrypts the LUN using 256-bit AES encryption. You must specify an encryption password. • Valid characters: All alphanumeric and special characters except spaces • Length: 8 to 16 characters You can also save a copy of the encryption key on the NAS.

6. Click **Next**.
7. Optional: Map the LUN to an existing target.
   a. Deselect **Do not map it to a target for now**.
   b. Select a target.
8. Click **Next**, and then **Next** again.
9. Click **Finish**.

QES creates the LUN.

iSCSI

iSCSI enables computers, servers, other NAS devices, and virtual machines to access NAS storage in the form of LUNs over a TCP/IP network. Hosts can partition, format, and use the LUNs as if they were local disks.

Getting Started with iSCSI

1. Create an iSCSI target on the NAS.
   For details, see Creating an iSCSI Target.

2. Create a LUN on the NAS.
   creates LUNs using storage pool space. For details, see Creating a LUN.
3. Map the LUN to the iSCSI target.
   Multiple LUNs can be mapped to one target.
   For details, see Creating an iSCSI Target With a Mapped LUN and Managing an iSCSI LUN.
4. Install an iSCSI initiator application or driver on the host.
   The host is the service, computer, or NAS device that will access the LUN.
5. Connect the iSCSI initiator to the iSCSI target on the NAS.

   Warning
   To prevent data corruption, multiple iSCSI initiators should not connect to the same LUN simultaneously.

   The LUNs mapped to the iSCSI target appear as disks on the host.
   For details, see iSCSI Target Access.
6. In the host OS, format the disks.

iSCSI Targets

iSCSI targets allow iSCSI initiators from other devices on the network to access mapped LUNs on the NAS. You can create multiple iSCSI targets and also map multiple LUNs to a single iSCSI target.

Creating an iSCSI Target

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.
2. Click **Create**, and then select **iSCSI Target / LUN**.
3. Select **iSCSI Target only**.
4. Click **Next**.
5. Specify a target name.
   QES appends the specified name to the iSCSI qualified name (IQN). IQNs are unique names used to identify targets and initiators.
   - Valid characters: 0 to 9, a to z, A to Z
   - Length: 1 to 16 characters
6. Specify a target alias.
   An alias enables you to identify the target more easily on the initiator.
   - Valid characters: 0 to 9, a to z, A to Z, underscore (_), hyphen (-)
   - Length: 1 to 32 characters
7. Optional: Enable CRC checksums.
   Initiators and targets communicate over TCP connections using iSCSI protocol data units (PDU). The sending device can send a checksum with each PDU. The receiving device uses this

checksum to verify the integrity of the PDU, which is useful in unreliable network environments. There are two checksum types, which can be enabled separately.

Checksum Type	Description
Data Digest	The checksum can be used to verify the data portion of the PDU.
Header Digest	The checksum can be used to verify the header portion of the PDU.

The following options are available for each checksum type.

Option	Description
None	The target reports that it does not support checksums. CRC32C checksums must be disabled on connecting initiators.
crc32c	The target reports that checksums are required. CRC32C checksums must be enabled on connecting initiators.
none/crc32c	

8. Click **Next**.
9. Optional: Enable CHAP authentication.
   An initiator must authenticate with the target using the specified username and password. This provides security, as iSCSI initiators do not require a NAS username or password.
   - Username
     - Length: 1 to 128 characters
     - Valid Characters: 0 to 9, a to z, A to Z
   - Password
     - Length: 12 to 16 characters
     - Valid characters: 0 to 9, a to z, A to Z
10. Optional: Enable mutual CHAP authentication.
    Both the initiator and the target must authenticate with each other for additional security. First, the initiator authenticates with the target using the CHAP authentication username and password. Next, the target authenticates with the initiator using the mutual CHAP username and password.
    - Username
      - Length: 1 to 128 characters
      - Valid characters: 0 to 9, a to z, A to Z, colon (:) , period (.) , hyphen (-)
    - Password
      - Length: 12 to 16 characters

- Valid characters: 0 to 9, a to z, A to Z, colon (:) , period (.) , hyphen (-)

11. Click **Next**.
12. Select the network interfaces that this target will use for data transmission.
13. Click **Next**.
14. Select the hosts that are allowed to access this target.
    Click the field in the **Access** column to change a host's access rights. You must select `All Access` for at least one host.
15. Click **Next**, and then **Next** again.
16. Click **Finish**.

QES creates the iSCSI target.

Creating an iSCSI Target With a Mapped LUN

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.
2. Click **Create**, and then select **iSCSI Target / LUN**.
3. Select **iSCSI Target with a mapped LUN** and then click **Next**.
4. Click **Next**.
5. Specify a target name.
   QES appends the specified name to the iSCSI qualified name (IQN). IQNs are unique names used to identify targets and initiators.
   - Valid characters: 0 to 9, a to z, A to Z
   - Length: 1 to 16 characters
6. Specify a target alias.
   An alias enables you to identify the target more easily on the initiator.
   - Valid characters: 0 to 9, a to z, A to Z, underscore (_), hyphen (-)
   - Length: 1 to 32 characters
7. Optional: Enable CRC checksums.
   Initiators and targets communicate over TCP connections using iSCSI protocol data units (PDU). The sending device can send a checksum with each PDU. The receiving device uses this checksum to verify the integrity of the PDU, which is useful in unreliable network environments. There are two checksum types, which can be enabled separately.

Checksum Type	Description
Data Digest	The checksum can be used to verify the data portion of the PDU.
Header Digest	The checksum can be used to verify the header portion of the PDU.

The following options are available for each checksum type.

Option	Description
None	The target reports that it does not support checksums. CRC32C checksums must be disabled on connecting initiators.
crc32c	The target reports that checksums are required. CRC32C checksums must be enabled on connecting initiators.
none/crc32c	The target reports that checksums can be disabled or enabled. Connecting initiators can choose whether to use CRC32C or not.

8. Click **Next**.
9. Optional: Enable CHAP authentication.
   An initiator must authenticate with the target using the specified username and password. This provides security, as iSCSI initiators do not require a NAS username or password.
   - Username
     - Length: 1 to 128 characters
     - Valid Characters: 0 to 9, a to z, A to Z
   - Password
     - Length: 12 to 16 characters
     - Valid characters: 0 to 9, a to z, A to Z
10. Optional: Enable mutual CHAP authentication.
    Both the initiator and the target must authenticate with each other for additional security. First, the initiator authenticates with the target using the CHAP authentication username and password. Next, the target authenticates with the initiator using the mutual CHAP username and password.
    - Username
      - Length: 1 to 128 characters
      - Valid characters: 0 to 9, a to z, A to Z, colon (:) , period (.) , hyphen (-)
    - Password
      - Length: 12 to 16 characters
      - Valid characters: 0 to 9, a to z, A to Z, colon (:) , period (.) , hyphen (-)
11. Click **Next**.
12. Select the network interfaces that this target will use for data transmission.
13. Click **Next**.

14. Select the hosts that are allowed to access this target.
    Click the field in the **Access** column to change a host's access rights. You must select `All Access` for at least one host.

15. Click **Next**.

16. Configure the following LUN settings.

Setting	Description
LUN name	• Valid characters: 0-9, a-z, A-Z, dash -, underscore (_) • Length: 1 to 32 characters
LUN Allocation	• Thin Provisioning: QES allocates storage pool space to a LUN only when necessary. However, QES cannot save data to the LUN if the storage pool runs out of space. • Instant Allocation: QES allocates storage pool space when creating the LUN. This option is also known as Thick provisioning.
LUN Location	Select the storage pool that this LUN will be created in.
Capacity	Specify the maximum capacity of the LUN. The maximum capacity depends on the LUN allocation method:
Alert threshold	QES issues a warning notification when the percentage of used LUN space is equal to or above the specified threshold.
Performance profile	Specify how the LUN will be used. Each option results in a different record size, optimizing performance for the specified application. • Generic • Hyper-V • VMware • Database • Custom (Choose from: 8k, 16k, 32k, 64k, 128k) **Tip** Select `Generic` if you are unsure of which option to select.

Setting	Description
Synchronous I/O	Select the ZFS Intent Log (ZIL) sync setting to improve either data consistency or performance. There are three options: • Always: (Default). All I/O transactions are treated as synchronous and are always written and flushed to a non-volatile storage (such as a SSD or HDD). This option gives the best data consistency, but might have a slight impact on performance. • Standard: QES uses synchronous I/O or asynchronous I/O based on the application and the type of I/O request. • Disabled: All I/O transactions are treated as asynchronous. This option gives the highest performance, but has a higher risk of data loss in the event of a power outage. Ensure that a UPS (uninterrupted power supply) is installed when using this option.
SSD Cache	The SSD cache will be used to improve LUN access performance. **Important** Shared folders and LUNs created in an all-SSD storage pool cannot use the SSD cache.
Deduplication	QES eliminates duplicate copies of data to reduce the required amount of storage space. **Warning** • Before QES 1.1.3, the default deduplication algorithm was `SHA256`. If you update a pre-QES 1.1.3 NAS to QES 1.1.3 or later and then change the deduplication algorithm to `SHA512` or `Skein`, data might become inaccessible . • Deduplication is only available if **Performance profile** is set to **VDI** or **Custom**, and **Thin provisioning** is selected.
Compression	QES compresses the data in the LUN to reduce the size of stored data. Enabling compression also reduces the total number of blocks that QES needs to read and write, increasing read and write speeds. **Tip** New shared folders and LUNs have compression enabled by default. Compression does not impact read/write and processor performance on ZFS filesystems. Only disable this setting when necessary.

Setting	Description
Enable Fast Clone	Fast Clone enables QES to create copies of files faster. It also saves storage space by modifying file metadata, allowing original and copied files to share the same data blocks. **Important** • To enable this setting, **Thin provisioning** must be selected. • Fast Clone only works when the copied file is created in the LUN containing the original file. • Fast Clone does not improve the speed of snapshot restoration operations such as restoring files from a snapshot, snapshot revert, and snapshot clone.
Encryption	QES encrypts the LUN using 256-bit AES encryption. You must specify an encryption password. • Valid characters: All alphanumeric and special characters except spaces • Length: 8 to 16 characters You can also save a copy of the encryption key on the NAS.

17. Click **Next**, and then **Next** again.
18. Click **Finish**.

QES creates the LUN and the target.

Editing iSCSI Target Settings

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.
2. Select an iSCSI target.
3. Click **Action**, and then select **Modify**.
   The **Modify iSCSI Target** window opens.
4. Modify any of the following settings.

Setting	Description
Target Alias	An alias enables you to identify the target more easily on the initiator. • Length: 1 to 32 characters • Valid characters: 0 to 9, a to z, A to Z, underscore (_), hyphen (-), space ( )

Setting	Description
CRC/ Checksum	Initiators and targets communicate over TCP connections using iSCSI protocol data units (PDU). The sending device can send a checksum with each PDU. The receiving device uses this checksum to verify the integrity of the PDU, which is useful in unreliable network environments. There are two checksum types, which can be enabled separately. • Data Digest: The checksum can be used to verify the data portion of the PDU. • Header Digest: The checksum can be used to verify the header portion of the PDU.

Use CHAP authenti-cation	An initiator must authenticate with the target using the specified username and password. This provides security, as iSCSI initiators do not require a NAS username or password.
	• Username
	  • Length: 1 to 128 characters
	  • Valid Characters: 0 to 9, a to z, A to Z
	• Password
	  • Length: 12 to 16 characters
	  • Valid characters: 0 to 9, a to z, A to Z

Mutual CHAP	Both the initiator and the target must authenticate with each other for additional security. First, the initiator authenticates with the target using the CHAP authentication username and password. Next, the target authen-ticates with the initiator using the mutual CHAP username and password.
	• Username
	  • Length: 1 to 128 characters
	  • Valid characters: 0 to 9, a to z, A to Z, colon (:) , period (.) , hyphen (-)
	• Password
	  • Length: 12 to 16 characters
	  • Valid characters: 0 to 9, a to z, A to Z, colon (:) , period (.) , hyphen (-)

Portals	Select the network interfaces that this target will use for data transmission.

5. Click **Apply**.

Managing an iSCSI Target

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.

2. Select a target.
3. Click **Action**.
4. Select an action.

Target Action	Description
Deactivate	Disable an active target and disconnect all connected iSCSI initiators.
Activate	Enable an inactive target.
Modify	Modify the target's settings.
View Connections	View the IP addresses and IQN information of iSCSI initiators connected to this target.
Delete	Disconnect all connected iSCSI initiators and delete the target.
Hosts	Select which hosts can connect to the target.

iSCSI LUN Management

Managing an iSCSI LUN

Important
Most of these actions will be unavailable if the LUN is part of a LUN group. For details, see LUN Groups.

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.
2. Select a LUN.

Tip
Double-click a target to see all mapped LUNs.

3. Click **Action**.
4. Select an action.

LUN Action	LUN Location	Description
Disable	iSCSI Target List	Disable the LUN and disconnect all connected initiators.
Enable	iSCSI Target List	Enable a disabled LUN.

LUN Action	LUN Location	Description
Un-map	iSCSI Target List	Unmap a disabled LUN from its target. QES moves the LUN to the **Un-Mapped iSCSI LUN** list.
Modify	iSCSI Target List Un-Mapped iSCSI LUN List	Open the **Modify an iSCSI LUN** window.
Map	Un-Mapped iSCSI LUN List	Map the LUN to a target.
Delete	Un-Mapped iSCSI LUN List	Delete the LUN and all data stored on it.

Changing the Target of an iSCSI LUN

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.
2. Select a mapped iSCSI LUN.

   Tip
   Double-click an iSCSI target to view all of its mapped LUNs.

3. Click **Action**, and then select **Disable**.
   A confirmation message appears.
4. Click **OK.**
   QES disables the LUN.
5. Click **Action**, and then select **Un-map**.
   QES unmaps the LUN from its target and then moves it to the **Un-Mapped iSCSI LUN List**.
6. Select the unmapped LUN.
7. Click **Action**, and then select **Map**.
   The **Map LUN to Target** window opens.
8. Select a target.
9. Click **Apply**.

QES maps the LUN to the new target.

Expanding an iSCSI LUN

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.
2. Select a LUN.
3. Click **Action** and then select **Modify**.
   The **Modify an iSCSI LUN** window opens.

4. Specify the new LUN capacity.

   Important
   The new capacity must be higher than the current capacity of the LUN.

5. Click **Apply**.

iSCSI Access Control List

The iSCSI access control list (ACL) allows you to configure a LUN masking policy for each connected iSCSI initiator. A LUN masking policy determines which LUNs the initiator is able to see and access. If no policy is specified for an iSCSI initiator, then QES applies the default policy to it.

Tip

- The default policy gives all iSCSI initiators full read/write access to all LUNs.
- You can edit the default policy so that all LUNs are either read-only or not visible to all iSCSI initiators, except for initiators with specific permissions from a policy.

Adding an iSCSI LUN Masking Policy

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.
2. Click **iSCSI ACL**.
   The **iSCSI ACL** window opens.
3. Click **Add a Policy**.
   The **Add a Policy** window opens.
4. Specify the policy name.
   The name must consist of 1 to 32 characters from any of the following groups:
   - Letters: a-z, A-Z
   - Numbers: 0-9
   - Special characters: Hyphen (-), space ( ), underscore (_)
5. Specify the initiator IQN.
6. Configure the access permissions for each LUN.

Permission	Description
Read Only	The iSCSI initiator can read data on the LUN, but cannot write, modify, or delete data.
Read/Write	The iSCSI initiator can read, write, modify, and delete data on the LUN.
Deny Access	The LUN is invisible to the iSCSI initiator.

> **Tip**
> Click the values in the columns to change the permissions.

7. Click **Apply**.

Editing an iSCSI LUN Masking Policy

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.
2. Click **iSCSI ACL**.
   The **iSCSI ACL** window opens.
3. Select a policy.
4. Click **Edit**.
   The **Modifiy a Policy** window opens.
5. Optional: Edit the policy name.
   The name must consist of 1 to 32 characters from any of the following groups:
   - Letters: a-z, A-Z
   - Numbers: 0-9
   - Special characters: Hyphen (-), space ( ), underscore (_)
6. Optional: Configure the access permissions for each LUN.

Permission	Description
Read Only	The iSCSI initiator can read data on the LUN, but cannot write, modify, or delete data.
Read/Write	The iSCSI initiator can read, write, modify, and delete data on the LUN.
Deny Access	The LUN is invisible to the iSCSI initiator.

> **Tip**
> Click the values in the columns to change the permissions.

7. Click **Apply**.

Deleting an iSCSI LUN Masking Policy

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.
2. Click **iSCSI ACL**.
   The **iSCSI ACL** window opens.
3. Select a policy.

4. Click **Delete**.
   A confirmation message appears.
5. Click **OK**.

iSCSI Target Authorization

Each iSCSI target can be configured either to allow connections from all iSCSI initiators, or to only allow connections from a list of authorized initiators.

> **Important**
> By default, iSCSI target authorization is disabled.

Configuring an iSCSI Target's Authorized Initiators List

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.
2. Select an iSCSI target.
3. Click **Action**, and then select **Modify**.
   The **Modify an iSCSI Target** window opens.
4. Click **Initiators**.
5. Select **Allow connections from the list only**.
6. Optional: Add one or more iSCSI initiators to the authorized iSCSI initiators list.
   a. Click **Add**.
   b. Specify the initiator IQN.
   c. Click **Confirm**.
   d. Repeat the previous steps for each additional iSCSI initiator that you want to add.
7. Optional: Delete one or more iSCSI initiators from the authorized iSCSI initiators list.
   a. Select an initiator IQN.
   b. Click **Delete**.
   c. Repeat the previous steps for each additional iSCSI initiator that you want to delete.
8. Click **Apply**.

Enabling iSCSI Target Authorization

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.
2. Select an iSCSI target.
3. Click **Action**, and then select **Modify**.
   The **Modify an iSCSI Target** window opens.

4. Click **Initiators**.
5. Select **Allow connections from the list only**.
6. Add one or more iSCSI initiators to the authorized iSCSI initiators list.
   a. Click **Add**.
   b. Specify the initiator IQN.
   c. Click **Confirm**.
7. Repeat the previous step for each additional iSCSI initiator that you want to add.
8. Click **Apply**.

Disabling iSCSI Target Authorization

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.
2. Select an iSCSI target.
3. Click **Action**, and then select **Modify**.
   The **Modify an iSCSI Target** window opens.
4. Click **Initiators**.
5. Select **Allow all connections**.
6. Click **Apply**.

iSCSI Target Access

For information on connecting to QES iSCSI targets from different operating systems, go to https://www.qnap.com/en/how-to/tutorial/storage-management.

QNAP Snapshot Agent

QNAP Snapshot Agent enables QES to take application-consistent snapshots of iSCSI and Fibre Channel LUNs on VMware or Microsoft servers. Application-consistent snapshots record the state of running applications, virtual machines, and data. When QES takes a LUN snapshot, QNAP Snapshot Agent triggers the following actions:

- Windows: The server flushes data in memory, logs, and pending I/O transactions to the LUN before the snapshot is created.
- VMware: The server takes a virtual machine snapshot.

Tip
To download QNAP Snapshot Agent, go to https://www.qnap.com/utilities and then click **Enterprise**.

FC Snapshot Agent Server List

To view a list of all FC clients that are using QNAP Snapshot Agent with this NAS, go to **Storage Manager** > **iSCSI & Fibre Channel** > **Fibre Channel** > **FC Storage** . Click **Snapshot**, and then select **Snapshot Agent**.

Tip

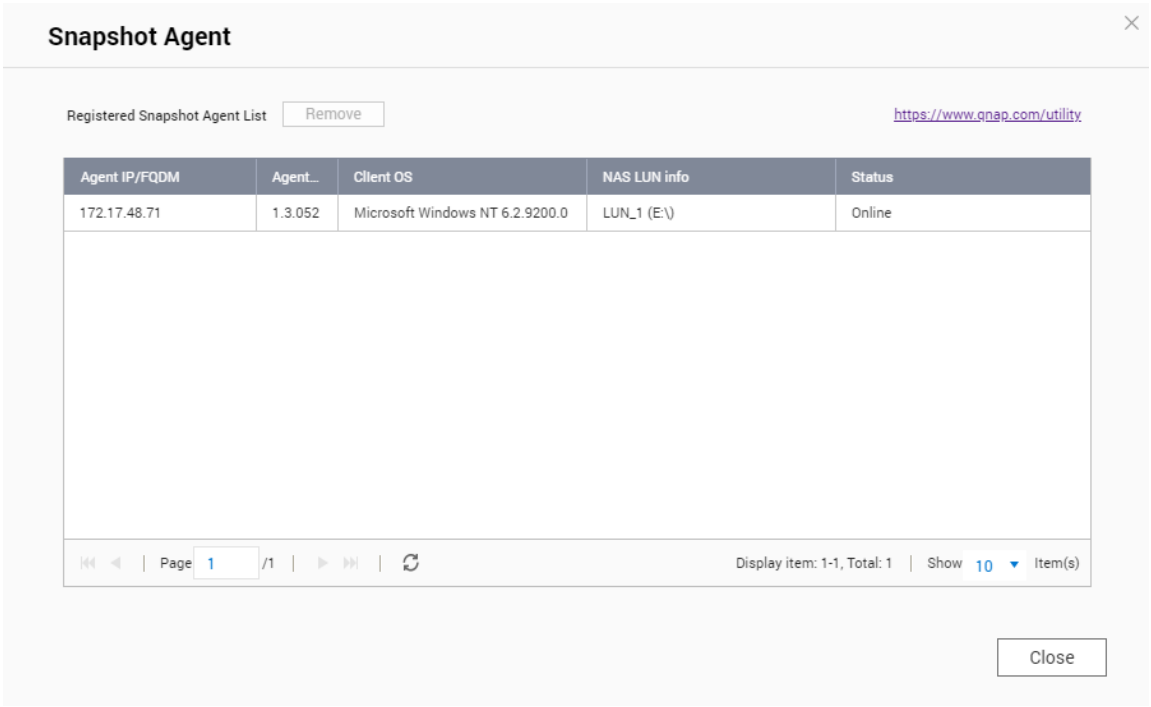
To unregister an FC client, select the client in the list and then click **Remove**.

iSCSI Snapshot Agent Server List

To view a list of all iSCSI initiators that are using QNAP Snapshot Agent with this NAS, go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage** . Click **Snapshot**, and then select **Snapshot Agent**.

Tip

To unregister an iSCSI initiator, select it in the list and then click **Remove**.



Fibre Channel

Fibre Channel enables computers, servers, other NAS devices, and virtual machines to access NAS storage in the form of LUNs over a Fibre Channel network. Hosts can partition, format, and use the LUNs as if they were local disks.

Fibre Channel Ports

You can view and configure Fibre Channel ports and port groups on the NAS by going to **Storage Manager** > **iSCSI & Fibre Channel** > **Fibre Channel** > **FC Ports**.

Fibre Channel Port Groups

A Fibre Channel port group is a group of one or more Fibre Channel ports. Fibre Channel port groups help you organize and manage LUN mappings more easily. When a LUN is mapped to a Fibre Channel port group, QES automatically maps the LUN to every Fibre Channel port in the group.

Important

- Each Fibre Channel port can be in one or more Fibre Channel port groups.
- Each LUN can only be mapped to one Fibre Chanel group.
- There is a default port group that contains all Fibre Channel ports.

Creating a Fibre Channel Port Group

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **Fibre Channel** > **FC Ports**.
2. Click **Create Port Group**.
   The **Create Port Group** window opens.
3. Specify a group name.
   Name requirements:
   - Length: 1–20 characters
   - Valid characters: A–Z, a–z, 0–9
4. Select one or more Fibre Channel ports.
5. Click **Create**.

Mapping a LUN to a Fibre Channel Port Group

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **Fibre Channel** > **FC Storage**.
2. Select a LUN.
3. Click **Action**, and then select **Edit LUN Mapping**.
   The **Edit LUN Mapping** window opens.
4. Select **Map to FC port group**.
5. Select a Fibre Channel port group.

   Tip
   The default group contains all Fibre Channel ports.

6. Choose whether you want to configure LUN masking.

Option	Description
Enable LUN and do not configure LUN masking	Do not configure LUN masking. Any initiator that is able to connect to a Fibre Channel port in the port group will be able to see the LUN.
Keep LUN disabled and configure LUN masking in the next step	Configure LUN masking. You can restrict which initiators can see the LUN.

7. Click **OK**.
8. Optional: Configure LUN masking.
   a. Add one or more initiator WWPNs to the LUN's authorized initiators list.

Method	Steps
Add from WWPN list	1. Select one or more initiator WWPNs in the WWPN list. 2. Click **Add**.
Add WWPNs as text	1. Specify one WWPN per line using any of the following formats: • `XXXXXXXXXXXXXXXX` • `XX:XX:XX:XX:XX:XX:XX:XX` 2. Click **Add**.

   b. Optional: Select **Add unknown WWPNs to the FC WWPN Aliases List**.
   When selected, QES will add any unknown WWPNs to the list of known aliases. To view the list, go to **Storage Manager** > **iSCSI & Fibre Channel** > **Fibre Channel** > **FC WWPN Aliases**.
   c. Optional: Select **Enable LUN**.
   If selected, QES will enable the LUN after mapping it to the target.
   d. Click **OK**.

Dual Controller NAS FC Port Groups

On dual controller NAS devices, QES creates the same FC port groups on storage controllers, for backup and redundancy.

Important

- Both storage controllers should have the same FC adapter.
- If the FC adapters in the storage controllers are different models, then QES might not be able to create a backup FC port group.
- If only one storage controller has an FC adapter, then clients have a higher chance of losing LUN access due to network connection issues.
- If the FC adapters have different port speeds, then the FC transmission speed on both adapters is reduced to the lowest FC port performance.

Configuring Fibre Channel Port Binding

Port binding is a Fibre Channel security method that enables you to restrict which initiator WWPNs are allowed to connect through a Fibre Channel port. It is similar to iSCSI target authorization.

Tip
By default, port binding is disabled on all Fibre Channel ports.

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **Fibre Channel** > **FC Ports**.
2. Select a Fibre Channel port.
3. Click **Action**, and then select **Edit Port Binding**.
   The **Fibre Channel Port Binding** window opens.
4. Add one or more initiator WWPNs to the LUN's authorized initiators list.

Method	Steps
Add from WWPN list	**a.** Select one or more initiator WWPNs in the WWPN list. **b.** Click **Add**.
Add WWPNs as text	**a.** Specify one WWPN per line using any of the following formats: • `XXXXXXXXXXXXXXXX` • `XX:XX:XX:XX:XX:XX:XX:XX` **b.** Click **Add**.

5. Optional: Select **Add unknown WWPNs to the FC WWPN Aliases List**.
   When selected, QES will add any unknown WWPNs to the list of known aliases. To view the list, go to **Storage Manager** > **iSCSI & Fibre Channel** > **Fibre Channel** > **FC WWPN Aliases**.
6. Click **OK**.

Fibre Channel Port Actions

You can perform various actions on Fibre Channel ports by going to **Storage Manager** > **iSCSI & Fibre Channel** > **Fibre Channel** > **FC Ports**. Select a port and then click **Action** to select the desired action.

Action	Description
Edit Alias	Edit the alias for the Fibre Channel port. The alias must consist of 1 to 20 characters from any of the following groups: • Letters: A-Z, a-z • Numbers: 0-9 • Special characters: Hyphen (-), underscore (_)
View initiators	View a list of all Fibre Channel initiators currently logged into the port.
Edit port binding	Modify the port binding for the port. Port binding allows you to restrict which initiators are allowed to connect to the port. For more information, see Configuring Fibre Channel Port Binding.

Fibre Channel Port Status

You can view Fibre Channel port statuses by going to **Storage Manager** > **iSCSI & Fibre Channel** > **Fibre Channel** > **FC Ports**.

Status	Description
Connected	The port has an active network connection.
Disconnected	The port does not have an active network connection.

Fibre Channel Storage

You can manage and monitor Fibre Channel LUNs by going to **Storage Manager** > **iSCSI & Fibre Channel** > **Fibre Channel** > **FC Storage**.

Configuring Fibre Channel LUN Masking

LUN masking is a security feature that enables you to make a LUN visible to some Fibre Channel initiators and invisible to other initiators.

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **Fibre Channel** > **FC Storage**.

2. Select a LUN.

   Important
   The LUN must be disabled.

3. Click **LUN Masking**.
   The **LUN Masking** window opens.

4. Add one or more initiator WWPNs to the LUN's authorized initiators list.

Method	Steps
Add from WWPN list	**a.** Select one or more initiator WWPNs in the WWPN list. **b.** Click **Add**.
Add WWPNs as text	**a.** Specify one WWPN per line using any of the following formats: • `XXXXXXXXXXXXXXXX` • `XX:XX:XX:XX:XX:XX:XX:XX` **b.** Click **Add**.

5. Optional: Select **Add unknown WWPNs to the FC WWPN Aliases List**.
   When selected, QES will add any unknown WWPNs to the list of known aliases. To view the list, go to **Storage Manager** > **iSCSI & Fibre Channel** > **Fibre Channel** > **FC WWPN Aliases**.

6. Select **Enable LUN**.
   If selected, QES will enable the LUN after mapping it to the target.

7. Click **OK**.

Fibre Channel LUN Actions

You can perform various actions on Fibre Channel LUNs by going to **Storage Manager** > **iSCSI & Fibre Channel** > **Fibre Channel** > **FC Storage**.

LUN Action	Description
Modify	Edit the LUN settings.
Enable	Enable the LUN if it is currently disabled.
Disable	Disable the LUN. The LUN will become inaccessible to connected iSCSI initiators.

LUN Action	Description
Delete	Delete the LUN and all data stored on it. **Important** This action is only available if the LUN is unmapped.
Edit LUN Mapping	Unmap the LUN, or map it to a different iSCSI target or Fibre Channel Port group.
Edit LUN Masking	LUN masking is an authorization method that makes a Logical Unit Number (LUN) visible to some initiators and invisible to other initiators.

Fibre Channel LUN Status

You can view Fibre Channel LUN statuses by going to **Storage Manager** > **iSCSI & Fibre Channel** > **Fibre Channel** > **FC Storage**. Expand a port group to view its LUNs.

Status	Description
Enabled	The LUN is active and visible to connected initiators.
Disabled	The LUN is inactive and invisible to connected initiators.

Fibre Channel WWPN Aliases

A WWPN (World Wide Port Name) is a unique identifier for Fibre Channel ports. A WWPN alias is a unique human-readable name for a Fibre Channel port that makes it easier to identify it.

You can view, edit, and add WWPNs and WWPN aliases by going to **iSCSI & Fibre Channel** > **Fibre Channel** > **FC WWPN Aliases**.

Adding WWPNs

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **Fibre Channel** > **FC WWPN Aliases**.
2. Click **Add**.
   The **Add WWPN** window appears.
3. Add one or more WWPNs to the list of known WWPNs using any of the following methods.

Method	Steps
Add WWPNs from logged-in Fibre Channel initiators.	Select **Add WWPNs from all logged-in FC initiators.**

Method	Steps
Add WWPNs as text	Specify one WWPN per line using any of the following formats: • `XXXXXXXXXXXXXXXX` • `XX:XX:XX:XX:XX:XX:XX:XX`

4. Click **Add**.

Configuring a WWPN Alias

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **Fibre Channel** > **FC WWPN Aliases**.
2. Locate a WWPN.
3. Under **Alias**, specify an alias for the WWPN.
   The alias must consist of 1 to 20 characters from any of the following groups:
   - Letters: A-Z, a-z
   - Numbers: 0-9
   - Special Characters: Underscore (_), hyphen (-)
4. Click **Save**.

Removing a WWPN Alias

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **Fibre Channel** > **FC WWPN Aliases**.
2. Locate a WWPN.
3. Clear the **Alias** field.
4. Click **Save**.

Exporting a List of WWPN Aliases

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **Fibre Channel** > **FC WWPN Aliases**.
2. Click **Export**.
   The file browser window opens.
3. In the file browser window, navigate to the folder where you want to save the file.
4. Specify a filename.
5. Click **Save**.

The list of WWPN aliases is saved to your local computer as a CSV file, in the format:

- Field 1: WWPN
- Field 2: Alias

```
11:00:24:5e:be:00:00:06,ja882c32p1
11:00:24:5e:be:00:00:07,ja88c32p2
11:00:00:24:5e:be:00:06,ja88c16p1
11:00:00:24:5e:be:00:07,ja882c16p2
10:00:00:10:9b:1b:cc:99,z640Emulex2
11:00:f4:e9:d4:54:89:49,z640Q32gport2
10:00:00:99:99:99:99:87,test3
10:00:00:99:99:99:99:99,test1
10:00:00:10:9b:1b:cc:98,z640Emulex1
11:00:f4:e9:d4:54:89:48,z640Q32gport1
10:00:00:99:99:99:99:89,test2
11:00:f4:e9:d4:58:23:46,QL16c1p1
11:00:f4:e9:d4:58:23:47,QL16c1p2
11:00:f4:e9:d4:58:31:bc,QL16c2p1
11:00:f4:e9:d4:58:31:bd,QL16c2p2
```

Example CSV Output

Importing a List of WWPN Aliases

You can import a list of WWPNs and aliases from a CSV file in the following format:

- Field 1: WWPN
- Field 2: Alias

```
11:00:24:5e:be:00:00:06,ja882c32p1
11:00:24:5e:be:00:00:07,ja88c32p2
11:00:00:24:5e:be:00:06,ja88c16p1
11:00:00:24:5e:be:00:07,ja882c16p2
10:00:00:10:9b:1b:cc:99,z640Emulex2
11:00:f4:e9:d4:54:89:49,z640Q32gport2
10:00:00:99:99:99:99:87,test3
10:00:00:99:99:99:99:99,test1
10:00:00:10:9b:1b:cc:98,z640Emulex1
11:00:f4:e9:d4:54:89:48,z640Q32gport1
10:00:00:99:99:99:99:89,test2
11:00:f4:e9:d4:58:23:46,QL16c1p1
11:00:f4:e9:d4:58:23:47,QL16c1p2
11:00:f4:e9:d4:58:31:bc,QL16c2p1
11:00:f4:e9:d4:58:31:bd,QL16c2p2
```

Example CSV File

Important

- Identical aliases will be overwritten from the CSV file.
- Lines not formatted correctly will be ignored.

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **Fibre Channel** > **FC WWPN Aliases**.
2. Click **Import**.
   The file browser window opens.
3. Locate and open the CSV file.

LUN Groups

LUN groups help you to organize, manage, and back up LUNs more easily. When you perform an action on a LUN group, the action is performed on every LUN in the group. LUN groups support the following actions:

- Map
- Unmap
- Take a snapshot
- Revert
- Clone
- Back up with SnapSync

LUN Group Features and Limitations

General

- LUN groups are only supported when using iSCSI.
- A LUN group must contain at least one LUN.
- The member LUNs must all be in the same storage pool.
- Only unmapped LUNs can be added to a LUN group.
- Encrypted LUNs cannot be added to a LUN group.
- A LUN can only be in one LUN group.

iSCSI

- Mapping a LUN group to a target maps all member LUNs to the target.
- Unmapping a LUN group from a target unmaps all member LUNs from the target.
- Adding a LUN to a mapped LUN group maps it to the group's target.
- LUNs in a LUN group cannot be mapped or unmapped individually.

Snapshots

- Taking a LUN group snapshot takes a snapshot of every member LUN.
- You cannot revert, clone, or take snapshots of individual LUNs in a LUN group.

- Existing snapshots of a LUN become inaccessible after adding the LUN to a LUN group. They become accessible again after removing the LUN from the LUN group.
- If a LUN group is deleted, all snapshots taken of the group are deleted.
- When reverting or cloning a LUN group using a LUN group snapshot, the current group members must be the same as when the snapshot was taken. If the group members are different, the action will fail.
- Cloning a LUN group clones the group and all members. The cloned group will be unmapped.

Creating a LUN Group

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.
2. Select **Create** > **LUN Group**.
3. Specify a LUN group name.
   The name must contain 1 to 31 characters from any of the following groups:
   - Letters: A to Z, a to z
   - Numbers: 0 to 9
4. Select a storage pool.
5. Add LUNs to the group.

   Important
   You must add at least one LUN.
6. Click **Apply**.

QES creates the group and then adds it to the **iSCSI Target List**.

LUN Group Actions

Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**, and then select a LUN group to perform one of the following actions.

Action	Description
Map	Map a LUN group and all member LUNs to an iSCSI target.
Unmap	Unmap a LUN group and all member LUNs from its iSCSI target.
Modify	Add or remove LUN group members.
Delete	Delete an unmapped LUN group. Member LUNs are not deleted.

LUN Group Snapshots

Taking a LUN Group Snapshot

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.
2. Select a LUN group.
3. Click **Snapshot** and then select **Take a Snapshot**.
   The **Take a Snapshot** window opens.
4. Specify a name.
   The name must consist of 1 to 24 characters from the following groups:
   - Letters: A-Z, a-Z
   - Numbers: 0-9
   - Special Characters: Dash (-), period (.), underscore (_)
5. Specify a retention time.

Option	Description
Keep For	QES retains the snapshot for the specified time period.
Keep this snapshot permanently	QES retains the snapshot indefinitely. **Important** QES will still delete the snapshot when the following two conditions are met: • **Delete the oldest snapshots when a storage pool is full** is enabled at **Storage Manager** > **Global Settings**. • Storage space is low.

6. Select the LUN snapshot type.

Type	Description
Crash consistent	The snapshot records the state of the data on the LUN.

Type	Description
Application consistent	The snapshot records the state of data and applications on the LUN. The iSCSI host flushes data in memory to the LUN before QES takes a snapshot. If VMware vCenter is using the LUN, vCenter takes a virtual machine snapshot. **Important** This option is only available for VMware vCenter, or for Volume Shadow Copy Service (VSS) aware applications running on a Windows server. You must install QNAP Snapshot Agent on the iSCSI initiator.

7. Click **OK**.

QES takes the snapshot. The snapshot appears in **Snapshot Manager**.

Configuring a LUN Group Snapshot Schedule

Tip

- All LUNs in the LUN group share the same snapshot schedule.
- You can configure a separate snapshot schedule for each LUN group.

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.
2. Select a LUN group.
3. Click **Snapshot**, and then select **Snapshot Manager**.
   The **Snapshot Manager** window opens.
4. Click **Schedule**.
   The **Schedule Snapshot** window opens.
5. Select **Enable schedule**.
6. Specify how often QES will take a snapshot.
7. Select the LUN snapshot type.

Type	Description
Crash consistent	The snapshot records the state of the data on the LUN.

Type	Description
Application consistent	The snapshot records the state of data and applications on the LUN. The iSCSI host flushes data in memory to the LUN before QES takes a snapshot. If VMware vCenter is using the LUN, vCenter takes a virtual machine snapshot. **Important** This option is only available for VMware vCenter, or for Volume Shadow Copy Service (VSS) aware applications running on a Windows server. You must install QNAP Snapshot Agent on the iSCSI initiator. For details, see QNAP Snapshot Agent.

8. Specify a retention time.
   QES retains the snapshot for the specified time period. If you deselect **Keep for**, QES retains the snapshot indefinitely.
9. Click **OK**.

QES takes snapshots according to the specified schedule.

Reverting a LUN Group

Reverting a LUN group restores each LUN in the group to the state at which the snapshot was taken. Restoring data using snapshot revert is faster than restoring individual files and folders.

Important
QES automatically unmaps an iSCSI LUN before reverting it.

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.
2. Select a LUN group.
3. Select **Snapshot** > **Snapshot Manager**.
   The **Snapshot Manager** window opens.
4. Select a snapshot.
5. Click **Revert**.
   A confirmation message appears.

   Warning
   All changes made after the snapshot was taken will be deleted.
6. Click **OK**.

QES unmaps the LUN group from its iSCSI target and then reverts all member LUNs.

Cloning a LUN Group

1. Go to **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.
2. Select a LUN group.

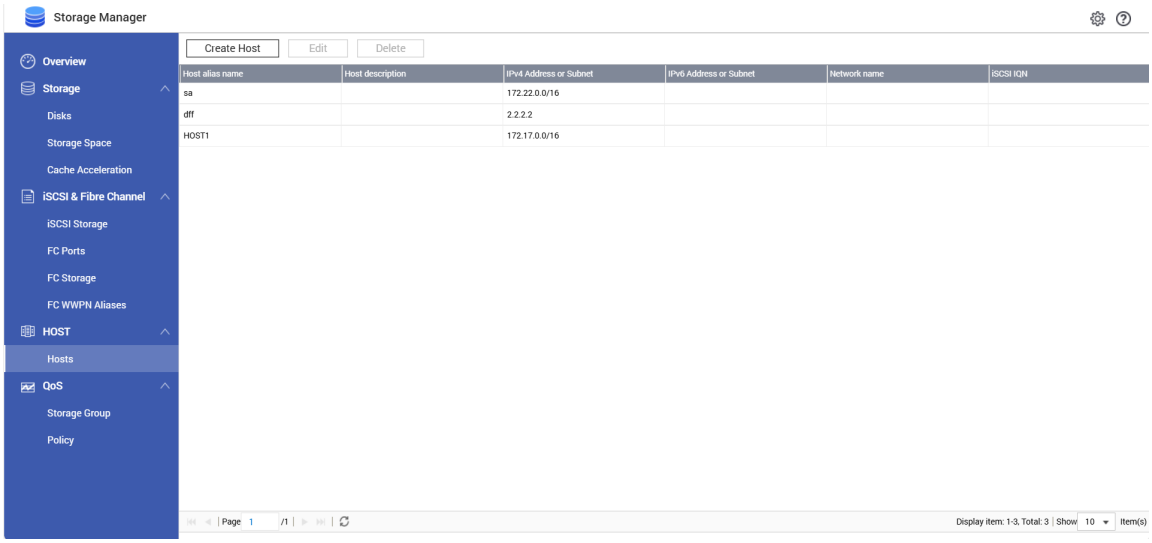
   Important
   The LUN group must have at least one snapshot.

3. Click **Snapshot**, and then select **Snapshot Manager**.
   The **Snapshot Manager** window opens.
4. Select a snapshot.
5. Click **Clone**.
   The **Clone Snapshot** window opens.
6. Specify a LUN group name.
7. Click **OK**.

QES clones the LUN group and all member LUNs, and then displays a confirmation message. The cloned LUN group and LUNs appear in **Storage Manager** > **iSCSI & Fibre Channel** > **iSCSI Storage**.

Hosts

Hosts are computers that are authorized to connect to the NAS. You can configure access permissions for shared folders and iSCSI LUNs on this screen.



Adding a Host

1. Go to **Storage Manager** > **HOST** > **Hosts**.
2. Click **Create Host**.
   The **Create Host** window opens.

3. Specify an alias.
   The alias must consist of one or more characters from the following groups:
   - Letters: A to Z, a to z
   - Numbers: 0 to 9
   - Special characters: space " ", underscore "_", period ".", hyphen "-"

   Important
   The alias cannot be "all".

4. Specify a description.
5. Specify one or more of the following identifiers.
   - IPv4 address
   - IPv4 subnet
   - IPv6 address
   - IPv6 subnet
   - Network name
   - iSCSI IQN

   Tip
   To obtain the iSCSI IQN of a host, perform the following actions.
   - Microsoft Windows: Start Microsoft iSCSI Initiator, and then click **General**.
   - VMware ESXi: Log into the vSphere client and select an ESXi host. Go to **Configuration** > **Hardware** > **Storage Adapters**, select a vmhba, and then click **Properties**.

6. Click **Apply**.

QES adds the host to the list.

QoS

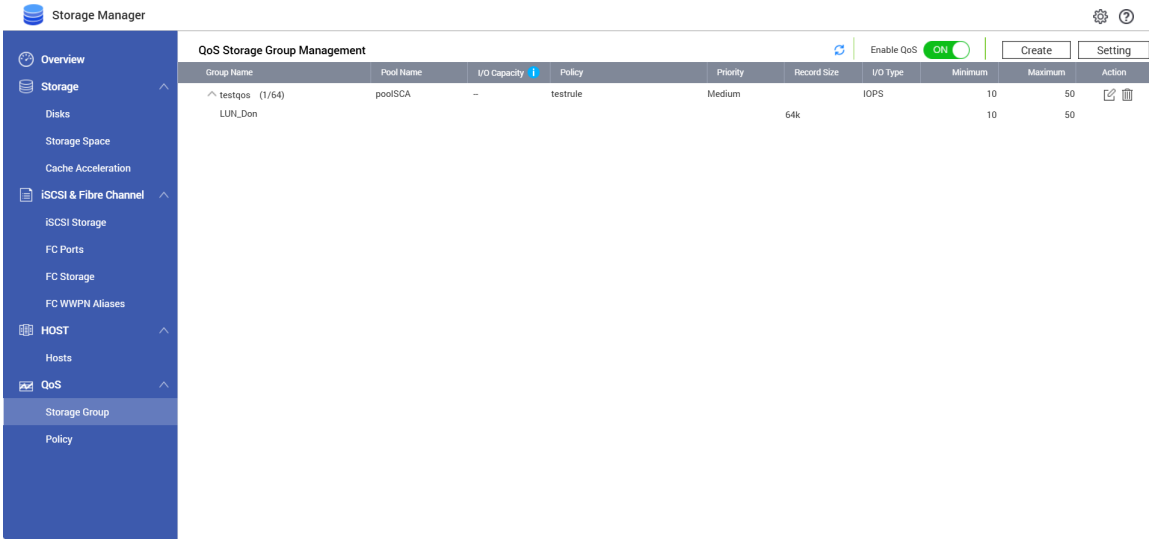
By default, all storage services running on the NAS share the same storage I/O resources. QoS (quality of service) can guarantee a minimum and maximum level of I/O resources for each LUN and shared folder, preventing resource-heavy services from negatively affecting the performance of other services.

Important
QoS does not support SnapSync.

Storage Group

On the Storage Group screen you can create and manage QoS storage groups. A storage group is a group of shared folders and LUNs with a policy applied to it. QES applies the policy to each storage group member individually.

- The maximum number of storage groups is 16.
- A storage group may contain 0 to 64 LUNs and shared folders from the same storage pool.
- A LUN or shared folder can only belong to one storage group.
- Removing a storage pool deletes all storage groups associated with the pool.



Enabling QoS

1. Go to **Main Menu** > **Storage Manager** > **QoS** > **Storage Group**.
2. Set **Enable QoS** to ON.

Creating a QoS Storage Group

1. Go to **Main Menu** > **Storage Manager** > **QoS** > **Storage Group**.
2. Click **Create**.
   The **QoS Configuration Wizard** window opens.
3. Specify a group name.
   The name must consist of 1 to 32 characters from the following groups:
   - Letters: A-Z, a-z
   - Numbers: 0-9
4. Specify a description.

5. Select a storage pool.

   Important
   You cannot mix shared folders or LUNs from different storage pools in one storage group.

6. Select a storage type.
   Choose from the following options:

   - LUN
   - Shared Folder

   Important
   You cannot add shared folders and LUNs to the same storage group.

7. Select one or more shared folders or LUNs.
8. Click **Next**.
9. Select a QoS policy to apply to the storage group.
   QES applies the policy to each storage member individually.

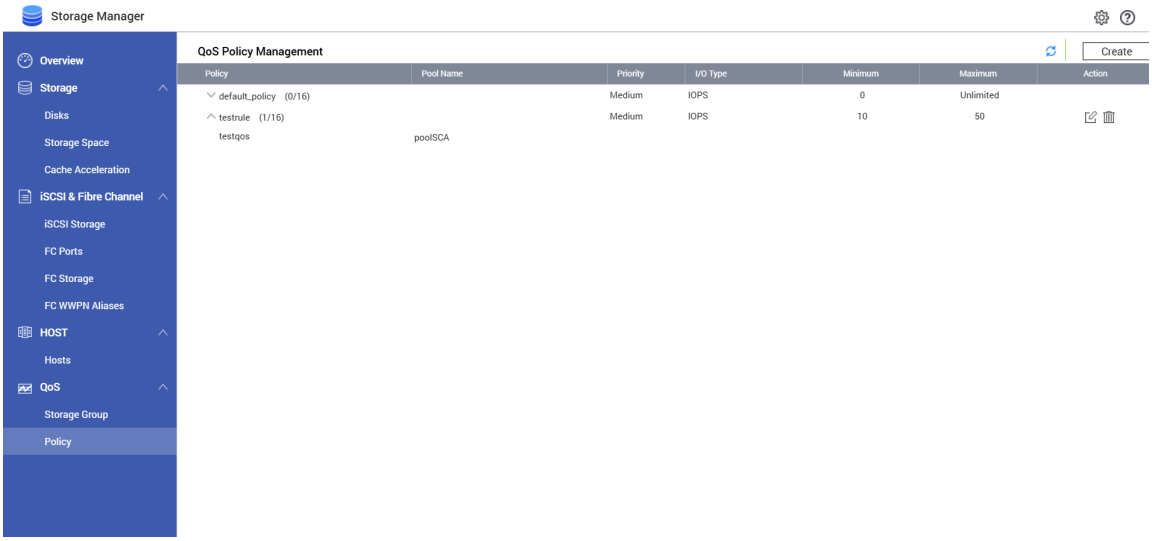
   Tip
   To create a new policy, click **Create Policy**. For details, see Creating a QoS Policy.

10. Click **Next**.
11. Review the storage group and policy information.
12. Click **Finish.**

Policy

On the Policy screen you can create and manage QoS policies. A policy is a set of I/O limits and a priority which is applied to a storage group.

- The maximum number of policies is 16.
- Each policy can be applied to a maximum of 16 storage groups.
- A policy is applied to each member of a storage group individually.
- Policies only affect shared folders and LUNs in the same storage pool.



Creating a QoS Policy

1. Go to **Storage Manager** > **QoS** > **Policy**
2. Click **Create**.
   The **Create Policy** window opens.
3. Specify a name.
   The name must consist of 1 to 32 characters from the following groups:
   - Letters: A-Z, a-z
   - Numbers: 0-9
4. Specify a description.
5. Select a priority.
   When a storage pool does not have enough I/O resources to fulfill the Maximum I/O requirements for all storage group members in the pool, QES uses the priority value to divide up I/O resources between members. Choose one of the following options:

Priority	Weight
Highest	100
High	80
Medium	60
Low	40
Lowest	20

6. Select an I/O type.
   Choose one of the following options:
   - IOPS (Input/output operations per second)
   - MB/s (Megabytes per second)
7. Optional: Specify throughput limits.

Setting	Description	Unit	Allowed Values
Maximum	The maximum amount of I/O that a storage group member is allowed to perform over an extended period of time.	IOPS or MB/s, depending on the selected I/O type	0–500,000 **Tip** Setting Maximum to 0 means I/O is unrestricted.

Setting	Description	Unit	Allowed Values
Minimum	The minimum amount of I/O required by this storage group member. QES tries to maintain the minimum I/O value for all storage group members that have a Minimum value set. When all members meet their minimum requirement, QES scales up the I/O for each member towards its Maximum value based on its priority. **Important** • Ensure that network bandwidth available to the pool is greater than or equal to than Minimum I/O capacity. • There should only be one storage pool per controller when using the Minimum setting. Having more than one storage pool may result in storage group members failing to meet the QoS minimum I/O requirements.	IOPS or MB/s, depending on the selected I/O type	0–500,000 **Important** • The value must be less than or equal to the maximum value. • Setting Minimum to 0 means there is no minimum I/O requirement.

Setting	Description	Unit	Allowed Values
Burst	The maximum amount of I/O that a storage group member is allowed to process over a short period of time. Burst requests are only processed when both of the following conditions are met: • The storage pool has sufficient spare I/O capacity. • The storage group member has had no I/O requests for a certain amount of time (see Burst Time).	IOPS or MB/s, depending on the selected I/O type	0–500,000 **Important** • The value must be greater than or equal to the maximum value. • If Maximum is set to 0, then I/O is unrestricted and burst is not used.
Burst Time	If a storage group member has no I/O requests for the specified amount of time, then when it starts I/O again it can perform burst I/O for an equal amount of time.	Seconds	0–60 **Important** Setting Burst Time to 0 disables the burst feature.

8. Click **Apply**.

Reserved Pool I/O Capacity

You can reserve a percentage of storage pool I/O capacity for shared folders and LUNs without a QoS minimum value applied to them. This ensures that all shared folders and LUNs in the pool always have sufficient I/O for normal operations.

Example: Six out of ten shared folders in a storage pool have throughput limits set to "Minimum”. If the reserved ratio is set to 20%, then 20% of the pool's total I/O capacity is reserved for the remaining four shared folders. This reserved I/O capacity is then allocated equally to the four shared folders when they request I/O. If only two folders request I/O, they will get 10% of the reserved I/O capacity each. If all four folders request I/O, they will get 5% of the reserved capacity each.

Reserving Pool I/O Capacity

1. Go to **Main Menu** > **Storage Manager** > **QoS** > **Storage Group**.
2. Click **Setting**.
   The **Reserve Pool I/O Capacity** window opens.

3. Under **Reserved Ratio**, select the percentage of I/O capacity to reserve for each storage pool.
4. Click **Apply**.

4. System Settings

Go to **Control Panel** > **System** to configure the basic settings of the NAS.

General Settings

Settings	Description
System Administration	This screen allows you to specify the server name and ports, and configure secure connection settings.
Time	Time settings affect event logs and scheduled tasks. This screen allows you to specify the time zone and format, and configure the system date and time.
Daylight Saving Time (DST)	Daylight saving time (DST) settings apply only to regions that use DST. This screen allows you to either automatically adjust the system clock or to manually configure the settings.
Codepage	This screen allows you to select the language that the NAS uses to display file and directory information.
Login Screen	This screen allows you to customize the NAS login screen.

Configuring the System Administration Settings

1. Go to **Control Panel** > **System** > **General Settings** > **System Administration**.

2. Specify the following information:

Field	User Action
Server name	Specify a NAS name that contains up to 14 characters from any of the following groups: • Letters: A to Z, a to z • Numbers: 0 to 9 **Important** The server name cannot consist of numbers only. • Dashes (-) **Important** Ensure that dashes are not preceded or followed by a space.
System port	Specify the port that you will use to access the web interface. The default port is 8080.
Service port	Specify a port that client services and utilities can use to access the NAS.
Enable secure connection (SSL)	Select this option and specify a port number to allow users to connect to the NAS using HTTPS.
Force secure connection (SSL) only	Select this option to require all users to connect to the NAS using only HTTPS.

3. Click **Apply**.

Configuring the Time Settings

Important

You must configure the system time correctly to avoid the following issues.

- When using a web browser to connect to the NAS or save a file, the displayed time of the action will be incorrect.
- Event logs do not reflect the exact time that events occurred.
- Scheduled tasks run at the wrong time.

1. Go to **Control Panel** > **System** > **General Settings** > **Time**.

2. Select the time zone.
3. Specify the date and time format.
4. Select the time setting.

Option	User Action
Manual setting	Specify the date and time.
Synchronize with an Internet time server automatically	Ensure that your NAS is connected to the Internet, and then specify the following information: • **Server**: Name of the Network Time Protocol (NTP) server Examples: time.nist.gov, time.windows.com • **Time interval**: Number of hours or days in between each time synchronization task **Tip** To manually synchronize your NAS time with the NTP server, click **Update**.

5. Click **Apply**.

Configuring the Daylight Saving Time (DST) Settings

These settings are available for NAS users in regions that use Daylight Saving Time (DST). Users outside these regions can ignore these settings.

1. Go to **Control Panel** > **System** > **General Settings** > **Daylight Saving Time**.

   Tip
   If you do not want to manually configure the DST settings, select **Adjust system clock automatically for daylight saving time**, then click **Apply**. Otherwise, perform steps 2 to 5.

2. Select **Enable customized daylight saving time table**.
3. Perform any of the following actions:

Action	Steps
Add DST data	**a.** Click **Add Daylight Saving Time Data**. **b.** Specify a time period and the number of minutes to offset. **c.** Click **Apply**.

Action	Steps
Edit DST data	**a.** Select a DST schedule from the table. **b.** Click  . **c.** Specify a time period and the number of minutes to offset. **d.** Click **Apply**.
Delete DST data	**a.** Select a DST schedule from the table. **b.** Click **Delete**. **c.** Click **OK**.

4. Select a DST schedule from the table.
5. Click **Apply**.

Configuring the Codepage Settings

All files and directories on the NAS use Unicode encoding. If your operating system or FTP client does not support Unicode, you must configure the following settings to properly view files and directories on the NAS.

For details on modifying FTP settings, see Configuring FTP Service Settings.

1. Go to **Control Panel** > **System** > **General Settings** > **Codepage**.
2. Select the language of your operating system.
3. Click **Apply**.

Configuring the Login Screen

1. Go to **Control Panel** > **System** > **General Settings** > **Login Screen**.
2. Specify the following information:

Field	User Action
Show firmware version	Select this option to display the QES firmware version.
Show the link bar	Select this option to display links to myQNAPCloud, QNAP Utility, and Feedback.
Background	Select a background image or fill color.

Field	User Action
Logo	Select a logo.
Message	Specify a message that will appear on the login screen. You can use a maximum of 120 ASCII characters.

3. Optional: Click **Preview** to view the changes.
4. Click **Apply All.**

Network

IPv4

You can configure the following settings on this screen:

- IP address
- Default gateway
- DNS
- Port trunking
- VLAN

IP Address

ES series NAS devices have one management interface and two Ethernet interfaces on each controller. The management interface allows users to access and manage the NAS, but is also used by certain network protocols such as AD, NTP, and SNMP. The Ethernet interfaces are dedicated to data transfer for iSCSI and shared folders.

> **Tip**
> You can configure services to use the management interface or Ethernet interfaces by enabling service binding. For more information, see Service Binding.

You can connect the Ethernet interfaces to different switches and configure the TCP/IP settings separately. The NAS acquires two IP addresses, which allow access from two different subnets. When using Qfinder Pro, the IP address of Ethernet 1 is displayed only in LAN 1 and the IP address of Ethernet 2 is displayed only in LAN 2.

Configuring IPv4 Settings

1. Go to **Control Panel** > **System** > **Network** > **IPv4**.
2. Identify the interface that you want to configure and then click  .
   The **TCP/IP - Property** window opens.

3. Select the network transfer speed of the interface.
   The default setting is **Auto-negotiation**, which means QES automatically detects and sets the transfer rate.

4. Configure the DHCP settings.

Setting	Description
Obtain the IP address settings automatically via DHCP	QES automatically obtains the IP address and network settings.
Use static IP address	You must specify the IP address, subnet mask, and default gateway. **Tip** In QES 1.1.3 and later, you can specify a default gateway for an interface that is part of a VLAN.

5. Enable jumbo frames.
   Jumbo Frames are Ethernet frames that are larger than 1500 bytes. They are designed to enhance Ethernet networking throughput, and to reduce CPU usage when transferring large files.
   QES uses standard Ethernet frames (1500 bytes) by default and supports the following jumbo frame sizes:

   - 4074
   - 7418
   - 9000

   Important

   - Using jumbo frames requires a network speed of 1000 Mbps or higher.
   - All connected network devices must enable jumbo frames and use the same MTU size.
   - In QES, the selected jumbo frame size applies to the size of the data payload only. It does not include overhead data, such as the Ethernet, VLAN, and IP headers. This means that actual packet size will be larger than the selected value. Ensure that the MTU size on all connected network devices is higher than the selected jumbo frame size.

6. Click **Apply**.
   A confirmation message appears.

7. Click **OK**.

Configuring Port Trunking

Port trunking enables you to combine two or more Ethernet interfaces for increased bandwidth, load balancing and fault tolerance.

1. Go to **Control Panel** > **System** > **Network** > **IPv4** > **IP Address**.
2. Click **Port Trunking**.
   The **TCP/IP - Port Trunking** window appears.
3. Select two or more network interfaces that you want to add to the trunking group.

   Important
   Ensure that the ports are connected to the same switch.

4. Select a port trunking mode.
   The default option is **Loadbalance**.

   Important
   Some port trunking modes must be supported by your network switches. Selecting an unsupported mode may affect network performance or cause the network interface to freeze.

Mode	Description	Benefits	Requires Switch Support
Failover	QES sends and receives traffic using only the master port, which is the interface that was added first to the trunking group. If the master port becomes unavailable, QES uses the next active port.	• Redundancy • Fault tolerance	No
Lacp (IEEE® 802.3ad Link Aggregation Control Protocol)	QES negotiates a set of aggregable links with the peer in to one or more Link Aggregated Groups (LAGs). Each LAG is composed of ports of the same speed, which are set to full-duplex operation. Traffic is balanced across the ports in the LAG with the greatest total speed. In the event of changes in physical connectivity, QES will quickly reconfigure the LAG. Incoming traffic is accepted by any active port.	• Redundancy • Fault tolerance • Greater bandwidth	Yes

Mode	Description	Benefits	Requires Switch Support
Loadbalance	QES distributes outgoing traffic based on the current load on each interface, which is computed relative to the interface's speed. The current interface receives incoming traffic. If that interface fails, another interface takes over its MAC address.	• Redundancy • Fault tolerance • Increased throughput	No
Roundrobin	QES sends packets in sequential order from the first active port to the last.	• General purpose load balancing • Fault tolerance	Supports static trunking. Ensure static trunking is enabled on the switch.

5. Optional: Click  to specify a hashing method.

Hashing Method	Description
L2/Mac	MAC address
L3/IP	IP address
L4/Port	Port number

6. Click **Apply**.

Virtual LANs (VLANs)

A Virtual LAN (VLAN) enables a group of network devices to communicate as if they were attached to the same network switch, even if they are located in different physical locations. You can use VLANs to increase security and flexibility, and to decrease network latency and load.

QES supports a maximum of 512 VLANs.

Adding an Interface to a VLAN

Important
To use both VLANs and port trunking, you must configure port trunking first.

1. Go to **Control Panel** > **System** > **Network** > **IPv4** > **IP Address**.

2. Click **VLAN**.
   The **VLAN** window opens.
3. Click **Add**.
   The **Add a VLAN** window opens.
4. Specify a VLAN ID.
   You must specify a VLAN ID between 1 and 4094.
5. Select an interface.
   You can select a management or data interface.
6. Click **Apply**.

The VLAN appears in the VLAN list.

DNS Server

You can configure the NAS to obtain a DNS server address automatically, or manually specify the IP address of a DNS server.

Configuring IPv4 DNS Settings

1. Go to **Control Panel** > **System** > **Network** > **IPv4** > **DNS Server**.
2. Select one of the following options.

Option	User Action
Automatically obtain the IP address using DHCP.	Select **Obtain DNS server address automatically**.
Manually specify the IP address.	a. Select **Use the following DNS server address**. b. Obtain the IP addresses of the primary and the secondary DNS servers from your network administrator or ISP. c. Specify the following information: 1. Primary DNS server 2. Secondary DNS server **Important** QNAP recommends specifying at least one DNS server to allow URL lookups.

3. Click **Apply**.

Default Gateway

You must specify a network interface for the default gateway. All outgoing network traffic passes through this interface by default.

Configuring the IPv4 Default Gateway

1. Go to **Control Panel** > **System** > **Network** > **IPv4** > **Default Gateway**.
2. Under **Use the settings from**, select an interface that QES will use as the default route.

   Important

   To use an interface as the default gateway:

   - The interface must have a gateway IP address configured. If the interface obtains its IP address using DHCP, ensure that the DHCP server assigns a gateway address.
   - The interface's link status must be `Connected`.

3. Add a static route.
   a. Click **Static Route**.
   The **Static Route** window opens.
   b. Specify an IP or subnet address.
   c. Select an interface.
   d. Click **Apply**.
   QES adds the IP address and interface to the routing table.
   e. Close the **Static Route** window.
4. Click **Apply**.

IPv6

You can configure IPv6 settings on this screen. These settings allow hosts on the same subnet to automatically acquire IPv6 addresses from the NAS. The following NAS services support IPv6:

- CIFS/SMB
- NFS
- FTP
- iSCSI
- SNMP
- SSH

Configuring IPv6 Settings

1. Go to **Control Panel** > **System** > **Network** > **IPv6** > **IP Address**.
2. Select **Enable IPv6**.
3. Click **Apply**.
4. Go to **Control Panel** > **System** > **Network** > **IPv6** > **IP Address**.
5. Identify the interface you want to configure, and then click  .
   The **IPv6 - Property** window appears.
6. Specify an IPv6 configuration.

Option	User Action
IPv6 Auto-Configuration	Select this option to automatically obtain the IPv6 settings if an IPv6-enabled router is available on the network.
Use static IP address	Select this option to use a static IP address. You must specify the following information: • IPv6 address • Prefix length **Tip** Obtain the prefix and the prefix length information from your ISP. • Default gateway IPv6 address

7. Click **Apply**.

Configuring IPv6 DNS Settings

1. Go to **Control Panel** > **System** > **Network** > **IPv6** > **DNS Server**.
2. Select one of the following options.

Option	User Action
Automatically obtain the IP address using DHCP.	Select **Obtain DNS server address automatically**.

Option	User Action
Manually specify the IP address.	**a.** Select **Use the following DNS server address**. **b.** Obtain the IP addresses of the primary and the secondary DNS servers from your network administrator or ISP. **c.** Specify the following information: **1.** Primary DNS server **2.** Secondary DNS server **Important** QNAP recommends specifying at least one DNS server to allow URL lookups.

3. Click **Apply**.

Service Binding

NAS services run on all available network interfaces by default. Service binding enables you to allow or block services from specific network interfaces to increase security. You can bind services to one or more specific wired or wireless network interfaces.

Applying changes to service binding settings does not affect the ongoing connections of online users. On their next session, these users will only be able to connect to services using the specified network interfaces.

Configuring Service Binding

1. Go to **Control Panel** > **System** > **Network** > **Service Binding**.
2. Select **Enable Service Binding**.
   QES displays the available network interfaces.
3. Select the network interfaces that you want each service to use.
4. Click **Apply**.

Tip
If QES is unable to save the settings, click **Refresh** to list the current network interfaces on the NAS and then configure the settings again.

Configuring Proxy Server Settings

1. Go to **Control Panel** > **System** > **Network** > **Proxy**.
2. Select **Use a proxy server**.

3. Specify a proxy server and port number.
   All internet requests will pass through this proxy server.
4. Optional: Select **Authentication**.
5. Optional: Specify a username and password.
6. Click **Apply**.

Security

Allow/Deny List

Go to **Control Panel** > **System** > **Security** > **Allow/Deny List** to select the security level for all your NAS connections.

Important
After modifying security level settings, the new settings do not take effect until a client has created a new connection session (disconnected then reconnected)

Security Level	Option	Description
No Security	**Allow all connections**	The NAS can connect to all IP addresses and network domains.
Low	**Deny connections from the list**	The NAS cannot connect to all IP addresses or network domains on the IP block list.
High	**Allow connections from the list only**	The NAS can only connect to the IP addresses or network domains specified on the IP allow list.

Creating an IP Block List

1. Go to **Control Panel** > **System** > **Security** > **Allow/Deny List**.
2. Select **Deny connections from the list**.
3. Click **Add**.
   The IP configuration window appears.
4. Select **IPv4** or **IPv6**.
5. Specify an IP address, netmask, or IP range.

6. Click **Create**.

> **Tip**
> To remove an IP address, netmask, or IP range, select an entry from the table, then click **Remove**.

7. Click **Apply**.

Creating an IP Allow List

1. Go to **Control Panel** > **System** > **Security** > **Allow/Deny List**.
2. Select **Allow connections from the list only**.
3. Click **Add**.
   The IP configuration window appears.
4. Select **IPv4** or **IPv6**.
5. Specify an IP address, netmask, or IP range.
6. Click **Create**.

> **Tip**
> To remove an IP address, netmask, or IP range, select an entry from the table, then click **Remove**.

7. Click **Apply**.

Network Access Protection

Network access protection enhances system security. You can block an IP for a specific period or indefinitely after a specified number of unsuccessful connection attempts.

Configuring Network Access Protection

1. Go to **Control Panel** > **System** > **Security** > **Network Access Protection**.
2. Select **Enable Network Access Protection**.
3. Select the connection methods that you want to protect.
4. Specify the following information:
   - Time period
   - Maximum number of unsuccessful login attempts
   - Amount of time the IP will be blocked
5. Click **Apply**.

Certificate & Private Key

Secure Socket Layer (SSL) is a protocol used for secure data transfers and encrypted communication between web servers and browsers. To prevent receiving alert or error messages when accessing the web interface, upload an SSL certificate from a trusted provider.

Uploading an SSL Certificate and Private Key

Warning

The NAS supports only X.509 PEM certificates and private keys. Uploading an invalid security certificate may prevent you from logging onto the NAS through SSL. To resolve the issue, you must restore the default security certificate and private key.
For details, see Restoring the Default SSL Certificate and Private Key.

1. Go to **Control Panel** > **System** > **Security** > **Certificate & Private Key**.
2. Specify an SSL certificate.

   Tip

   Click **View Sample** to view a valid SSL certificate sample.

3. Specify a private key.

   Tip

   Click **View Sample** to view a valid private key sample.

4. Click **Apply**.

Downloading the SSL Certificate and Private Key

1. Go to **Control Panel** > **System** > **Security** > **Certificate & Private Key**.
2. Click **Download Certificate**.
   The SSL certificate is downloaded.
3. Click **Download Private Key**.
   The private key is downloaded.

Restoring the Default SSL Certificate and Private Key

1. Go to **Control Panel** > **System** > **Security** > **Certificate & Private Key**.
2. Click **Restore Default Certificate & Private Key**.
   A confirmation message appears.
3. Click **OK**.
4. Click **Apply**.

Password Policy

Enabling password policy rules will force NAS users to set stronger, more secure passwords.

Configuring the Password Policy

1. Go to **Control Panel** > **System** > **Security** > **Password Policy** > **Password Strength**.
2. Select the password strength criteria.
   - A new password has to contain characters from at least three of the following classes: lowercase letters, uppercase letters, digits, and special characters.
   - No character in the new password may be repeated three (or more) times consecutively. Example: `AAA`.
   - The password must not be the same as the username, or username reversed. Example: Username: `user1`, password: `1resu`.
3. Click **Apply**.

Hardware

Reset Button

You must enable the configuration reset switch to perform a basic or advanced system reset using the NAS reset button. You can enable the configuration reset switch on the **General** screen (**Control Panel** > **System** > **Hardware** > **General**).

For details on reset options, see System Reset and Restore to Factory Default.

Buzzer

The buzzer inform you of any ongoing NAS operations or errors. You can enable this option on the **Buzzer** screen (**Control Panel** > **System** > **Hardware** > **Buzzer**).

Option	Description
System operations	The buzzer sounds when the NAS starts, shuts down, or updates the firmware.
System events	The buzzer sounds when errors or critical events occur.

Tip

You can find the full list of NAS events and their corresponding buzzer sounds in your NAS hardware user guide.

Smart Fan

Enabling the Smart Fan

1. Go to **Control Panel** > **System** > **Hardware** > **Smart Fan**.
2. Select **Enable smart fan (recommended)**.
3. Specify a smart fan setting.

Option	Description

Pre-set temperature	• The smart fan rotates at low speed when the system temperature is lower than 50°C (122°F).
	• The smart fan rotates at high speed when any of the following conditions occur.
	  • The system temperature is higher than or equal to 60°C (140°F).
	  • The CPU temperature is higher than or equal to 75°C (167°F).
	  • The hard drive temperature is higher than or equal to 52°C (125°F).

User-specified temperature	The smart fan rotates at low and high speed according to the temperature you specify.

4. Click **Apply All**.

Configuring the Fan Speed Manually

1. Go to **Control Panel** > **System** > **Hardware** > **Smart Fan**.
2. Select **Set fan rotation speed manually**.
3. Select a fan speed.
4. Click **Apply All**.

Backup Battery Unit (BBU)

You can schedule a learning cycle for the backup battery units (BBUs). A learning cycle is when a controller performs a battery calibration operation to determine the battery's condition. During this cycle, the system switches to write-through mode to protect data integrity.

In write-through mode, the NAS writes data directly to HDDs/SSDs instead of writing to the RAM first. This prevents data loss if a power outage occurs before the NAS finishes writing data. Because this process takes up memory, QNAP strongly recommends scheduling the learning cycle during off-peak hours.

Configuring the Backup Battery Unit (BBU) Settings

QNAP strongly recommends scheduling the learning cycle during off-peak hours.

1. Go to **Control Panel** > **System** > **Hardware** > **BBU**.
2. Select **Enable BBU learning schedule**.
3. Specify a learning cycle schedule.
4. Click **Apply All**.

Power

You can configure Wake-on-LAN (WOL) and specify the NAS behavior after a power outage.

Wake-on-LAN (WOL)

You can power on the NAS remotely using the Wake-on-LAN (WOL) protocol in Qfinder. This feature is enabled by default.

> **Important**
> If the power cable is disconnected when the NAS is powered off, WOL will not work until the NAS has been manually powered on.

Enabling or Disabling Wake-on-Lan (WOL)

1. Go to **Control Panel** > **System** > **Power** > **Wake-on-LAN (WOL)**.
2. Select **Enable** or **Disable**.
3. Click **Apply**.

Power Recovery

This feature allows you to configure the power on and off status of the NAS after a power outage.

Configuring the Power Recovery Settings

1. Go to **Control Panel** > **System** > **Power** > **Power Recovery**.
2. Select a power recovery setting.
   - Resume the server to the previous power-on or power-off status.
   - Turn on the server automatically.
   - The server should remain off.
3. Click **Apply**.

Notification

You can configure the NAS to send you alert messages when system events, such as warnings or errors, occur.

Email Alerts

You can configure an SMTP server so you can receive alert notifications through email.

Configuring an Email Server

1. Go to **Control Panel** > **System** > **Notification** > **Email** > **SMTP Server**.
2. Specify the following information.

Field	User Actions
Select an e-mail account	Select an email service. To use a custom SMTP server, see Configuring a Custom SMTP Server.
E-mail	Specify an email address that contains a maximum of 128 characters. This is for testing purposes.
Password	Specify the password of the email account. The password must contain a maximum of 128 characters.

3. Click **Apply**.

Configuring a Custom SMTP Server

1. Go to **Control Panel** > **System** > **Notification** > **Email** > **SMTP Server**.
2. Under **Select an e-mail account**, select **Custom**.
3. Specify the following information.

Field	User Actions
SMTP Server	Specify an SMTP server name such as `smtp.gmail.com`.
Port Number	Specify the port number for the SMTP server.
E-mail	Specify the email address that will receive QES notifications.
Username	Specify a username that contains a maximum of 128 characters. This field is optional.

Field	User Actions
Password	Specify a password that contains a maximum of 128 characters. This field is optional.
Secure connection	Select one of the following options. • **SSL**: Use SSL to secure the connection. • **TLS**: Use TSL to secure the connection. • **None**: Do not use a secure connection. **Tip** QNAP recommends enabling a secure connection if the SMTP server supports it.
Authentication	Select one of the following SMTP authentication options. • None • LOGIN • PLAIN • CRAM-MD5

4. Click **Apply**.

SMS Alerts

Configuring the SMSC server settings allows QES to send SMS messages to specified phone numbers from the NAS. You can use the default SMS service or specify a custom service provider.

Configuring SMS Alerts from Clickatell Communicator/Central

Important
Clickatell Communicator/Central is for Clickatell accounts created before November 2016.

1. Go to **Control Panel** > **System** > **Notification** > **SMS** > **SMSC Server**.
2. Under **SMS Service Provider**, select **Clickatell -Communicator/Central**.

3. Specify the following information.

Field	User Action
SMS server login name	Specify your Clickatell username. The username must contain a maximum of 32 characters.
SMS server login password	Specify your Clickatell password. The password must contain a maximum of 32 characters.
API ID	Specify your Clickatell API ID.

4. Click **Apply**.

Configuring SMS Alerts from Clickatell SMS Platform

Important
Clickatell SMS Platform is for Clickatell accounts created from November 2016 onwards.

1. Go to **Control Panel** > **System** > **Notification** > **SMS** > **SMSC Server**.
2. Specify the following information.

Field	User Action
Alias	Specify your Clickatell alias.
API Key	Specify your Clickatell API key.

3. Click **Apply**.

Configuring SMS Alerts from a Custom Service Provider

1. Go to **Control Panel** > **System** > **Notification** > **SMS** > **SMSC Server**.
2. Under **SMS Service Provider**, select **Add SMS service provider**.
3. Specify the following information.

Field	Description
SMS service provider	Specify the name of the service provider. The name must contain a maximum of 32 characters.

Field	Description
URL template text	Specify the URL template text according to the format of your SMS service provider. Use the following replaceable URL template parameters: • `@@UserName@@`: Specify the username for this connection. • `@@Password@@`: Specify the password for this connection. • `@@PhoneNumber@@`: Specify the phone number where the SMS messages are sent. This parameter is required. • `@@Text@@`: Specify the text content of the SMS message. This parameter is required. **Important** You will not be able to receive SMS messages if the template text does not match the format used by your SMS service provider.

4. Click **Apply**.

Configuring Notification Settings

1. Go to **Control Panel** > **System** > **Notification** > **Alert Notification**.
2. Configure the alert notification settings.

Alert Notification	Description
System error alert	QES sends an alert notification through email or SMS when a system error occurs. System errors include failures in updating applications or enabling NAS features.
System warning alert	QES sends an alert notification through email when the following occur. • NAS resources, such as storage space and memory, are critically low. • The hardware behaves abnormally.

3. Configure the email notification settings.
   a. Verify that an SMTP server is configured.
   For details, see Email Alerts.
   b. Specify one to two email addresses that will receive notifications.
   c. Click **Send a test E-mail**.

4. Configure the SMS notification settings.
   a. Verify that an SMSC server is configured.
      For details, see SMS Alerts.
   b. Select a country code.
   c. Specify one to two mobile phone numbers that will receive notifications.
   d. Click **Send a test SMS message**.
5. Click **Apply**.

Firmware Update

Checking for Live Updates

QNAP recommends backing up all data before updating the firmware.

Important
You cannot perform a QES firmware update if the High Availability status is `Takeover`. This prevents firmware inconsistencies between storage controllers.

1. Go to **Control Panel** > **System** > **Firmware Update** > **Live Update**.
2. Perform one of the following actions:

Action	Description
Click **Check for Live Update**.	QES immediately checks for firmware updates.
Select **Automatically check if a newer version is available when logging into the NAS web administration interface**.	QES periodically checks for firmware updates. When an update is available, QES notifies you after you log in as an administrator.

3. Click **Apply**.

Updating the Firmware Manually

QNAP recommends backing up all data before updating the firmware.

Important
You cannot perform a QES firmware update if the High Availability status is `Takeover`. This prevents firmware inconsistencies between storage controllers.

1. Download the NAS firmware.
   a. Go to http://www.qnap.com/download.

b. Read the release notes and confirm that your NAS mode supports the new firmware.

c. Download the firmware package.

d. Extract the firmware image file.

2. Go to **Control Panel** > **System** > **Firmware Update** > **Firmware Update**.
3. Click **Browse** and then select the extracted firmware image file.
4. Click **Update System**.
5. Select a restart option.

Option	Description
Automatically apply new firmware and restart the system after update	The NAS automatically installs the new firmware and restarts the system once the update is complete.
Restart the system without interrupting services	This option is only available on dual-controller ES NAS models. The NAS passes control from the primary controller to the secondary controller, and then restarts. After restarting, the NAS passes control back to the primary controller. This process takes more time but ensures that all services stay running.

6. Click **OK**.
   The firmware update may require a few minutes or longer to complete, depending on system load and storage pool utilization.

Updating the Firmware Using Qfinder Pro

QNAP recommends backing up all data before updating the firmware.

Important
You cannot perform a QES firmware update if the High Availability status is `Takeover`. This prevents firmware inconsistencies between storage controllers.

1. Download the NAS firmware.

   a. Go to http://www.qnap.com/download.

   b. Read the release notes and confirm the following:

   - The NAS model and firmware version match.
   - Updating the firmware is necessary.

   c. Ensure that the product model and firmware version are correct.

d. Download the firmware package.

e. Extract the firmware image file.

2. In Qfinder Pro, select a NAS model.
3. Go to **Tools** > **Update Firmware** .

> **Tip**
> You can also right-click the NAS model in the list, and then click **Update Firmware**.

The **Firmware Update** window appears.

4. Log on to the NAS as an administrator.
5. Click **Browse**, and then select a firmware image file.
6. Perform one of the following actions:

Action	Steps
Update a single NAS device	Select a NAS model from the list.
Update multiple NAS devices with the same model number	a. Select a NAS model from the list. b. Select **Update all the devices with the same model number within the network**.

7. Click **Start**.

Backup/Restore

Backing Up the System Settings

1. Go to **Control Panel** > **System** > **Backup/Restore** > **Backup/Restore Settings**.
2. Click **Backup**.
QES exports the system settings as a BIN file.

Restoring the System Settings

> **Warning**
> If the backup files contain users or groups that already exist on the NAS, QES overwrites the duplicate information on the NAS.

1. Go to **Control Panel** > **Sytem** > **Backup/Restore** > **Backup/Restore Settings**.
2. Select a system settings BIN file.
3. Click **Restore**.

System Reset and Restore to Factory Default

QES provides different options for resetting or restoring the NAS to its default state.

System Reset	Description	User Action

Basic system reset	This resets the following settings to the default values without deleting user data.
	• System administrator password:
	  • Before QES 2.1.1 build 20200424: `admin`
	  • QES 2.1.1 build 2020424: The NAS serial number in lowercase
	  • QES 2.1.1 build 20200515 or later: The NAS serial number in uppercase
	• TCP/IP configuration:
	  • Obtain IP address settings automatically via DHCP
	  • Disable jumbo frames
	• System port: 8080 (system service port)
	• Security level: Low (Allow all connections)
	• LCD panel password: (blank)
	• VLAN: Disabled
	• Service binding: All NAS services can run on all available network interfaces.
		Use one of the following methods:
		• Basic system reset using QES
		  a. Go to **Control Panel** > **System** > **Hardware** > **Backup/Restore** > **Restore to Factory Default**.
		  b. Click **Reset Settings**.
		• Basic system reset using the reset button
		  a. Power on the NAS.
		  b. Press and hold the reset button for 3 seconds.

System Reset	Description	User Action
Advanced system reset	This performs a basic system reset and deletes all user and user group settings. It does not delete user data.	Use one of the following methods: • Advanced system reset using QES a. Go to **Control Panel** > **System** > **Hardware** > **Backup/Restore** > **Restore to Factory Default**. b. Click **Reset System Pool**. • Advanced system reset using the reset button a. Power on the NAS. b. Press and hold the reset button for 10 seconds.

Important
Back up all data before reinitializing the NAS.

Reinitialize	Description	User Action
Reinitialize NAS	This deletes the operating system and all stored data.	1. Go to **Control Panel** > **System** > **Backup/Restore** > **Restore to Factory Default**. 2. Click **Reinitialize NAS**.
Reinitialize QTS	This deletes all system settings and stored data, and then installs QTS. Only TES and TDS NAS models support this feature.	1. Go to **Control Panel** > **System** > **Backup/Restore** > **Restore to Factory Default**. 2. Click **Reinitialize QTS**. A confirmation message appears. 3. Click **OK**.
Reinitialize QES	This deletes all system settings and stored data, and then installs QES. Only TES and TDS NAS models support this feature.	1. Go to **Control Panel** > **System** > **Backup/Restore** > **Restore to Factory Default**. 2. Click **Reinitialize QES**. A confirmation message appears. 3. Click **OK**.

External Device

Uninterruptible Power Supply (UPS)

The NAS connects to uninterruptible power supply (UPS) devices that can protect your NAS from abnormal system shutdowns resulting from power disruptions.

Configuring an SNMP UPS

1. Ensure that the NAS is connected to the same network as the UPS.
2. Go to **Control Panel** > **System** > **External Device** > **UPS**.
3. Select **Enable UPS Support**.
4. Specify the IP address of the network UPS server.
5. Select a power failure option for the NAS.

Option	Description
Turn off the server after the AC power fails	The NAS shuts down after a specified time and then remains powered off.
Enter auto-protection mode after the AC power fails	The NAS stops all running services after a specified time and then resumes the stopped services after power is restored.

6. Specify the number of minutes the NAS should wait before performing the action that you selected.

> **Important**
> If the remaining UPS power during an outage is less than 15%, the NAS performs the selected action after 30 seconds regardless of the specified waiting time.

7. Click **Apply All**.

NAS Behavior During a Power Outage

The following table describes the possible scenarios during a power outage and the corresponding NAS behavior.

Phase	Scenario	NAS Behavior
Phase 1: From the start of the power outage until the end of the specified waiting time	The power outage starts.	The NAS detects the remaining UPS power.

Phase	Scenario	NAS Behavior
Phase 1: From the start of the power outage until the end of the specified waiting time	The UPS power is more than 15%.	Depending on your UPS settings, the NAS powers off or switches to auto-protection mode after the specified waiting time lapses.
	The UPS power is less than 15%.	After 30 seconds, the NAS automatically powers off or switches to auto-protection mode regardless of the specified waiting time.
	The power resumes.	The NAS remains operational.
Phase 2: From the end of your specified waiting time to when the UPS runs out of power	The power does not resume and the NAS is in auto-protection mode.	The NAS stops all running services. All shared folders and iSCSI LUNs become inaccessible.
	The power does not resume and the NAS is powered off.	The NAS remains powered off.
	The power resumes and the NAS is in auto-protection mode.	The NAS reboots and resumes its previous state.
	The power resumes and the NAS is powered off.	The NAS remains powered off.
Phase 3: From when the UPS device runs out power to when the power is restored	The power does not resume and the NAS is in auto-protection mode.	The NAS powers off.
	The power does not resume and the NAS is powered off.	The NAS remains powered off.

Phase	Scenario	NAS Behavior
Phase 3: From when the UPS device runs out power to when the power is restored	The power resumes.	The NAS applies the specified power recovery settings. For details, see Configuring the Power Recovery Settings.

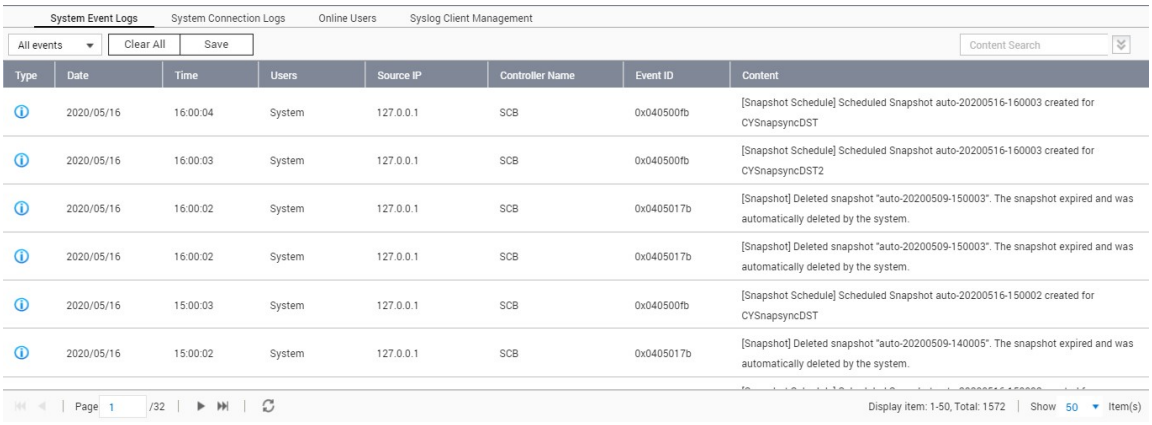
System Status

You can check the status of your NAS on the System Status screen (**Control Panel** > **System** > **System Status**).

Section	Description
Controller Information	This section displays the information (such as CPU and memory usage, storage pool usage, shared folders and LUNs) for each controller.
System Information	This section displays the system information (such as the server name, memory, firmware and system up time) for each controller.
Network Status	This section displays the current network settings and statistics for each network interface.
System Service	This section displays the current status of system services, such as Microsoft networking, NFS, FTP, and File Station.
Hardware Information	This section displays the basic NAS hardware information, such as CPU usage, memory, cache, and system fan speed.
Resource Monitor	This section displays the CPU usage, disk usage, and bandwidth transfer statistics of the NAS.

System Logs

You can view logs on the system logs screen at **Control Panel** > **System** > **System Logs**.



System Event Logs

QES stores a maximum of 10,000 event logs, including warnings, errors, and information messages. You can perform the following actions:

- Delete a single entry: Right-click on the log message.
- Delete all logs: Click **Clear All**.

System Connection Logs

QES can log the following events:

Protocol	Events
FTP, HTTP, HTTPS, iSCSI, and SMB	• Logging on and off • Accessing, creating, deleting, moving, and renaming files and folders
SSH	Logging on and off

You can perform the following actions:

Action	Steps
Record connection logs	Click **Start Logging**. **Note** Logging connections may affect file transfer speeds.
Select protocols to log	1. Click **Options**. 2. Select one or more protocols.

Action	Steps
Archive connection logs when the number of logs reaches 10,000.	1. Click **Options**. 2. Select **When the number of log entries reaches 10,000, archive the connection logs.** 3. Select a folder for storing log files.

Online Users

This screen shows the users that are currently connected to the NAS, ordered by network service. You can right-click on a log to disconnect the IP connection and block the IP.

Syslog Client Management

Syslog is a standard for forwarding log messages on an IP network. You must enable this service to store event and connection logs on a remote syslog server.

You can also export logs to a CSV file. The following tables contain the supported connection types and actions with their respective codes.

Connection Type Codes

Code	Connection Type
0	UNKNOWN
1	SAMBA
2	FTP
3	HTTP
4	NFS
5	AFP
6	TELNET
7	SSH
8	ISCSI

Action Codes

Code	Action
0	UNKNOWN
1	DEL
2	READ
3	WRITE
4	OPEN
5	MKDIR
6	NFSMOUNT_SUCC
7	NFSMOUNT_FAIL
8	RENAME
9	LOGIN_FAIL
10	LOGIN_SUCC
11	LOGOUT
12	NFSUMOUNT
13	COPY
14	MOVE
15	ADD

5. Privilege

Go to **Control Panel** > **Privilege** to configure the privilege settings, disk quotas, and domain security on the NAS.

Users

Default User Accounts

User Account	Description
admin	This account can configure settings, create users, and install applications. You cannot delete this account.
guest	Users without dedicated accounts can use this account to view and modify files. You cannot delete this account. **Note** For security reasons, the guest account is disabled by default.

User Creation

Creating a Local User

1. Go to **Control Panel** > **Privilege** > **Users**.
2. Click **Create** > **Create a User**.
   The **Create a User** window appears.
3. Specify the following information:

Field	Actions
Profile photo	Upload a profile photo for the user.
User Description (optional)	Specify a user description that contains a maximum of 50 characters.

Field	Actions
Username	Specify a username between 1 and 32 characters that contains any of the following: • Letters: A to Z • Numbers: 0 to 9 • Multi-byte characters: Chinese, Japanese, Korean, and Russian • Special characters: . - _ ~ ! @ # $ % ^ & ( ) { } **Note** Usernames are not case-sensitive.
Password	Specify a password that contains 5 to 64 ASCII characters.
Phone number	Specify the user's phone number. The information is for your reference and is not used by QES.
Email (optional)	Specify an email address that will receive notifications from QES.
Send a notification mail to the newly created user	When selected, QES sends a message that contains the following information to the specified email address: • Username and password • URLs for connecting to the NAS

4. Optional: Specify the user groups the user belongs to.
   For details, see Editing a User's Groups.
5. Optional: Specify the user's shared folder permissions.
   For details, see Editing a User's Shared Folder Permissions.
6. Optional: Specify the user's application privileges.
   For details, see Editing Application Privileges.
7. Optional: Specify a custom UID.
   Typically, QES assigns UIDs automatically. However, sometimes you might need to set the UID manually, such as when some NFS clients require that local and NAS users with the same name also use the same UID.
   a. Under **Advanced Options**, click **Edit**.
   b. Specify a UID for the user.
      - The UID must be between 2,001 and 65,000.
      - QES warns you if the specified UID is already in use.

8. Click **Create**.
   QES creates the local user account and adds it to the displayed list of users.

Creating Multiple Users

1. Go to **Control Panel** > **Privilege** > **Users**.
2. Click **Create** > **Create Multiple Users**.
   The **Multiple Users Creation Wizard** appears.
3. Click **Next**.
4. Specify the following information:

Field	Description
User Name Prefix	Specify a user name that will be used as a prefix for all users. Example: `test`
User Name Start Number	Specify a start number. Example: `1` **Note** QES removes leading zeros in starting numbers. For example, `001` becomes `1`.
Number of Users	Specify the number of users. Example: `5`

Note
The username format is `[username prefix][user number]`. The specified start number and number of users determine the user number.
Using the examples, the users created will have the following usernames: `test1`, `test2`, `test3`, `test4`, and `test5`.

5. Specify a password for all users that will be created in this batch.
6. Click **Next**.
   QES creates the user accounts and adds them to the displayed user list.
7. Click **Finish**.
   The **Multiple Users Creation Wizard** closes.

User Account Lists

The NAS supports importing user accounts from TXT, CSV, and BIN files. The files contain user account information including usernames, passwords, user groups, and quota settings.

File Format	Description
TXT	Create user account lists using a text editor. For details, see Creating a TXT User Account List.
CSV	Create user account lists using Microsoft Excel. For details, see Creating a CSV User Account List.
BIN	QNAP NAS devices can export user account information, including quota settings, to BIN files. For details, see Exporting Users and Quota.

Creating a TXT User Account List

1. Create a new file in a text editor.
2. Specify user information in the following format:
   `Username,Password,Quota (MB),Group Name`

   Important

   - Separate values using commas.
   - Specify information for only one user in each line.
     Example:
     ```
     John,s8fk4b,30,Sales
     Jane,9fjwbx,40,Marketing
     Mary,f9xn3ns,10,RD
     ```
3. Save the file.

   Important
   If the list contains multi-byte characters, save the file with UTF-8 encoding.

Creating a CSV User Account List

1. Create a new workbook in Microsoft Excel.
2. Specify user information in the following format:
   - column A: `Username`
   - column B: `Password`
   - column C: `Quota (MB)`
   - column D: `Group name`

Important

Specify information for only one user in each row.
Example:

	A	B	C	D
1	John	s8fk4b	30	Sales
2	Jane	9fjwbx	40	Marketing
3	Mary	f9xn3ns	10	RD

3. Save the workbook as a CSV file.

Important

If the list contains multi-byte characters, open the file using a text editor and then save with UTF-8 encoding.

Importing Users

1. Go to **Control Panel** > **Privilege** > **Users**.
2. Click **Create** > **Import/Export Users**.
   The **Import/Export Users** window appears.
3. Select **Import user and user group settings**.
4. Click **Browse**, and then select the file that contains the user account list.

   Important

   Ensure that you are importing a valid QES user account list file to avoid parsing errors.

   For details, see User Account Lists.
5. Click **Next**.
   QES imports the user account list.
6. Click **Finish**.
   QES displays the imported user account information.

Exporting Users

1. Go to **Control Panel** > **Privilege** > **Users**.
2. Click **Create** > **Import/Export Users**.
   The **Import/Export Users** window appears.
3. Select **Export user and user group settings**.

4. Click **Next**.
   QES exports the user account list to a BIN file on your computer.

   Tip
   You can use this file to import users to another NAS running QES.

User Management

Changing User Passwords

1. Go to **Control Panel** > **Privilege** > **Users**.
2. Identify a user.
3. Under **Action**, click  .
   The **Change Password** window appears.
4. Specify a password that contains 5 to 64 ASCII characters.
5. Specify the password again.
6. Click **Apply**.
   QES saves the new password.

Editing a User Account

1. Go to **Control Panel** > **Privilege** > **Users**.
2. Identify a user.
3. Under **Action**, click  .
   The **Edit Account Profile** window appears.
4. Modify any of the following information.

Field	Actions
Email (optional)	Specify the user's email address.
Phone number	Specify the user's phone number. The information is for your reference and is not used by QES.
Description (optional)	Specify a user description that contains a maximum of 50 characters.

Field	Actions
Custom UID	Specify a custom UID. Typically, QES assigns UIDs automatically. However, sometimes you might need to set the UID manually, such as when some NFS clients require that local and NAS users with the same name also use the same UID. **Note** • The UID must be between 2,001 and 65,000. • QES warns you if the specified UID is already in use.
Disable this account	Select this option to disable the user account. You can either select to disable the account **Now** or specify an **Expiry Date**.
Quota	Specify a quota limit for the user. **Note** This option is only available when user quotas are enabled. For more details, see Configuring Quota Settings.

5. Click **OK**.
   QES saves the changes.

Editing a User's Groups

1. Go to **Control Panel** > **Privilege** > **Users**.
2. Identify a user.
3. Under **Action**, click  .
   The **Edit User's Groups** window appears.
4. Select or deselect user groups.
   For details, see User Groups.
5. Click **Apply**.
   QES saves the changes.

Editing Application Privileges

1. Go to **Control Panel** > **Privilege** > **Users**
2. Identify a user.

3. Under **Action**, click  .
   The **Edit Application Privileges** window appears.
4. Select the applications that the user is allowed to access.
5. Click **Apply**.
   QES saves the changes.

Deleting Users

1. Go to **Control Panel** > **Privilege** > **Users**
2. Select the user accounts that you want to delete.
3. Click **Delete**.
   A warning message appears.
4. Click **OK**.
   QES deletes the selected user accounts.

Home Folders

Enabling home folders creates a personal folder for each local and domain user on the NAS. Users can access their home folder through Microsoft networking, FTP, and File Station.

All the home folders are located in the homes shared folder. By default, only the administrator can access this folder.

Enabling Home Folders

1. Go to **Control Panel** > **Privilege** > **Users**.
2. Click **Home Folder**.
   The **Home Folder** window appears.
3. Select **Enable home folder for all users**.
4. Select a storage pool where the home folder will be created.
5. Click **Apply**.

User Groups

A user group is a collection of users with the same access rights to files or folders. Administrators can create user groups to manage folder permissions for multiple users.

Default User Groups

User Group	Description
administrators	Users in this group can configure settings, create users, and install applications. You cannot delete this group.
users	Users in this group can only view and modify files. This group contains all local user accounts and can be used to grant shared folder permissions to all local user accounts. You cannot delete this group.

Creating a User Group

1. Go to **Control Panel** > **Privilege** > **User Groups**.
2. Click **Create**.
   The **Create a User Group** window appears.
3. Specify the following information:

Field	Actions
User group name	Specify a user group name between 1 and 32 characters that contains any of the following: • Letters: A to Z, a to z • Numbers: 0 to 9 • Multi-byte characters: Chinese, Japanese, Korean, and Russian • Dashes (-)
Description	Specify a description that contains a maximum of 128 ASCII characters.

4. Optional: Add users to the user group.
   a. Under **Assign users to this group**, click **Edit**.
   b. Select one or more users.
5. Specify shared folder permissions for the user group.
   a. Under **Edit shared folder permissions**, click **Edit**.
   b. Select the permissions for each shared folder.
   For details, see Conflicts in Shared Folder Permissions.
6. Optional: Specify a custom GID.
   Typically, QES assigns GIDs automatically. However, sometimes you might need to set the GID manually, such as when some NFS clients require that local and NAS groups with the same name also use the same GID.

a. Under **Advanced Options**, click **Edit**.

b. Specify a GID for the group.

- The GID must be between 2,001 and 65,000.
- QES warns you if the specified GID is already in use.

7. Click **Create**.
   QES creates the user group and then adds it to the **User Groups** screen.

Editing a User Group's Description

1. Go to **Control Panel** > **Privilege** > **User Groups**
2. Identify a user group.
3. Under **Action**, click  .
   The **View Group Details** window appears.
4. Modify the description.
5. Click **OK**.
   QES saves the changes.

Editing User Groups

1. Go to **Control Panel** > **Privilege** > **User Groups**
2. Identify a user group.
3. Under **Action**, click  .
   The **Edit User Group** window appears.
4. Select the users you want to include or remove from the group.
5. Click **Apply**.
   QES saves the changes.

Deleting User Groups

1. Go to **Control Panel** > **Privilege** > **User Groups**
2. Select the user groups that you want to delete.
3. Click **Delete**.
   A warning message appears.
4. Click **OK**.
   QES deletes the selected user groups.

Shared Folder Permissions

Conflicts in Shared Folder Permissions

When a user is assigned different permissions for a shared folder, QES uses the following hierarchy to resolve conflicts.

1. No Access (Deny)
2. Read/Write (RW)
3. Read Only (RO)

User Permission	User Group Permission	Actual Permission
No Access	No Access	No Access
Read Only		No Access
Read/Write		No Access
Not Specified		No Access
No Access	Read Only	No Access
Read Only		Read Only
Read/Write		Read/Write
Not Specified		Read Only
No Access	Read/Write	No Access
Read Only		Read/Write
Read/Write		Read/Write
Not Specified		Read/Write
No Access	Not Specified	No Access
Read Only		Read Only
Read/Write		Read/Write
Not Specified		No Access

Editing a User's Shared Folder Permissions

1. Go to **Control Panel** > **Privilege** > **Users**
2. Identify a user.
3. Under **Action**, click  .
   The **Edit Shared Folder Permissions** window appears.
4. Select the permissions the user will have for each shared folder.

Option	Description
Read Only (RO)	The user group can read but not write files in the shared folder.
Read/Write (RW)	The user group can read and write files in the shared folder.
Deny	The user group cannot read or write files in the shared folder.

   For details, see Conflicts in Shared Folder Permissions.
5. Click **Apply**.
   QES saves the changes.

Editing a User Group's Shared Folder Permissions

1. Go to **Control Panel** > **Privilege** > **User Groups**
2. Identify a user group.
3. Under **Action**, click  .
   The **Edit Shared Folder Permissions** window appears.
4. Select the permissions the user group will have for each shared folder.

Option	Description
Read Only (RO)	The user group can read but not write files in the shared folder.
Read/Write (RW)	The user group can read and write files in the shared folder.
Deny	The user group cannot read or write files in the shared folder.

   For details, see Conflicts in Shared Folder Permissions.
5. Click **Apply**.
   QES saves the changes.

Quota

To efficiently allocate storage space, you can specify a quota value (in megabytes or gigabytes) that applies to all users. When the feature is enabled, QES prevents users from uploading data to the NAS once the quota is reached. By default, no quotas are set for the users.

Configuring Quota Settings

1. Go to **Control Panel** > **Privilege** > **Quota**.
2. Select **Enable a quota for all users**.
3. Specify the **Quota size on the disk**.
4. Click **Apply**.

> **Tip**
> You can specify a quota size for each user. For details, see Editing a User Account.

Exporting Quota Settings

You can export quota settings to a CSV file after you have configured them. For details, see Configuring Quota Settings.

You can use the exported settings to review the quota allocated for each user or as a reference when configuring user accounts on other devices.

1. Go to **Control Panel** > **Privilege** > **Quota**.
2. Click **Generate**.
3. Click **Download**.

Domain Security

The NAS supports user authentication by local access right management, Microsoft Active Directory (AD), and Lightweight Directory Access Protocol (LDAP) directory.

By joining the NAS to an Active Directory domain or an LDAP directory, AD or LDAP users can access the NAS using their own accounts without extra user account configuration on the NAS.

> **Note**
> QES supports AD running on Windows Server 2003, 2008, 2008 R2, 2012, 2012 R2, and 2016.

The following options are available on the **Domain Security** screen.

Option	Description
No domain security	Only the local users can access the NAS.
Active Directory Authentication	Local and AD users can access the NAS using Samba, FTP, and File Station.
LDAP Authentication	Local and LDAP users can access the NAS using Samba, FTP, and File Station.

Active Directory (AD) Authentication

Active Directory (AD) is a hierarchical data center that centrally holds information for users, user groups, and computers for secure access management. Windows environments use AD to store, share, and manage a network's information and resources.

When you join a NAS to an AD domain, the NAS automatically imports all of the AD server's user accounts. AD users will be able to use the same login details to access the NAS.

When joining a domain controller using a dual-controller ES NAS, you must connect both management ports of each controller to the network switch.

Configuring Active Directory (AD) Authentication Using the Quick Configuration Wizard

1. Go to **Control Panel** > **Privilege** > **Domain Security**.
2. Select **Active Directory authentication (Domain member)**.
3. Click **Quick Configuration Wizard**.
   The **Active Directory Wizard** appears.
4. Read the introduction, and then click **Next**.
5. Specify the fully qualified domain name (FQDN) of the AD DNS server, and then type ENTER.
   QES automatically generates the **NetBIOS domain name**.
6. Specify the IP address of the AD DNS server.
7. Click **Next**.
8. Select a domain controller.
9. Specify the domain administrator username and password.
10. Click **Join**.
    The NAS joins the domain.
11. Click **Finish**.
    The **Active Directory Wizard** closes.

Configuring Active Directory (AD) Authentication Manually

1. Verify the following:
   - The time settings of the NAS and the AD server are identical. The maximum time disparity tolerated is 5 minutes. For details, see Configuring the Time Settings.
   - The AD server is configured as the primary DNS server. If you use an external DNS server, you will not be able to join the domain. For details, see Network.
   - You have specified the IP address of the WINS server that you use for name resolution. For details, see Configuring Microsoft Networking Settings.
2. Log in to the NAS as an administrator.
3. Go to **Control Panel** > **Privilege** > **Domain Security**.
4. Select **Active Directory authentication (Domain member)**.
5. Click **Manual Configuration**.
   The **Active Directory** box appears.
6. Specify the following AD information:

Field	Description
Domain NetBIOS Name	Example: qnap
AD Server Name	Example: dc1
Domain	Example: qnap.com
Domain Administrator User Name	The specified user must have administrator access rights to the AD domain. Example: admin
Domain Administrator Password	Example: password123
Organizational Unit (Optional)	You can specify the organizational unit the NAS belongs to. Example: computers
Server Description (Optional)	The NAS Samba service replicates this in the server's **Comment** field. You will see this description when connecting to a NAS Samba share using the command line interface. Example: QNAP ES1652DC NAS

7. Click **Join**.

Active Directory (AD) Server and Domain Names

After joining the NAS to the AD domain, you can use the following username formats to log into the NAS and access shared folders:

- Local users: `NASname\NASusername`
- Active Directory users: `Domain\DomainUsername`

The location of your Active Directory server and domain names varies depending on your Windows Server version.

Windows Server Version	Location
2003	Go to **System Properties** in Windows. Example: If the computer name is "node1.qnap-test.com", the AD server name is "node1", and the domain name is "qnap-test.com".
2008	Go to **Control Panel** > **System** in Windows. The AD server name will appear as the computer name, and the domain name can be found in the domain field.
2012, 2016	Right-click  , and then click **System**. The AD server name will appear as the computer name, and the domain name can be found in the domain field.

Trusted Domains

A trusted domain is a domain that Active Directory (AD) trusts to authenticate users. If you join the NAS to an AD domain, all users from trusted domains can log on and access shared folders.

Trusted domains are configured in AD. You can only enable trusted domains on the NAS. By default, this feature is disabled in QES.

Enabling Trusted Domain Authentication

1. Log on to the NAS as an administrator.
2. Go to **Control Panel** > **Network & File Services** > **Win/NFS** > **Microsoft Networking**.
3. Click **Advanced Options**.
   The **Advanced Options** window appears.
4. Select **Enable trusted domains**.

5. Click **Apply**.
   The **Advanced Options** window closes.
6. Click **Apply**.

LDAP Authentication

An LDAP (Lightweight Directory Access Protocol) server stores user and user group information. Administrators can use LDAP to manage users in the LDAP server and to connect to multiple NAS devices with the same logon details. This feature requires a running LDAP server and knowledge of FreeBSD servers, LDAP servers, and Samba.

Configuring LDAP Authentication

1. Log on to the NAS as an administrator.
2. Go to **Control Panel** > **Privilege** > **Domain Security**.
3. Select **LDAP authentication**.
4. Specify the following information:

Field	Description
LDAP Server Host	Host name or IP address of the LDAP server
LDAP Security	Method the NAS uses to communicate with the LDAP server • **ldap:// =** Use a standard LDAP connection. The default port is 389. • **ldap:// (ldap + SSL)** = Use an encrypted connection with SSL. The default port is 686. Older versions of LDAP servers normally use this port. • **ldap:// (ldap + TLS)** = Use an encrypted connection with TLS. The default port is 389. Newer versions of LDAP servers normally use this port.
Base DN	LDAP domain Example: `dc=mydomain,dc=local`
Root DN	LDAP root user Example: `cn=admin, dc=mydomain,dc=local`
Password	Root user password
Users Base DN	Organizational unit (OU) where users are stored Example: `ou=people,dc=mydomain,dc=local`

Field	Description
Groups Base DN	OU where groups are stored Example: `ou=group,dc=mydomain,dc=local`

5. Click **Apply**.
   The **LDAP authentication options** window appears.
6. Select which users are allowed to access the NAS.
   For details, see LDAP Authentication Options.
7. Click **Finish**.

LDAP Authentication Options

The **LDAP authentication options** vary depending on when Microsoft Networking is enabled.

To enable Microsoft Networking, see Configuring Microsoft Networking Settings.

Condition	Options
Microsoft Networking is enabled while LDAP settings are applied.	• **Local users only**: Only local users can access the NAS using Microsoft Networking. • **LDAP users only**: Only LDAP users can access the NAS using Microsoft Networking.
Microsoft Networking is enabled after the NAS is connected to the LDAP server.	• **Standalone Server**: Only local users can access the NAS using Microsoft Networking. • **LDAP Domain Authentication**: Only LDAP users can access the NAS using Microsoft Networking.

LDAP Authentication via Server Message Block (SMB)

Authenticating LDAP users requires third-party software and a Samba schema.

Third-party Software

Software applications such as the following allow management of LDAP users and Samba passwords.

Application	Description
LDAP Account Manager (LAM)	Web-based front end interface available at http://www.ldap-account-manager.org/
smbldap-tools	Command line tool

Application	Description
webmin/ldap-useradmin	Web-based LDAP user administration module

Samba Schema

Importing the Samba schema to the LDAP server requires a samba.schema file. You can find this file in the directory `examples/LDAP` in the Samba source distribution. For details, refer to the documentation or FAQ of the LDAP server.

Below is a Samba schema example for openldap in the FreeBSD server where the LDAP server is running. The schema varies depending on the FreeBSD distribution.

```
zcat /usr/share/doc/samba-doc/examples/LDAP/samba.schema.gz >
      /etc/ldap/schema/samba.schema
```

When editing openldap server configuration files like `/etc/ldap/slapd.conf`, the following lines should be present:

```
include /etc/ldap/schema/samba.schemainclude
/etc/ldap/schema/cosine.schemainclude
/etc/ldap/schema/inetorgperson.schema
include /etc/ldap/schema/nis.schema
```

Configuration Examples

The following are some domain name examples you can use as guides when configuring LDAP authentication.

- FreeBSD OpenLDAP Server

Field	Example
Base DN	`dc=qnap,dc=com`
Root DN	`cn=admin,dc=qnap,dc=com`
Users Base DN	`ou=people,dc=qnap,dc=com`
Groups Base DN	`ou=group,dc=qnap,dc=com`

- Mac Open Directory Server

Field	Example
Base DN	`dc=macserver,dc=qnap,dc=com`
Root DN	`uid=root,cn=users,dc=macserver,dc=qnap,dc=com`

Field	Example
Users Base DN	`cn=users,dc=macserver,dc=qnap,dc=com`
Groups Base DN	`cn=groups,dc=macserver,dc=qnap,dc=com`

Active Directory (AD) and LDAP Management

The administrator can perform the following tasks when the NAS joins an AD domain or connects to an LDAP server.

Task	Steps
View and modify users	1. Go to **Privilege** > **Users** 2. Select **Domain Users** . QES displays the list of domain users. To modify a user's privileges, see User Management.
View and modify user groups	1. Go to **Privilege** > **User Groups** 2. Select **Domain Groups** . QES displays a list of domain user groups. To modify a user group, see User Groups.

Tip

Click  to display newly created users or user groups in the AD or LDAP server. User permission settings are automatically synchronized with the domain controller.

UIDs and GIDs

Each NAS user has a unique identifier, called a UID, which QES assigns when it creates the user. When a user is deleted:

- QES adds the deleted user's UID to a list of deleted UIDs. QES does not assign these deleted UIDs to new users.
- The file and folder permissions associated with the deleted user's UID are left on the NAS, as removing them would be too resource intensive

If the number of usable UIDs becomes low, you can reclaim these deleted UIDs. Reclaiming UIDs does the following:

1. QES cycles through each file and folder on the NAS, and removes all permissions associated with UIDs from the deleted UID list. This process is resource intensive, and may reduce system performance while it is running.

2. QES removes all UIDs from the deleted UID list, and adds them back onto the pool of usable UIDs.

> **Note**
> All the above information also applies to NAS groups and GIDs.

Reclaiming UIDs

> **Warning**
> The reclaim process might take a long time. System performance will be reduced while the reclaim process is running. You should run this process during off-peak hours.

1. Go to **Control Panel** > **Privilege** > **Users**.
2. Click **Reclaim UIDs**.
3. Confirm **OK**.

Reclaiming GIDs

> **Warning**
> The reclaim process might take a long time. System performance will be reduced while the reclaim process is running. You should run this process during off-peak hours.

1. Go to **Control Panel** > **Privilege** > **User Groups**.
2. Click **Reclaim GIDs**.
3. Confirm **OK**.

6. Network and File Services Settings

Win/NFS

Microsoft Networking

Configuring Microsoft Networking Settings

1. Go to **Control Panel** > **Network & File Services** > **Win/NFS** > **Microsoft Networking**.
2. Select **Enable file service for Microsoft Networking**.
3. Specify the following:

Setting	User Action
Server description (Optional)	Specify a description that contains a maximum of 256 characters. The description must enable users to easily identify the NAS on a Microsoft network.
Workgroup	Specify a name between 1 and 32 characters that contains any of the following: • Letters: A to Z, a to z • Numbers: 0 to 9 • Multi-byte characters: Chinese, Japanese, Korean, and Russian • Special characters: ~ ! @ # $ ^ & ( ) - _ { } . '

4. Select an authentication method.

Option	Description
Standalone server	QES uses the local user account information for authentication. For details, see User Creation.
AD Domain Member	QES uses Microsoft Active Directory (AD) for authentication. For details, see Active Directory (AD) Authentication.
LDAP domain authentication	QES uses an LDAP directory for authentication. For details, see LDAP Authentication.

5. Configure the advanced settings.
   a. Click **Advanced Options**.
   The **Advanced Options** window opens.

b. Specify the following information:

Option	User Action
Use the specified WINS server	Select this option to specify a WINS server IP address that the NAS will use for name resolution. Do not select this option if you are unsure about the settings.
Local master browser	Select this option to use the NAS as a local master browser. A local master browser is responsible for maintaining the list of devices in a specific workgroup on a Microsoft network. When deselected, another device on the network maintains the device list. **Important** To use the NAS as local master browser, you must specify the name of the workgroup that your NAS belongs to. The default workgroup in Windows is "workgroup".
Allow only NTLMv2 authentication	Select this option to authenticate clients using only NT LAN Manager version 2 (NTLMv2). When this option is deselected, the NAS uses NT LAN Manager (NTLM).
Name resolve priority	Select the name service that you want to use for name resolution. The default service is **DNS only**. If you specified a WINS server, **Try WINS then DNS** is selected by default.
Automatically register in DNS	Select this option to register the NAS on the DNS server. If the NAS IP address changes, the NAS automatically updates the IP address on the DNS server. This option is only available if Active Directory (AD) authentication is enabled. For details, see Active Directory (AD) Authentication.
Enable trusted domains	Select this option to join users from trusted AD domains. For details, see Trusted Domains. This option is only available if Active Directory (AD) authentication is enabled. For details, see Active Directory (AD) Authentication.

Option	User Action
Enable Asynchronous I/O	Select this option to improve the Samba performance using asynchronous I/O. Asynchronous I/O refers to the I/O behavior on the CIFS protocol layer. This is different from the synchronous I/O feature found in the shared folder settings, which only applies to specific shared folders on the file system level. **Tip** To prevent power interruption, use a UPS when asynchronous I/O is enabled.
Force Encryption Transport	Select this option to encrypt all data using Microsoft Networking. When selected, only SMB 3 clients can connect to the NAS.
Highest SMB version	Select the highest SMB protocol version supported for Microsoft Networking operations.
Lowest SMB version	Select the lowest SMB protocol version supported for Microsoft Networking operations. For example, if you set **Highest SMB version** to `SMB 3` and **Lowest SMB version** to `SMB 2`, QES supports SMB 2, SMB 2.1, and SMB 3 for Microsoft Networking.
Windows Previous Versions	Windows users can view and recover files from snapshots using the Previous Versions menu in Windows. This setting can be disabled per folder by editing the folder's properties in QES.

c. Click **Apply**.

6. Click **Apply All**.

NFS Service

Enabling the NFS service allows Linux and FreeBSD users to connect to the NAS.

- To configure NFS permissions, see Configuring NFS Host Access Permissions.
- To connect to the NAS from Linux using NFS, see Mounting a Shared Folder on a Linux Computer.

Enabling the NFS Service

1. Go to **Control Panel** > **Network & File Services** > **Win/NFS** > **NFS Service**.

2. Select **Enable NFS Service**.
3. Click **Apply**.

FTP

The NAS FTP service helps optimize FTP data transfer. To use the service, you must configure the settings and then connect the NAS to an FTP client such as FileZilla.

Configuring FTP Service Settings

1. Go to **Control Panel** > **Network & File Services** > **FTP** > **FTP Service**.
2. Select **Enable FTP Service**.
3. Configure the following settings:

Setting	User Action
Protocol type	Select the protocols to use. At least one protocol must be selected. • **FTP**: Standard file transfer protocol • **FTP with TLS (Explicit)**: File transfer protocol with channel encryption
TLS version	Select which TLS version to use for FTP with TLS.
Port number	Specify the port number that the FTP service will use.
Enforce Unicode-only filenames	Select one of the following options. **Yes**: Your FTP client supports Unicode encoding. **No**: Your FTP client does not support Unicode encoding. **Tip** To correctly display the file and folder names, specify a filename encoding language. For details, see Configuring the Codepage Settings.
Maximum number of all FTP connections	Specify the maximum number of allowed FTP connections for the NAS. The maximum possible number that you can specify is 1024.
Maximum number of connections for a single account	Specify the maximum number of allowed FTP connections for single user accounts. The maximum possible number that you can specify is 1024.

Setting	User Action
Enable FTP transfer limitation	Select this option, and then specify the maximum upload and download rates.

4. Click **Apply All**.

Configuring the FTP Service Advanced Settings

1. Go to **Control Panel** > **Network & File Services** > **FTP** > **Advanced**.
2. Configure the following settings:

Setting	User Action
Passive FTP port range	Select one of the following options. • **Use the default port range**: Use ports 55536 to 56559. • **Define port range**: Specify a port range larger than 1023. **Important** When specifying a custom port range, ensure that your router and firewall ports are open.
Respond with external IP address for passive FTP connection requests	Enable this option and then specify an external IP address. Remote devices can use this IP address to connect to the NAS FTP server. **Important** Use this feature when the following conditions are true: • The NAS is using a passive FTP connection. • The NAS FTP server is behind a router. • Remote devices cannot connect to the FTP server over the WAN.
Enable Site-to-Site Transfer (FXP)	Enable File eXchange Protocol (FXP). FXP enables an FTP client to transfer data directly from one FTP server to another, without routing the data through the client's connection.

3. Click **Apply All**.

SSH

Enabling the Secure Shell (SSH) service on the NAS allows administrators to connect to the NAS using an SSH-encrypted connection or SSH clients such as PuTTY.

Tip

By default, SSH connections use the NAS management interface, which usually supports 1 Gbps. To use a different interface (for example, one that supports 10 Gbps), enable service binding and then configure **SSH Service**. For details, see Service Binding.

Configuring SSH

1. Go to **Control Panel** > **Network & File Services** > **SSH**.
2. Select **Allow SSH connection**.
3. Specify a port number from 1 to 65535.

   Tip

   The default SSH port is 22.

4. Click **Apply**.

SNMP

Enabling the Simple Network Management Protocol (SNMP) service on the NAS allows the immediate reporting of NAS events, such as warnings or errors, to an SNMP management station (SNMP manager).

Configuring the SNMP Settings

1. Go to **Control Panel** > **Network & File Services** > **SNMP**.
2. Select **Enable SNMP Service**.
3. Specify the following information:

Setting	User Action
Port number	Specify the port that the SNMP manager will use to connect to the NAS.
SNMP Trap Level	Select the type of alert messages that the NAS will send to the SNMP manager. • **Information**: QES sends information regarding ongoing or scheduled NAS operations. • **Warning**: QES alerts you when the NAS resources are critically low or the hardware behaves abnormally. • **Error**: QES alerts you when enabling NAS features or updating applications fail.

Setting	User Action
Trap Address	Specify the IP addresses of the SNMP manager. You can specify a maximum of 3 trap addresses.

4. Select the SNMP version that the SNMP manager uses.

Option	User Action
SNMP V1/V2	Specify an SNMP community name that contains 1 to 64 characters from any of the following groups: • Letters: A to Z, a to z • Numbers: 0 to 9 • Special characters: _ - The SNMP community string functions as a password that is used to authenticate messages sent between the SNMP manager and the NAS. Every packet that is transmitted between the SNMP manager and the SNMP agent includes the community string.
SNMP V3	Specify the user name, authentication protocol and password, and privacy protocol and password. For details, see Configuring SNMP V3 Settings.

5. Click **Apply**.

Configuring SNMP V3 Settings

1. Specify a user name.
   The user name must contain 1 to 32 characters from any of the following groups:
   - Letters: A to Z, a to z
   - Numbers: 0 to 9
   - Special characters: _ -
2. Optional: Select **Use Authentication**.
   a. Specify the authentication protocol.

   Tip
   You can select either **HMAC-MD5** or **HMAC-SHA**. If you are unsure about this setting, QNAP recommends selecting **HMAC-SHA**.

   b. Specify an authentication password.
   The password must contain 8 to 64 characters from any of the following groups:
   - Letters: A to Z, a to z

- Numbers: 0 to 9
- Special characters: _ -

3. Optional: Select **Use Privacy**.

   a. Specify the privacy protocol.

   > **Tip**
   > You can select either **DES** or **AES**. If you are unsure about this setting, QNAP recommends selecting **AES**.

   b. Specify a privacy password.
   The password must contain 8 to 64 characters from any of the following groups:

   - Letters: A to Z, a to z
   - Numbers: 0 to 9
   - Special characters: _ -

SNMP Management Information Base (MIB)

The Management Information Base (MIB) is a type of database in ASCII text format that is used to manage the NAS in the SNMP network. The SNMP manager uses the MIB to determine the NAS status or understand the messages that the NAS sends within the network. You can download the MIB and then view the contents using any word processor or text editor.

> **Important**
> MIBs describe the structure of the management data of a device subsystem. They use a hierarchical namespace containing object identifiers (OID). Each OID identifies a variable that you can read or set using SNMP. You must assign the correct OID to retrieve the NAS information. The default OID for QNAP ES NAS devices is 1.3.6.1.4.1.24861.2.

Downloading the SNMP MIB

1. Go to **Control Panel** > **Network & File Services** > **SNMP**.
2. Under **SNMP MIB**, click **Download**.
   QES downloads the NAS.mib file on your computer.

Service Discovery

Bonjour

Bonjour is a networking technology developed by Apple that enables usage of devices and services on a network. Enabling Bonjour allows Mac computers to automatically discover network services that are running on the NAS without requiring you to specify IP addresses or configure DNS servers.

Configuring the Bonjour Settings

You must enable all relevant services before configuring the Bonjour settings.

1. Go to **Control Panel** > **Network & File Services** > **Service Discovery** > **Bonjour**.
2. Select the services that you want Bonjour to broadcast.
3. Click **Apply**.

Network Recycle Bin

The Network Recycle Bin contains files and folders that users have deleted from the NAS through File Station, FTP, and Samba. You can specify file types to exclude from the bin.

> **Important**
> Each file or folder in the Network Recycle Bin must have a unique name. If the Network Recycle Bin contains two files or folders with the same name, QES adds a unique number to the end of the newest file or folder's name.

Configuring the Network Recycle Bin

1. Go to **Control Panel** > **Network & File Services** > **Network Recycle Bin**.
2. Select **Enable Network Recycle Bin**.
3. Optional: Specify a file retention time.
   a. Select **File retention time (days)**.
   b. Specify a file retention time.
   QES deletes files from the recycle bin after the specified number of days. This field supports a maximum of 9999 days. The default is 180 days.
   c. Specify what time QES should check the recycle bin for expired files every day.
   This check might affect system performance, and therefore should be set outside of working hours.
4. Optional: Specify the file extensions to exclude.
5. Click **Apply**.

Deleting All Files in the Network Recycle Bin

1. Go to **Control Panel** > **Network & File Services** > **Network Recycle Bin**.
2. Click **Empty All Network Recycle Bin**.
   A warning message appears.
3. Click **OK**.
   QES deletes all files in the Network Recycle Bin.

Permanently Deleting a File or Folder

Warning
After a file or folder is permanently deleted, it can no longer be recovered.

1. Open **File Station**.
2. Click **Recycle Bin**.
3. Right-click on a file or folder.
4. Select **Delete**.
   A confirmation message appears.
5. Click **OK**.

QES creates a background task which deletes the file or folder from the Network Recycle Bin.

Recovering a Deleted File or Folder

1. Open **File Station**.
2. Click **Recycle Bin**.
3. Right-click on a file or folder.
4. Select **Recover**.
   The **Recover** window opens.
5. Choose whether to overwrite an existing file or folder.

Option	Description
Yes	QES restores the file or folder to its original location. If a file or folder exists in the same location with the same name, QES overwrites it with the file or folder from the Network Recycle Bin.
No	QES restores the file or folder to its original location. If a file or folder exists in the same location with the same name, QES does not restore the file.

QES restores the file or folder to its original location.

Restricting Access to the Network Recycle Bin

1. Go to **Control Panel** > **Storage Manager** > **Storage Space**.
2. Click a shared folder.
3. Click **Actions** > **Edit Properties**.
   The **Shared Folder Properties** window appears.
4. Under **Advanced Settings**, click **Edit**.

5. Under **Recycle Bin**, select **Enabled**.
6. Select **Restrict the access to Recycle Bin to administrators only for now**.
7. Click **Apply**.

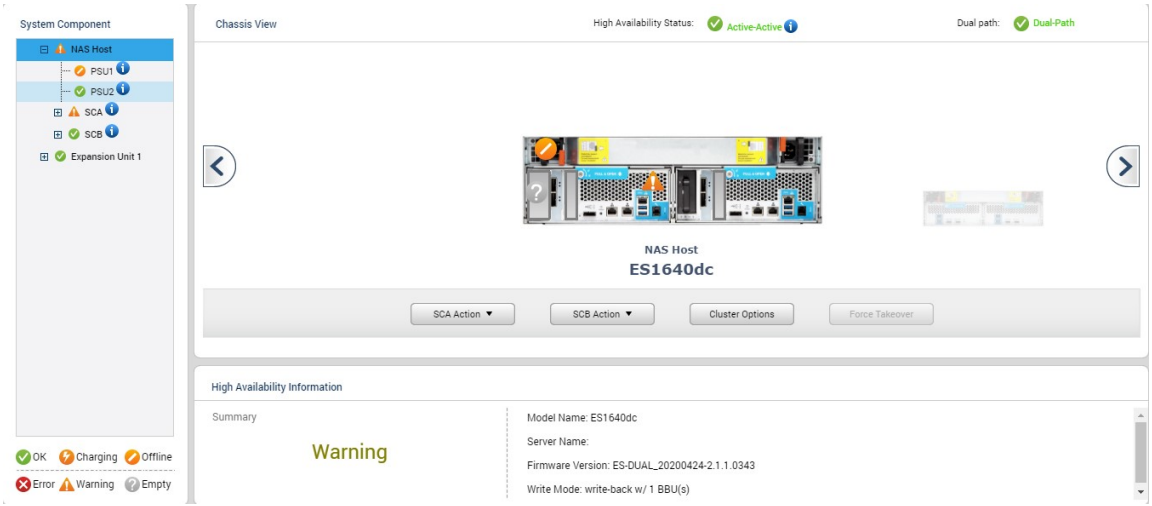
7. High Availability

About High Availability

High availability enables you to manage the storage controllers of your NAS. QNAP ES Series NAS devices are designed with a dual active-active controller architecture. If one controller fails, the other one immediately takes over to eliminate downtime.

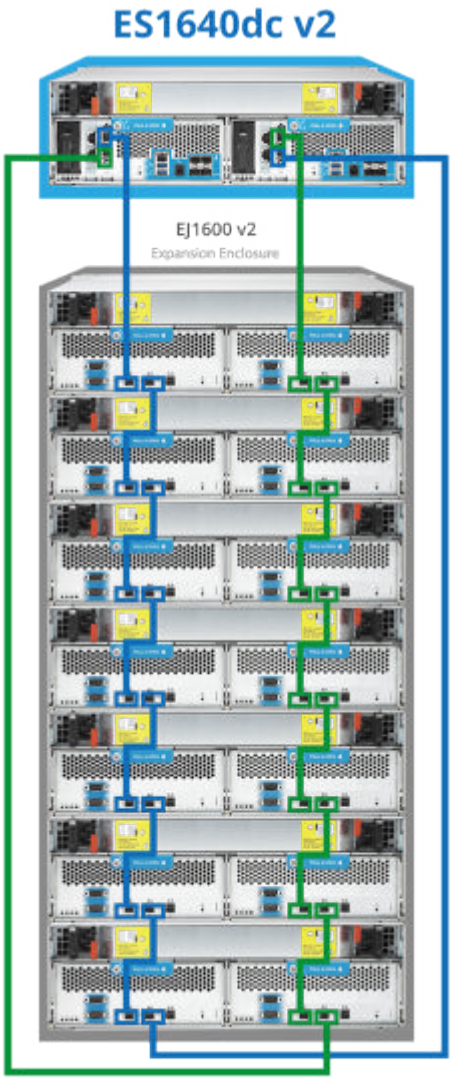
Important

Only ES series NAS models support high availability.



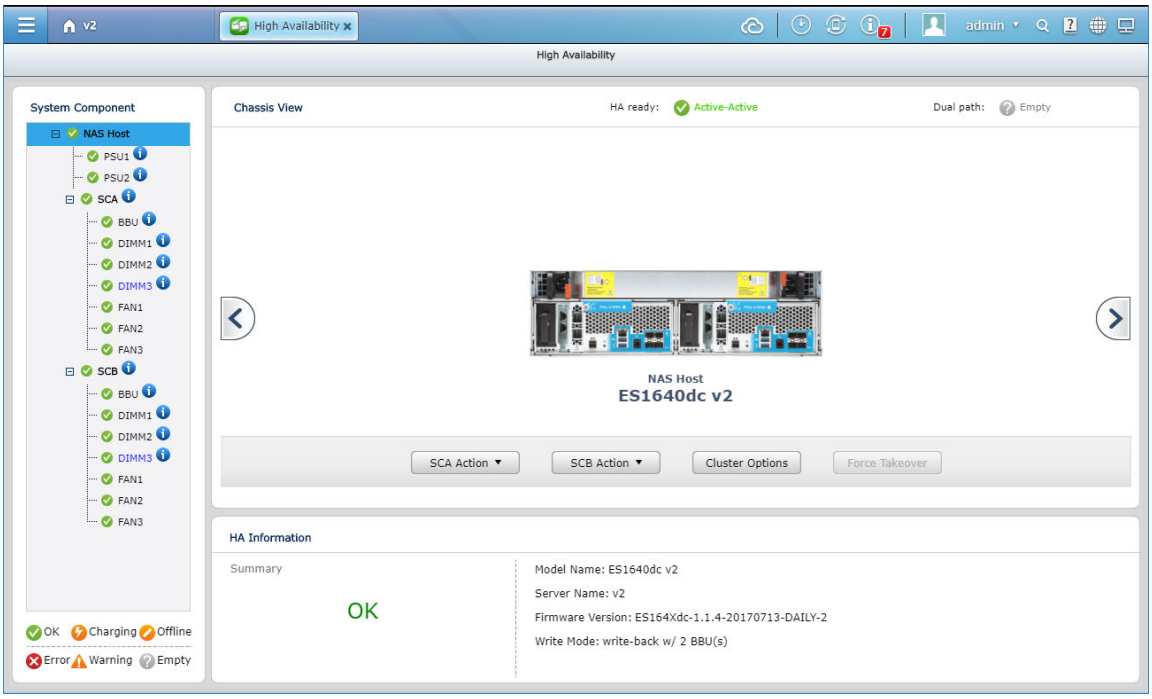
Dual Path Overview

ES series NAS models use a redundant cross loop cabling configuration to connect the storage controllers and the SAS expansion units (also known as JBODs). This ensures continuous operation even if one cable is disconnected or damaged. The following image provides an example of dual-path cabling.



System Components

Select a system component in the left panel to see its location within the main NAS chassis and to view additional hardware information.



Component	Description	HA Information	Additional Information
NAS host	The ES NAS	Model name, server name, firmware version, write mode	Write mode: • Write-back: QES writes incoming data to NVRAM first, notifies the host that the write command was completed, and then writes the data to disk storage later. • Write-through: QES writes incoming data to both NVRAM and disk, and then notifies the host that the write command was completed. This mode is enabled when a BBU is not working.
REXP	Expansion enclosure	Model name	

Component	Description	HA Information	Additional Information
SCA, SCB	Storage controller	Host name, machine status, initialized	Machine status: • power_on: The controller is working normally. • power_off: The controller is powered off. • empty: There is no controller installed in the bay. • connecting: The communication channel between SCA and SCB is not established. • boot: The communication channel between SCA and SCB is established. The controller is starting up.
ECA, ECB	Expansion enclosure controller	Machine status	
PSU	Power supply unit	Temperature, fan speed NAS host only: Model, power	
BBU	Backup battery unit	Capacity, temperature, voltage, serial number, manufacturing date, initialization date	
DIMM	Memory module	Manufacturer, type, serial number, size, speed	
FAN	Internal fan	Fan speed NAS host only: Mode	

System Component Status

Status	Description
OK	The component is functioning properly.
Charging	The battery is charging.
Offline	The component is disabled. QES cannot communicate with it.
Error	The component is not functioning properly. You should replace it immediately.
Warning	The component might fail soon.
Empty	The component is missing or not installed.

System Availability Status

The **High Availability** window contains the following status indicators.

Status Indicator	Description
High Availability Status	This shows the current high availability status of the NAS.
Dual Path	This shows the status of the connections between the storage controllers and the SAS expansion units.

High Availability Status

Status	Description
Active-Active	Both controllers are active and working as expected.
Taking over	Only one controller is active and it is taking control from the other controller.
Takeover	Only one controller is active. **Important** You cannot perform a QES firmware update if the High Availability status is `Takeover`. This prevents firmware inconsistencies between storage controllers.

Status	Description
Giving back	Only one controller is active and it is returning control to the inactive controller.

Dual Path Status

> **Note**
> QES issues a system notification every time the dual path status changes.

Status	Description
Dual Path	The storage controllers and SAS expansion units are connected using two independent paths. This ensures continuous operation of the NAS even if one cable is damaged or disconnected.
Single Path	The storage controllers and SAS expansion units are connected using one path.
Empty	No SAS expansion units are connected to the NAS.

Storage Controller Actions

Action	Description
Takeover	The controller takes over all services while the other controller transitions into standby mode. HA status changes to `Takeover`.
Giveback	The controller gives back services to the other inactive controller. HA status changes to `Active-Active`.
Restart	The controller restarts.
Shutdown	The controller powers off.
Power On	The controller powers on.
Force Takeover	A recovered controller is forced to take over if it does not regain control automatically. This button becomes available only if a takeover or giveback attempt is unsuccessful.

Cluster Options

Setting	Description
System failover protection	When a controller fails, the other controller automatically takes over. A controller failure may result from one of the following situations: • The controller is powered off. • The controller is unresponsive. • The controller encounters an unrecoverable hardware failure. • The amount of memory installed in the controller is inconsistent with the other controller. • The CPU model of the controller is inconsistent with the other controller.
Failover when network fails	When a controller becomes inaccessible as a result of network connection failure, the other controller automatically takes over.
Failover when JBOD fails	When a SAS expansion unit that is connected to a controller becomes inaccessible, the other controller automatically takes over.
Automatically failback when system recovers	When a controller functions again after an automatic failover, it initiates a giveback and then regains control.
Prevent failback repeatedly	When automatic failback is unsuccessful, the recovered controller might repeatedly try to initiate failback. When enabled, a recovered controller can only attempt two failbacks with a 30-second interval between them. QES then disables automatic failback for 24 hours and changes the High Availability status to `Locked`. During this 24-hour period, you can manually initiate a failback by clicking **Giveback** on the working controller. If this succeeds, QES enables automatic failback again.
Management port failover	When the management interface of one controller fails, the other controller automatically takes over. This feature is disabled if static IP addresses are not assigned to the management interfaces of both controllers.

8. Applications

Backup Station

Backup Station enables you to back up files and folders to other remote NAS devices. You can also configure QES as a backup destination for other NAS devices.

Comparison of Backup Methods

Source	Destination	Backup Method
QES	QES	• Real-time SnapSync (Recommended) • Scheduled SnapSync, NAS to NAS • NAS to NAS
QES	QTS	NAS to NAS
QTS	QES	NAS to NAS
QES	QuTS hero	• Real-time SnapSync (Recommended) • Scheduled SnapSync, NAS to NAS • NAS to NAS
QuTS hero	QES	• Real-time SnapSync (Recommended) • Scheduled SnapSync, NAS to NAS • NAS to NAS
QES	Linux	Rsync
Linux	QES	Rsync (with SSH)

Rsync

Rsync is file transfer utility that enables you to synchronize files between QNAP NAS devices and Unix clients.

Configuring the Rsync Server

1. Go to **Backup Station** > **Backup Server** > **Rsync Server**.

2. Configure the following settings.

Setting	Description
Port number	The port used for incoming and outgoing Rsync connections. The default port is 873.
Enable maximum download rate	Limit the amount of bandwidth used by clients backing up this NAS using Rsync. 0 is unrestricted.
Allow remote Rsync server to back up data to the NAS	UNIX clients can back up to this NAS using Rsync.

3. Click **Apply**.

Creating an Rsync Backup Job

1. Go to **Backup Station** > **Remote Replication** > **Rsync**.
2. Click **Create a Replication Job**.
3. Specify a job name.
4. Configure the remote server.
   a. Click **Settings**.
   b. Configure the following remote site settings.

Setting	Description
Name or IP address of the remote server	The remote server DNS name or IP address.
User name	The username of the remote user. The user must have full read/write access and a sufficient quota limit on the remote server.
Password	The password of the remote user.
Port Number	The Rsync port of the remote server. The default is 873.
Server Mode	By default, this setting is enabled and Rsync runs on server mode. When disabled, Rsync runs in daemon mode.
Skip Group ID	When enabled, Rsync does not replicate the group ownership of files and folders to the remote server.

Setting	Description
Enable encryption	Rsync transfers are encrypted for additional security. SSH connections must be enabled on the remote server and the remote user must have permission to perform SSH encrypted backup jobs. Port number: Set the SSH port of the remote server. The default is port 22.

c. Optional: Test the remote server connection.

d. Click **Apply**.

5. Select the source folder.
   The source folder is a local shared folder or subfolder.
6. Select the destination folder.
   The destination folder is a shared folder or subfolder on the remote server.
7. Click **Add**.
8. Optional: Configure job options.

   a. Click **Options**.

   b. Configure the following settings.

Setting	Description
Activate file compression	QES compresses the data before sending it to the destination. The destination NAS decompresses the data before saving it to disk. Enabling this setting can reduce transfer times if your NAS or the remote NAS has a slow network connection, or the NAS devices are connecting via a WAN.
Perform incremental replication	On the first run of a job, Rsync replicates all files to the remote server. On subsequent runs, Rsync only replicates files that have been modified since the last run. **Tip** QNAP recommends enabling this setting as it can greatly reduce backup times.
Delete extra files on remote destination	By default, Rsync only adds new files and updates modified files at the destination. When enabled, Rsync deletes files from the destination folder if they no longer exist in the source folder.

Setting	Description
Handle sparse files efficiently	A sparse file is a type of computer file that contains large blocks of zero-byte data. When enabled, Rsync replicates sparse files more quickly.
Remove source files	QES automatically deletes the source files from the source NAS after the job has run successfully.
Replicate ACL and extended attributes	Rsync replicates ACLs for Windows files and extended attributes for Mac and UNIX files. **Important** QES and the remote server must have the same ACL features enabled and must join the same domain.
Maximum transfer rate (KB/s)	Configuring this setting limits the bandwidth consumption of Rsync and prevents it from affecting the NAS storage performance. The default value is 0, which means unrestricted bandwidth.
Check file contents	By default, Rsync determines if two files in the source and destination are identical by comparing their filenames, last modified dates, and file sizes. When this setting is enabled, Rsync also compares content of both files using checksums.
Send alert emails when the following events occur	When enabled, QES sends out an email alert each time a job succeeds or fails. To use this feature, you must first configure the SMTP server on QES. Go to **Control Panel** > **System** > **Notification** > **E-mail** > **SMTP Server**.

9. Configure a job schedule.
   a. Click **Backup frequency**.
   b. Select **Enable schedule**.
   c. Specify the schedule.
      The job can be scheduled to run daily, weekly, monthly, or to repeat after a certain number of hours.
   d. Click **Apply.**
10. Optional: Select **Execute backup immediately**.
    The job runs immediately after you finish creating it. Subsequent runs follows the backup schedule.
11. Click **Apply**.

QES creates the job and runs it based on the specified settings.

Rsync Job Settings

To configure the following settings, go to **Backup Station** > **Remote Replication** > **Rsync** and click **Options**.

Setting	Description
Timeout (seconds)	If no data is received from the remote server during an Rsync job, QES waits for the specified number of seconds and then stops the job.
Number of retries	After an Rsync job fails, QES runs the job again until the specified number of retries is reached.
Retry intervals (second)	QES waits for the specified number of seconds between each retry.

Rsync Job Buttons

Icon	Action	Description
	Start	Run the job immediately.
	Stop	Stop a running job.
	Rsync Log	View the job's logs.
	Edit	Edit the job's settings.
	Disable schedule	Disable the job's schedule.
	Enable schedule	Enable the job's schedule. This button is only active if a schedule is configured for the job.

NAS to NAS Backups

Creating a NAS to NAS Backup Job

1. Go to **Backup Station** > **Remote Replication** > **NAS to NAS**.
2. Click **Create a Replication Job**.
3. Specify a job name.

4. Configure the remote server.
   a. Click **Settings**.
   b. Configure the following remote site settings.

Setting	Description
Name or IP address of the remote server	The remote server DNS name or IP address.
User name	The username of the remote user. The user must have full read/write access and a sufficient quota limit on the remote server.
Password	The password of the remote user.
Port Number	The Rsync port of the remote server. The default is 873.
Enable encryption	Transfers are encrypted for additional security. SSH connections must be enabled on the remote server and the remote user must have permission to perform SSH encrypted backup jobs. Port number: The SSH port of the remote server .

   c. Optional: Test the remote server connection.
   d. Click **Apply**.
5. Select the source folder.
   The source folder is a local shared folder or subfolder.
6. Select the destination folder.
   The destination folder is a shared folder or subfolder on the remote server.
7. Click **Add**.
8. Configure the following settings.

Setting	Description
Activate file compression	QES compresses the data before sending it to the destination. The destination NAS decompresses the data before saving it to disk. Enabling this setting can reduce transfer times if your NAS or the remote NAS have slow network connections, or are connecting via a WAN.

Setting	Description
Perform incremental replication	On the first run of a job, Rsync replicates all files to the remote server. On subsequent runs, Rsync only replicates files that have been modified since the last run. **Tip** QNAP recommends enabling this setting, as it can greatly reduce backup times.
Delete extra files on remote destination	By default, Rsync only adds new files and updates modified files at the destination. Enabling this setting causes Rsync to delete files from the destination folder if they no longer exist in the source folder.
Handle sparse files efficiently	A sparse file is a type of computer file that contains large blocks of zero-byte data. Enabling this setting allows Rsync to replicate sparse files more quickly.
Remove source files	QES automatically deletes the source files from the source NAS after the job has run successfully.
Replicate ACL and extended attributes	Rsync replicates ACLs for Windows files and extended attributes for Mac and UNIX files. **Important** QES and the remote server must have the same ACL features enabled and be joined to the same domain.
Maximum transfer rate (KB/s)	Limit the amount of bandwidth used by Rsync. By configuring this setting, you can prevent Rsync from consuming all bandwidth and affecting NAS storage performance. 0 is unrestricted.
Check file contents	By default, Rsync determines if two files in the source and destination are identical by comparing their filenames, last modified dates and file sizes. When this setting is enabled, Rsync also compares content of both files using checksums.
Send alert emails when the following events occur	You can receive an email alert each time a job fails or finishes successfully. The SMTP server must be configured in QES at **Control Panel** > **System** > **Notification** > **E-mail** > **SMTP Server**.

9. Configure a job schedule.
   a. Click **Backup frequency**.
   b. Select **Enable schedule**.

c. Specify the schedule.
The job can be scheduled to run daily, weekly, monthly, or to repeat after a certain number of hours.

d. Click **Apply.**

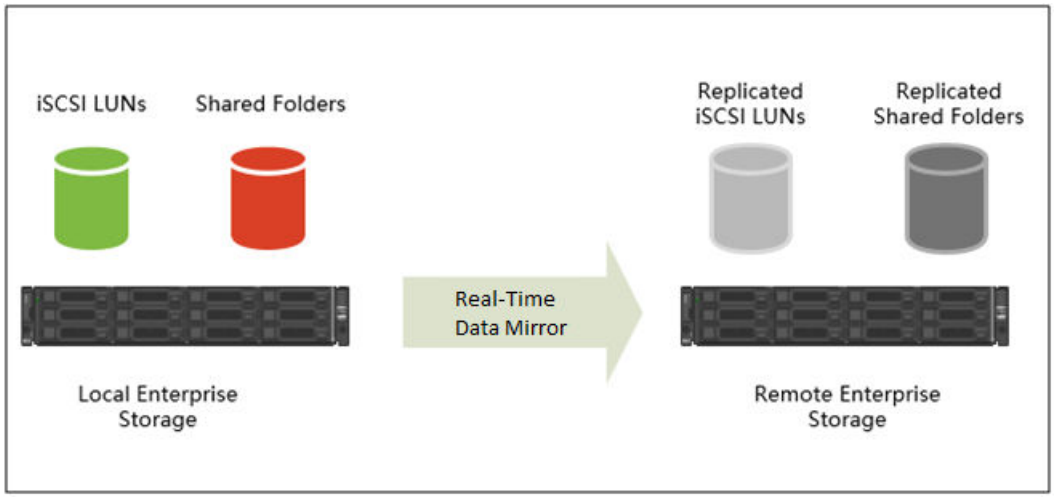
10. Optional: Select **Execute backup immediately**.
The job will run immediately after you finish creating the job. Subsequent runs will follow the backup schedule.

11. Click **Apply**.

QES creates the job, and then runs it if you selected **Execute backup immediately**.

SnapSync

SnapSync is a disaster recovery solution that enables you to back up data from the local NAS to another QNAP NAS using block-level replication in real time. This means that whenever data is written to the source NAS, it is also immediately written to the destination NAS. This reduces the backup time and lowers the risk of data loss.



Note

- You can also configure SnapSync to run periodically on a schedule (Scheduled SnapSync), in order to save system resources.
- SnapSync encrypts data during transmission using AES-256 encryption.

SnapSync Requirements

OS requirements:

SnapSync Job Type	QES Version	QuTS hero Version
QES to QES	QES 2.0.0 or later	N/A
QuTS hero to QuTS hero	N/A	QuTS hero 4.5.2 or later
QES to QuTS hero QuTS hero to QES	QES 2.1.1 Build 20210303 or later	QuTS hero 4.5.2 or later

Other requirements:

- The source and destination shared folder or LUN must be the same provisioning type (thick or thin).
- If the source and destination NAS devices are running incompatible versons of SnapSync, then you will be prompted to update the system firmware on one or both NAS devices.
- If both the source and destination NAS devices are running QES, then they must run the same version of QES to ensure data consistency.
- When using real-time SnapSync, the round-trip latency between the source and destination NAS devices must be 5ms or less. Higher latency might cause local storage write delays.

SnapSync Restrictions

The following restrictions apply after creating a SnapSync job.

- If the destination is a shared folder, the folder becomes read-only.
- If the destination is a LUN, the LUN becomes read-only and is no longer accessible to iSCSI initiators.

Deleting the SnapSync job removes these restrictions.

SnapSync Job Creation

Creating a Real-Time SnapSync Job

1. Go to **Backup Station** > **Remote Replication** > **SnapSync**.
2. Click **Create a Replication Job**.
   The **Create a Replication Job** wizard opens.
3. Specify a job name.
   The name cannot contain any of the following special characters: ` * = + [ ] \ | ; : ' " , < > / ? %
4. Select **Real-Time**.
5. Select the backup destination.
   Choose from one of the following settings.

Setting	Description
Local Interface	Back up from one shared folder to another shared folder on the same NAS.
Remote Host	Back up to another NAS. You must specify the IP address, username, and password of the destination NAS, and then click **Connect**.

6. Select the source storage pool.
7. Select the source shared folder or LUN.
8. Select the destination storage pool.
9. Select the destination shared folder or LUN.

   Warning
   All data in the shared folder will be deleted.

10. Optional: Click **New** to create a new destination shared folder.
11. Set the source and destination network adapters for this job.

Adapter Setting	Description
Auto-Select Network Adapter	QES automatically selects the fastest network adapters at the source and destination for this job. If either network adapter becomes disconnected, QES will select the fastest available adapter.
Manual-Select Network Adapter	Manually select the network adapters at the source and destination for this job. You can also select failover adapters, which the job uses if the either primary adapter becomes disconnected. **Note** The adapter lists are automatically filtered to only display adapters that can connect to the currently selected adapter.

12. Optional: Configure job options.

Setting	Description
Compression	SnapSync compresses the data before sending it to the destination. The destination NAS decompresses the data before saving it to disk. Enabling this setting can reduce transfer times if your NAS or the remote NAS has a slow network connection, or the two NAS devices are connecting via WAN.
Deduplication	SnapSync reduces the amount of storage and bandwidth needed by eliminating duplicate copies of repeated data.
Encryption	SnapSync encrypts the data during transmission to the destination NAS. The data is then decrypted before being stored at the destination.
Support application consistent snapshots	SnapSync creates application consistent snapshots. **Note** This option is only available for VMware vCenter and Volume Shadow Copy Service (VSS) aware applications running on a Windows server. You must install QNAP Snapshot Agent on the iSCSI initiator.
Send alert emails when the following events occur	You can receive an email alert each time a job fails or finishes successfully. **Important** An SMTP server must be configured at **Control Panel** > **System** > **Notification** > **E-mail** > **SMTP Server**.

13. Enable latency monitor.
When latency monitor is enabled, QES monitors the latency of the SnapSync job to ensure the job is running normally. If the job latency goes over the threshold six times within a time period of one minute, QES issues a warning notification.
    a. Click **Latency Monitor**.
    b. Optional: To view the average latency in previous performance tests, click **SnapSync Performance Report**.
    c. Enable **Latency threshold**.
    d. Set a threshold value, in milliseconds. The value must be 1–5000.
14. Click **OK**.

Creating a Scheduled SnapSync Job

1. Go to **Backup Station** > **Remote Replication** > **SnapSync**.
2. Click **Create a Replication Job**.
   The **Create a Replication Job** wizard opens.
3. Specify a job name.
   The name cannot contain any of the following special characters: ` * = + [ ] \ | ; : ' " , < > / ? %
4. Select **Scheduled**.
5. Select the backup destination.
   Choose from one of the following settings.

Setting	Description
Local Interface	Back up from one shared folder to another shared folder on the same NAS.
Remote Host	Back up to another NAS. You must specify the IP address, username, and password of the destination NAS, and then click **Connect**.

6. Select the source storage pool.
7. Select the source shared folder or LUN.
8. Select the destination storage pool.
9. Select the destination shared folder or LUN.

   Warning
   All data in the shared folder will be deleted.

10. Optional: Click **New** to create a new destination shared folder.
11. Set the source and destination network adapters for this job.

Adapter Setting	Description
Auto-Select Network Adapter	QES automatically selects the fastest network adapters at the source and destination for this job. If either network adapter becomes disconnected, QES will select the fastest available adapter.

Adapter Setting	Description
Manual-Select Network Adapter	Manually select the network adapters at the source and destination for this job. You can also select failover adapters, which the job uses if the either primary adapter becomes disconnected. **Note** The adapter lists are automatically filtered to only display adapters that can connect to the currently selected adapter.

12. Optional: Configure job options.

Setting	Description
Compression	SnapSync compresses the data before sending it to the destination. The destination NAS decompresses the data before saving it to disk. Enabling this setting can reduce transfer times if your NAS or the remote NAS has a slow network connection, or the two NAS devices are connecting via WAN.
Deduplication	SnapSync reduces the amount of storage and bandwidth needed by eliminating duplicate copies of repeated data.
Encryption	SnapSync encrypts the data during transmission to the destination NAS. The data is then decrypted before being stored at the destination.
Support application consistent snapshots	SnapSync creates application consistent snapshots. **Note** This option is only available for VMware vCenter and Volume Shadow Copy Service (VSS) aware applications running on a Windows server. You must install QNAP Snapshot Agent on the iSCSI initiator.
Send alert emails when the following events occur	You can receive an email alert each time a job fails or finishes successfully. **Important** An SMTP server must be configured at **Control Panel** > **System** > **Notification** > **E-mail** > **SMTP Server**.

13. Optional: Configure the backup frequency.
You can set the schedule to daily, weekly, or monthly. On the day the job runs, you can set the job to run once or periodically.

> **Important**
> If you do not enable a schedule, the job only runs when you start it manually.

14. Optional: Select **Execute backup immediately**.
    When selected, the job will run immediately after it has been created.
15. Click **OK**.

SnapSync Screen

To get to this screen, go to **Backup Station** > **Remote Replication** > **SnapSync**.

SnapSync Screen UI Elements

UI Element	Description
SnapSync Service	Enable or disable the SnapSync service in QES. You must enable the SnapSync service to create and run SnapSync jobs, and to allow other NAS devices to back up data to this NAS using SnapSync.
Port	Displays the port used for incoming and outgoing SnapSync connections.
SnapSync Settings	Set the SnapSync port and limit upload rate. For details, see SnapSync Settings.
Create a Replication Job	Create a real-time or scheduled SnapSync job. For details, see Creating a Real-Time SnapSync Job.
Job Name	Displays the job's name.
Source	Displays the following information: • Source NAS name • Source shared folder or LUN name • Source interface IP address • Source link and adapter speed
Destination	Displays the following information: • Destination NAS name • Destination shared folder or LUN name • Destination interface IP address • Destination link and adapter speed

UI Element	Description
Compression	Displays whether compression is enabled for this job.
Deduplication	Displays whether deduplication is enabled for this job.
Schedule	Displays the backup plan for this job: • Manual • Scheduled • Real-time
Data Status	Displays the status of the job's source and destination folders. For details, see SnapSync Data Status.
Job Status	Displays the current job status. For details, see the following topics: • Real-Time SnapSync Job Status • Scheduled SnapSync Job Status If QES is unable to contact the remote NAS, this field displays the last known job status plus `(Disconnected)`. If the job is running, this field also shows job speed for real-time and scheduled jobs, and percentage completed for scheduled jobs.
Action	Choose to edit, delete, or resume the job. For details, see SnapSync Job Actions.

SnapSync Settings

UI Element	Action
SnapSync version	This displays the SnapSync version on the current NAS firmware. **Tip** If you are having SnapSync compatibility issues, ensure that both source and destination NAS devices have the same SnapSync version.
Port number	Set the port used for incoming and outgoing SnapSync connections. The default port is 874.
Limit upload rate	Limit the amount of upload bandwidth used by SnapSync.

UI Element	Action
Maximum upload rate (KB/s)	Set the maximum upload rate for SnapSync, in kilobytes per second. 0 is unrestricted.

SnapSync Job Actions

Icon	Action	Description
	Start	Run the job immediately.
	Stop	Stop a running job.
	Edit	Edit the job's settings. You can edit backup frequency, network adapter, and certain job options. **Note** • You cannot change the job's backup frequency from Scheduled or Manual to Real-Time, or from Real-time to Scheduled or Manual. • If the destination login account password changes, then the job will stop working. To resolve this issue, edit the job setting on the source NAS and then update the destination password. • If the destination IP address changes, then the job state will change to `Disconnected`. To resolve this issue, edit the job setting on the source NAS and then update the destination address.
	Suspend job	Temporarily prevents a job from running as scheduled.
	Resume job	Allows a previously suspended job to run as scheduled. If QES detects that the source and destination folders are different, then it immediately runs the job and synchronizes them.

Real-Time SnapSync Job Status

Status	Description
Ready	The job has been created but has not started synchronizing.
Transferring	The job is running for the first time. SnapSync must transfer all source data to the destination NAS. QES displays the data transmission speed and synchronization progress as a percentage.
Updating	The job has started running. QES is synchronizing the source and destination folders.
Updated	The source and destination folders are synchronized.
Aborted	The job has stopped running. The files in the source and destination folders might be either consistent or inconsistent.
Connection Failed	The two NAS devices are disconnected.
Login Failure	The source NAS is able to connect to the destination NAS, but the username and password saved in the job's settings are invalid.

Scheduled SnapSync Job Status

Status	Description
Idle	The job is not currently running.
Starting	SnapSync is preparing to run the job.
Ready	The job is not currently running. This status appears after deleting a SnapSync job, and then creating a new job with the same name and the same source and destination.
Updated	The job has finished running. The source was synchronized to a destination on a remote NAS.
Local Updated	The job has finished running. The source was synchronized to a destination on the local NAS.
Suspended	The job was suspended by a user who clicked **Suspend job** on the source or destination NAS.
Not run yet	The job was created but has not been run.

Status	Description
Updating	The job is running. SnapSync is synchronizing data from the source folder to the destination folder. QES displays the data transmission speed and synchronization progress as a percentage.
Disconnected	The two NAS devices are disconnected.

SnapSync Data Status

Status	Description
Updating	The job has started running. QES is synchronizing the source and destination folders. When the job runs for the first time, QES displays the data transmission speed and synchronization progress as a percentage.
Updated	The source and destination folders are synchronized.
Aborted	The job has stopped running. The files in the source and destination folders are identical. The destination folder is read-only.
Interrupted	The job has stopped running. The files in the source and destination folders are not identical. The destination folder is read-only.
Split	The source and destination folders are no longer paired. The destination folder has full read/write permissions.

SnapSync Performance Test

A SnapSync performace test measures synchronization performance to the destination server. The test results show the performance of SnapSync under current system load.

> **Note**
> To get realistic results, we recommend running the test during regular hours under typical working conditions.

Running a SnapSync Performance Test

1. Go to **Backup Station** > **Remote Replication** > **SnapSync**.
2. Click **Create a SnapSync Performance Test**.
   The **Create a SnapSync Performance Test** window opens.

3. Specify the IP address, username, and password of a NAS that supports SnapSync, and then click **Connect**.
4. Select the source storage pool.
5. Select the destination storage pool.
6. Select the IP address of the source network adapter.
7. Select the IP address of the destination network adapter.
8. Click **Run Test**.

Accessing a SnapSync Destination Folder

The destination shared folder has separate permissions from the source folder. To access a destination folder, you must configure its access permissions on the destination NAS.

Important
The destination folder of a SnapSync job is configured as read-only. To restore full read/write permissions you must suspend the SnapSync job.

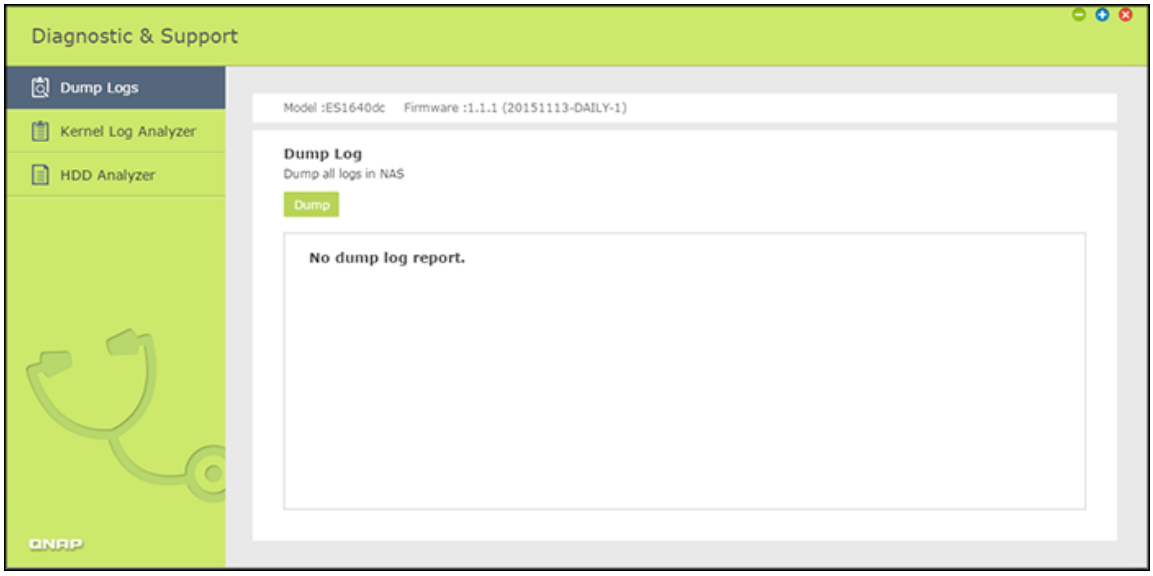
1. Log onto the destination NAS using an account with administrator permissions.
2. Go to **Storage Manager** > **Storage** > **Storage Space**.
3. Select the destination storage pool.
4. Select the destination folder.
   The **Shared Folder Manager** window opens.
5. Select **Actions** > **Edit Properties**.
   The **Shared Folder Properties** window opens.
6. Under **Storage Settings and Services**, click **Edit**.
7. Select one or more storage services.
8. Click **Apply**.
9. Click **Permissions**.
   The **Shared Folder** window opens.
10. Select **Users and groups permission**.
11. Configure user and group access permission, then click **Apply**.
    You can only select RO (read-only) permissions. For details, see Configuring User and Group Permissions.
12. Configure NFS host access.
    For details, see Configuring NFS Host Access Permissions.

13. Configure SMB host access.
    For details, see Configuring SMB Host Access Control.

You can now access the destination folder.

Diagnostic Tool

The Diagnostic Tool provides several features for checking the stability of the NAS. Users can export system kernel records to quickly check whether abnormal operations have recently occurred. In addition, users can send the records to QNAP technical support for further investigation. The Diagnostic tool also provides features for checking the file system, hard drives, and RAM.



Tip
QNAP strongly recommends using the Diagnostic Tool to efficiently troubleshoot NAS issues.

Downloading System Logs

1. Go to **Control Panel** > **Applications** > **Diagnostic Tool** > **Dump Log**.
2. Click **Dump**.
   The system will produce a .zip file.
3. Download the .zip file.
4. Optional: Send the file to QNAP technical support for further investigation.

Analyzing Kernel Logs

1. Go to **Control Panel** > **Applications** > **Diagnostic Tool** > **Kernel Log Analyzer**.
2. Click **Start**.

QES will show the results of the kernel log analysis.

Analyzing Hard Disk Drives

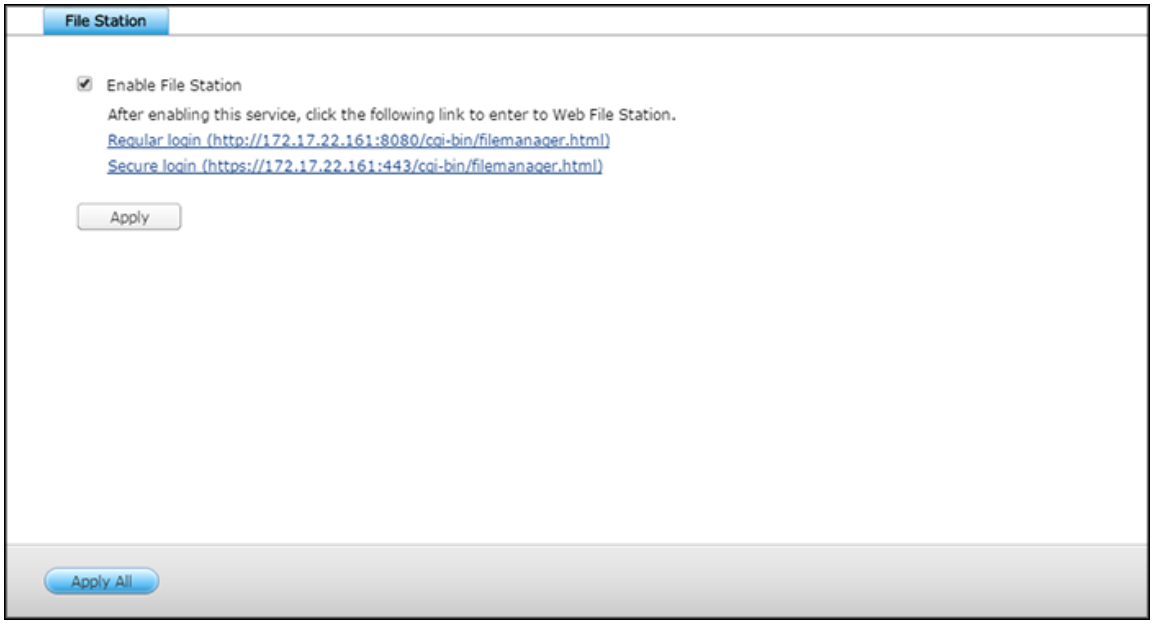
1. Go to **Control Panel** > **Applications** > **Diagnostic Tool** > **HDD Analyzer**.
2. Perform one of the following actions.

Action	Steps
Dump SMART test logs	**a.** Select **Dump SMART value**. **b.** Select the enclosure you wish to analyze. **c.** Click **Dump**. **Note** You can download the SMART test logs after they have been dumped.
Test system performance	**a.** Select **Test performance**. **b.** Select the enclosure you wish to analyze. **c.** Click **Start**. **Note** QES will show the results of the system performance test.
Dump RAID logs	**a.** Select **Dump RAID information**. **b.** Select the pool you wish to analyze. **c.** Click **Update**. **Note** QES will show the results of the RAID information dump.

Tip
QNAP recommends sending these logs to technical support when you open a technical support request.

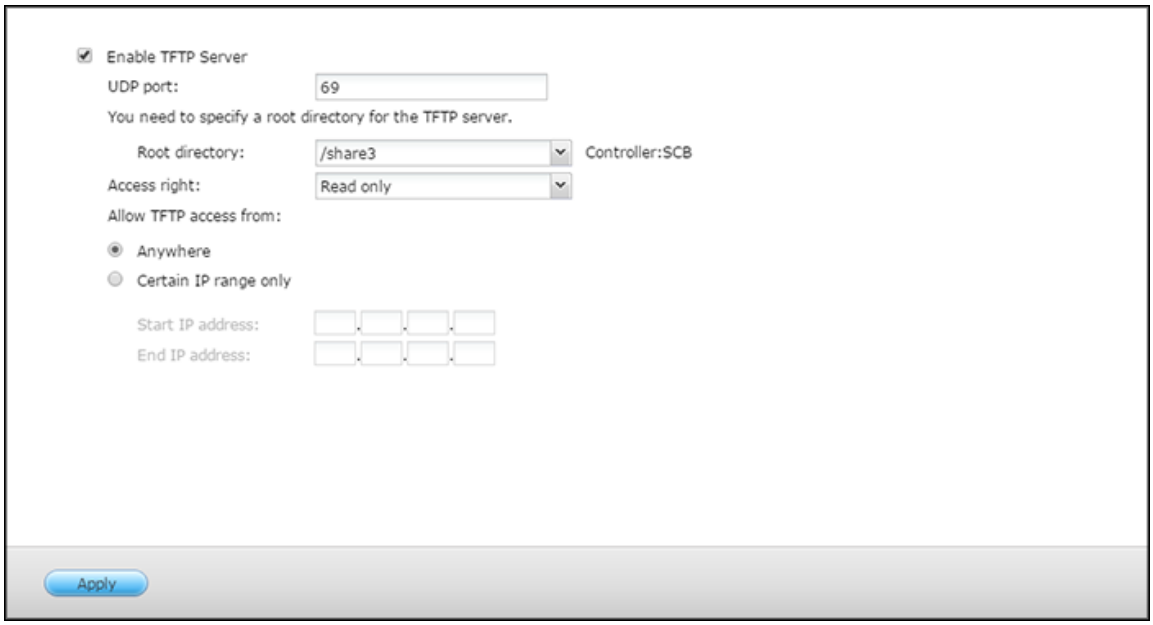
Station Manager

Station Manager is an integrated control panel for enabling and disabling QNAP stations. File Station is currently the only station on QES.



TFTP Server

Trivial File Transfer Protocol (TFTP) is a basic form of FTP. You can configure the NAS as a TFTP server for network device management and remote network booting. TFTP does not provide user authentication and you cannot connect to it using a standard FTP client.



Enabling the TFTP Server

1. Go to **Control Panel** > **Applications** > **TFTP Server**.
2. Select **Enable TFTP Server**.
3. Specify the UDP port.
   The default UDP port is 69.
4. Specify the TFTP root directory.
   The TFTP root directory stores all files and folders uploaded to the NAS using TFTP.
5. Select access rights.

Option	Description
Read only	TFTP clients can view and download files.
Full access	TFTP clients can view, modify, upload, and download files.

6. Configure TFTP client access.

Option	Description
Anywhere	
Certain IP range only	

7. Click **Apply**.

QES enables the TFTP server.

Virtualization

The QNAP ES NAS is a virtualization-ready storage solution that includes VMware vSphere, Microsoft Hyper-V, and Citrix XenServer, as well as VAAI for iSCSI, VAAI for NAS, and Offloaded Data Transfer (ODX). The NAS supports thin provisioning and storage reclamation, and QNAP offers network accessories that support 10GbE and SSD cache. In addition, you can use vSphere Client and SMI-S Provider to increase productivity and efficiency.

For more information, go to https://www.qnap.com/en/how-to/tutorial/zfs-virtualization.

VAAI for iSCSI and VAAI for NAS

For details, go to https://files.qnap.com/news/pressresource/datasheet/QNAP_Plugin_for_VMWare_vStorage_API_for_Array_Integration_(VAAI)(English).pdf

Offloaded Data Transfer (ODX)

The ES NAS supports Offloaded Data Transfer (ODX) in Microsoft Windows Server 2016, making it a high-performance iSCSI storage solution for Hyper-V virtualized environments. By supporting ODX, the NAS can be offloaded with all the copying processes from Windows servers. ODX significantly

reduces the load on Windows servers and improves the efficiency of copying and moving operations for Windows 2016 hosts that use QNAP iSCSI storage.

10GbE Support

A 10GbE network is essential for businesses that require high bandwidth for virtualization and quick, efficient backup and data restoration. The QNAP ES NAS series is a reliable storage solution for deploying a 10GbE environment. For details, go to https://www.qnap.com/solution/10gbe-ready/en/.

vSphere Client

The vSphere Client for the ES NAS is an interface between ESXi and the NAS. This tool enables system administrators to manage VMware datastores and verify the status of NAS units directly from the vSphere Client. For details, go to https://www.qnap.com/en/how-to/tutorial/article/using-qnap-vsphere-web-client-plug-in-with-qnap-es-nas.

QNAP SMI-S Provider

The QNAP SMI-S Provider is required for System Center Virtual Machine Manager (SCVMM 2012). With the SMI-S Provider, the NAS can directly communicate with SCVMM 2012, and server management tasks can be facilitated for administrators. For details, see https://files.qnap.com/news/pressresource/datasheet/QNAP_Enterprise-class_ES_NAS_SMI-S_Provider_for_System_Center_Virtual_Machine_Manager(English).pdf.

9. Notices

BSD License

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. Neither the name of the copyright holder nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT HOLDER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

CDDL License

COMMON DEVELOPMENT AND DISTRIBUTION LICENSE Version 1.0 (CDDL-1.0)

1. Definitions.

1.1. Contributor means each individual or entity that creates or contributes to the creation of Modifications.

1.2. Contributor Version means the combination of the Original Software, prior Modifications used by a Contributor (if any), and the Modifications made by that particular Contributor.

1.3. Covered Software means (a) the Original Software, or (b) Modifications, or (c) the combination of files containing Original Software with files containing Modifications, in each case including portions thereof.

1.4. Executable means the Covered Software in any form other than Source Code.

1.5. Initial Developer means the individual or entity that first makes Original Software available under this License.

1.6. Larger Work means a work which combines Covered Software or portions thereof with code not governed by the terms of this License.

1.7. License means this document.

1.8. Licensable means having the right to grant, to the maximum extent possible, whether at the time of the initial grant or subsequently acquired, any and all of the rights conveyed herein.

1.9. Modifications means the Source Code and Executable form of any of the following:

A. Any file that results from an addition to, deletion from or modification of the contents of a file containing Original Software or previous Modifications;

B. Any new file that contains any part of the Original Software or previous Modification; or

C. Any new file that is contributed or otherwise made available under the terms of this License.

1.10. Original Software means the Source Code and Executable form of computer software code that is originally released under this License.

1.11. Patent Claims means any patent claim(s), now owned or hereafter acquired, including without limitation, method, process, and apparatus claims, in any patent Licensable by grantor.

1.12. Source Code means (a) the common form of computer software code in which modifications are made and (b) associated documentation included in or with such code.

1.13. You (or Your) means an individual or a legal entity exercising rights under, and complying with all of the terms of, this License. For legal entities, You includes any entity which controls, is controlled by, or is under common control with You. For purposes of this definition, control means (a) the power, direct or indirect, to cause the direction or management of such entity, whether by contract or otherwise, or (b) ownership of more than fifty percent (50%) of the outstanding shares or beneficial ownership of such entity.

2. License Grants.

2.1. The Initial Developer Grant: Conditioned upon Your compliance with Section 3.1 below and subject to third party intellectual property claims, the Initial Developer hereby grants You a world-wide, royalty-free, non-exclusive license:

(a) under intellectual property rights (other than patent or trademark) Licensable by Initial Developer, to use, reproduce, modify, display, perform, sublicense and distribute the Original Software (or portions thereof), with or without Modifications, and/or as part of a Larger Work; and

(b) under Patent Claims infringed by the making, using or selling of Original Software, to make, have made, use, practice, sell, and offer for sale, and/or otherwise dispose of the Original Software (or portions thereof).

(c) The licenses granted in Sections 2.1(a) and (b) are effective on the date Initial Developer first distributes or otherwise makes the Original Software available to a third party under the terms of this License.

(d) Notwithstanding Section 2.1(b) above, no patent license is granted: (1) for code that You delete from the Original Software, or (2) for infringements caused by: (i) the modification of the Original Software, or (ii) the combination of the Original Software with other software or devices.

2.2. Contributor Grant: Conditioned upon Your compliance with Section 3.1 below and subject to third party intellectual property claims, each Contributor hereby grants You a world-wide, royalty-free, non-exclusive license:

(a) under intellectual property rights (other than patent or trademark) Licensable by Contributor to use, reproduce, modify, display, perform, sublicense and distribute the Modifications created by such Contributor (or portions thereof), either on an unmodified basis, with other Modifications, as Covered Software and/or as part of a Larger Work; and

(b) under Patent Claims infringed by the making, using, or selling of Modifications made by that Contributor either alone and/or in combination with its Contributor Version (or portions of such combination), to make, use, sell, offer for sale, have made, and/or otherwise dispose of: (1) Modifications made by that Contributor (or portions thereof); and (2) the combination of Modifications made by that Contributor with its Contributor Version (or portions of such combination).

(c) The licenses granted in Sections 2.2(a) and 2.2(b) are effective on the date Contributor first distributes or otherwise makes the Modifications available to a third party. (d) Notwithstanding Section 2.2(b) above, no patent license is granted: (1) for any code that Contributor has deleted from the Contributor Version; (2) for infringements caused by: (i) third party modifications of Contributor Version, or (ii) the combination of Modifications made by that Contributor with other software (except as part of the Contributor Version) or other devices; or (3) under Patent Claims infringed by Covered Software in the absence of Modifications made by that Contributor.

3. Distribution Obligations.

3.1. Availability of Source Code: Any Covered Software that You distribute or otherwise make available in Executable form must also be made available in Source Code form and that Source Code form must be distributed only under the terms of this License. You must include a copy of this License with every copy of the Source Code form of the Covered Software You distribute or otherwise make available. You must inform recipients of any such Covered Software in Executable form as to how they can obtain such Covered Software in Source Code form in a reasonable manner on or through a medium customarily used for software exchange.

3.2. Modifications: The Modifications that You create or to which You contribute are governed by the terms of this License. You represent that You believe Your Modifications are Your original creation(s) and/or You have sufficient rights to grant the rights conveyed by this License.

3.3. Required Notices: You must include a notice in each of Your Modifications that identifies You as the Contributor of the Modification. You may not remove or alter any copyright, patent or trademark notices contained within the Covered Software, or any notices of licensing or any descriptive text giving attribution to any Contributor or the Initial Developer.

3.4. Application of Additional Terms: You may not offer or impose any terms on any Covered Software in Source Code form that alters or restricts the applicable version of this License or the recipients rights hereunder. You may choose to offer, and to charge a fee for, warranty, support, indemnity or liability obligations to one or more recipients of Covered Software. However, you may do so only on Your own behalf, and not on behalf of the Initial Developer or any Contributor. You must make it absolutely clear that any such warranty, support, indemnity or liability obligation is offered by You

alone, and You hereby agree to indemnify the Initial Developer and every Contributor for any liability incurred by the Initial Developer or such Contributor as a result of warranty, support, indemnity or liability terms You offer.

3.5. Distribution of Executable Versions: You may distribute the Executable form of the Covered Software under the terms of this License or under the terms of a license of Your choice, which may contain terms different from this License, provided that You are in compliance with the terms of this License and that the license for the Executable form does not attempt to limit or alter the recipients rights in the Source Code form from the rights set forth in this License. If You distribute the Covered Software in Executable form under a different license, You must make it absolutely clear that any terms which differ from this License are offered by You alone, not by the Initial Developer or Contributor. You hereby agree to indemnify the Initial Developer and every Contributor for any liability incurred by the Initial Developer or such Contributor as a result of any such terms You offer.

3.6. Larger Works: You may create a Larger Work by combining Covered Software with other code not governed by the terms of this License and distribute the Larger Work as a single product. In such a case, You must make sure the requirements of this License are fulfilled for the Covered Software.

4. Versions of the License.

4.1. New Versions: Sun Microsystems, Inc. is the initial license steward and may publish revised and/or new versions of this License from time to time. Each version will be given a distinguishing version number. Except as provided in Section 4.3, no one other than the license steward has the right to modify this License.

4.2. Effect of New Versions: You may always continue to use, distribute or otherwise make the Covered Software available under the terms of the version of the License under which You originally received the Covered Software. If the Initial Developer includes a notice in the Original Software prohibiting it from being distributed or otherwise made available under any subsequent version of the License, You must distribute and make the Covered Software available under the terms of the version of the License under which You originally received the Covered Software. Otherwise, You may also choose to use, distribute or otherwise make the Covered Software available under the terms of any subsequent version of the License published by the license steward.

4.3. Modified Versions: When You are an Initial Developer and You want to create a new license for Your Original Software, You may create and use a modified version of this License if You: (a) rename the license and remove any references to the name of the license steward (except to note that the license differs from this License); and (b) otherwise make it clear that the license contains terms which differ from this License.

5. DISCLAIMER OF WARRANTY.

COVERED SOFTWARE IS PROVIDED UNDER THIS LICENSE ON AN AS IS BASIS, WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, WARRANTIES THAT THE COVERED SOFTWARE IS FREE OF DEFECTS, MERCHANTABLE, FIT FOR A PARTICULAR PURPOSE OR NON-INFRINGING. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE COVERED SOFTWARE IS WITH YOU. SHOULD ANY COVERED SOFTWARE PROVE DEFECTIVE IN ANY RESPECT, YOU (NOT THE INITIAL DEVELOPER OR ANY OTHER CONTRIBUTOR) ASSUME THE COST OF ANY NECESSARY SERVICING, REPAIR OR CORRECTION. THIS DISCLAIMER OF WARRANTY CONSTITUTES AN ESSENTIAL PART OF THIS LICENSE. NO USE OF ANY COVERED SOFTWARE IS AUTHORIZED HEREUNDER EXCEPT UNDER THIS DISCLAIMER.

6. TERMINATION.

6.1. This License and the rights granted hereunder will terminate automatically if You fail to comply with terms herein and fail to cure such breach within 30 days of becoming aware of the breach. Provisions which, by their nature, must remain in effect beyond the termination of this License shall survive.

6.2. If You assert a patent infringement claim (excluding declaratory judgment actions) against Initial Developer or a Contributor (the Initial Developer or Contributor against whom You assert such claim is referred to as Participant) alleging that the Participant Software (meaning the Contributor Version where the Participant is a Contributor or the Original Software where the Participant is the Initial Developer) directly or indirectly infringes any patent, then any and all rights granted directly or indirectly to You by such Participant, the Initial Developer (if the Initial Developer is not the Participant) and all Contributors under Sections 2.1 and/or 2.2 of this License shall, upon 60 days notice from Participant terminate prospectively and automatically at the expiration of such 60 day notice period, unless if within such 60 day period You withdraw Your claim with respect to the Participant Software against such Participant either unilaterally or pursuant to a written agreement with Participant.

6.3. In the event of termination under Sections 6.1 or 6.2 above, all end user licenses that have been validly granted by You or any distributor hereunder prior to termination (excluding licenses granted to You by any distributor) shall survive termination.

7. LIMITATION OF LIABILITY.

UNDER NO CIRCUMSTANCES AND UNDER NO LEGAL THEORY, WHETHER TORT (INCLUDING NEGLIGENCE), CONTRACT, OR OTHERWISE, SHALL YOU, THE INITIAL DEVELOPER, ANY OTHER CONTRIBUTOR, OR ANY DISTRIBUTOR OF COVERED SOFTWARE, OR ANY SUPPLIER OF ANY OF SUCH PARTIES, BE LIABLE TO ANY PERSON FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OF ANY CHARACTER INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOST PROFITS, LOSS OF GOODWILL, WORK STOPPAGE, COMPUTER FAILURE OR MALFUNCTION, OR ANY AND ALL OTHER COMMERCIAL DAMAGES OR LOSSES, EVEN IF SUCH PARTY SHALL HAVE BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. THIS LIMITATION OF LIABILITY SHALL NOT APPLY TO LIABILITY FOR DEATH OR PERSONAL INJURY RESULTING FROM SUCH PARTYS NEGLIGENCE TO THE EXTENT APPLICABLE LAW PROHIBITS SUCH LIMITATION. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THIS EXCLUSION AND LIMITATION MAY NOT APPLY TO YOU.

8. U.S. GOVERNMENT END USERS.

The Covered Software is a commercial item, as that term is defined in 48 C.F.R. 2.101 (Oct. 1995), consisting of commercial computer software (as that term is defined at 48 C.F.R. 252.227-7014(a)(1)) and commercial computer software documentation as such terms are used in 48 C.F.R. 12.212 (Sept. 1995). Consistent with 48 C.F.R. 12.212 and 48 C.F.R. 227.7202-1 through 227.7202-4 (June 1995), all U.S. Government End Users acquire Covered Software with only those rights set forth herein. This U.S. Government Rights clause is in lieu of, and supersedes, any other FAR, DFAR, or other clause or provision that addresses Government rights in computer software under this License.

9. MISCELLANEOUS.

This License represents the complete agreement concerning subject matter hereof. If any provision of this License is held to be unenforceable, such provision shall be reformed only to the extent necessary to make it enforceable. This License shall be governed by the law of the jurisdiction specified in a notice contained within the Original Software (except to the extent applicable law, if any, provides otherwise), excluding such jurisdictions conflict-of-law provisions. Any litigation relating to this License shall be subject to the jurisdiction of the courts located in the jurisdiction and venue specified in a notice contained within the Original Software, with the losing party responsible for costs, including, without limitation, court costs and reasonable attorneys fees and expenses. The application of the United Nations Convention on Contracts for the International Sale of Goods is expressly excluded. Any law or regulation which provides that the language of a contract shall be construed against the drafter shall not apply to this License. You agree that You alone are responsible for compliance with the United States export administration regulations (and the export control laws and regulation of any other countries) when You use, distribute or otherwise make available any Covered Software.

10. RESPONSIBILITY FOR CLAIMS.

As between Initial Developer and the Contributors, each party is responsible for claims and damages arising, directly or indirectly, out of its utilization of rights under this License and You agree to work with Initial Developer and Contributors to distribute such responsibility on an equitable basis. Nothing herein is intended or shall be deemed to constitute any admission of liability.

GNU Public License

Version 3, 29 June 2007

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

Preamble

The GNU General Public License is a free, copy left license for software and other kinds of works.

The licenses for most software and other practical works are designed to take away your freedom to share and change the works. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change all versions of a program--to make sure it remains free software for all its users. We, the Free Software Foundation, use the GNU General Public License for most of our software; it applies also to any other work released this way by its authors. You can apply it to your programs, too.

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for them if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs, and that you know you can do these things.

To protect your rights, we need to prevent others from denying you these rights or asking you to surrender the rights. Therefore, you have certain responsibilities if you distribute copies of the software, or if you modify it: responsibilities to respect the freedom of others.

For example, if you distribute copies of such a program, whether gratis or for a fee, you must pass on to the recipients the same freedoms that you received. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

Developers that use the GNU GPL protect your rights with two steps: (1) assert copyright on the software, and (2) offer you this License giving you legal permission to copy, distribute and/or modify it.

For the developers' and authors' protection, the GPL clearly explains that there is no warranty for this free software. For both users' and authors' sake, the GPL requires that modified versions be marked as changed, so that their problems will not be attributed erroneously to authors of previous versions.

Some devices are designed to deny users access to install or run modified versions of the software inside them, although the manufacturer can do so. This is fundamentally incompatible with the aim of protecting users' freedom to change the software. The systematic pattern of such abuse occurs in the area of products for individuals to use, which is precisely where it is most unacceptable. Therefore, we have designed this version of the GPL to prohibit the practice for those products. If such problems arise substantially in other domains, we stand ready to extend this provision to those domains in future versions of the GPL, as needed to protect the freedom of users.

Finally, every program is threatened constantly by software patents. States should not allow patents to restrict development and use of software on general-purpose computers, but in those that do, we wish to avoid the special danger that patents applied to a free program could make it effectively proprietary. To prevent this, the GPL assures that patents cannot be used to render the program non-free.

The precise terms and conditions for copying, distribution and modification follow.

Terms and Conditions

1. Definitions.
   “This License” refers to version 3 of the GNU General Public License.
   “Copyright” also means copyright-like laws that apply to other kinds of works, such as semiconductor masks.
   “The Program” refers to any copyrightable work licensed under this License. Each licensee is addressed as “you”. “Licensees” and “recipients” may be individuals or organizations.
   To “modify” a work means to copy from or adapt all or part of the work in a fashion requiring copyright permission, other than the making of an exact copy. The resulting work is called a “modified version” of the earlier work or a work “based on” the earlier work.
   A “covered work” means either the unmodified Program or a work based on the Program.
   To “propagate” a work means to do anything with it that, without permission, would make you directly or secondarily liable for infringement under applicable copyright law, except executing it on a computer or modifying a private copy. Propagation includes copying, distribution (with or without modification), making available to the public, and in some countries other activities as well.
   To “convey” a work means any kind of propagation that enables other parties to make or receive copies. Mere interaction with a user through a computer network, with no transfer of a copy, is not conveying.
   An interactive user interface displays “Appropriate Legal Notices” to the extent that it includes a convenient and prominently visible feature that (1) displays an appropriate copyright notice, and (2) tells the user that there is no warranty for the work (except to the extent that warranties

are provided), that licensees may convey the work under this License, and how to view a copy of this License. If the interface presents a list of user commands or options, such as a menu, a prominent item in the list meets this criterion.

2. Source Code.
   The “source code” for a work means the preferred form of the work for making modifications to it. “Object code” means any non-source form of a work.
   A “Standard Interface” means an interface that either is an official standard defined by a recognized standards body, or, in the case of interfaces specified for a particular programming language, one that is widely used among developers working in that language.
   The “System Libraries” of an executable work include anything, other than the work as a whole, that (a) is included in the normal form of packaging a Major Component, but which is not part of that Major Component, and (b) serves only to enable use of the work with that Major Component, or to implement a Standard Interface for which an implementation is available to the public in source code form. A “Major Component”, in this context, means a major essential component (kernel, window system, and so on) of the specific operating system (if any) on which the executable work runs, or a compiler used to produce the work, or an object code interpreter used to run it.
   The “Corresponding Source” for a work in object code form means all the source code needed to generate, install, and (for an executable work) run the object code and to modify the work, including scripts to control those activities. However, it does not include the work's System Libraries, or general-purpose tools or generally available free programs which are used unmodified in performing those activities but which are not part of the work. For example, Corresponding Source includes interface definition files associated with source files for the work, and the source code for shared libraries and dynamically linked subprograms that the work is specifically designed to require, such as by intimate data communication or control flow between those subprograms and other parts of the work.
   The Corresponding Source need not include anything that users can regenerate automatically from other parts of the Corresponding Source.
   The Corresponding Source for a work in source code form is that same work.

3. Basic Permissions.
   All rights granted under this License are granted for the term of copyright on the Program, and are irrevocable provided the stated conditions are met. This License explicitly affirms your unlimited permission to run the unmodified Program. The output from running a covered work is covered by this License only if the output, given its content, constitutes a covered work. This License acknowledges your rights of fair use or other equivalent, as provided by copyright law.
   You may make, run and propagate covered works that you do not convey, without conditions so long as your license otherwise remains in force. You may convey covered works to others for the sole purpose of having them make modifications exclusively for you, or provide you with facilities for running those works, provided that you comply with the terms of this License in conveying all material for which you do not control copyright. Those thus making or running the covered works for you must do so exclusively on your behalf, under your direction and control, on terms that prohibit them from making any copies of your copyrighted material outside their relationship with you.
   Conveying under any other circumstances is permitted solely under the conditions stated below. Sublicensing is not allowed; section 10 makes it unnecessary.

4. Protecting Users' Legal Rights From Anti-Circumvention Law.

No covered work shall be deemed part of an effective technological measure under any applicable law fulfilling obligations under article 11 of the WIPO copyright treaty adopted on 20 December 1996, or similar laws prohibiting or restricting circumvention of such measures.
When you convey a covered work, you waive any legal power to forbid circumvention of technological measures to the extent such circumvention is effected by exercising rights under this License with respect to the covered work, and you disclaim any intention to limit operation or modification of the work as a means of enforcing, against the work's users, your or third parties' legal rights to forbid circumvention of technological measures.

5. Conveying Verbatim Copies.
   You may convey verbatim copies of the Program's source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice; keep intact all notices stating that this License and any non-permissive terms added in accord with section 7 apply to the code; keep intact all notices of the absence of any warranty; and give all recipients a copy of this License along with the Program.
   You may charge any price or no price for each copy that you convey, and you may offer support or warranty protection for a fee.

6. Conveying Modified Source Versions.
   You may convey a work based on the Program, or the modifications to produce it from the Program, in the form of source code under the terms of section 4, provided that you also meet all of these conditions:

   a. The work must carry prominent notices stating that you modified it, and giving a relevant date.

   b. The work must carry prominent notices stating that it is released under this License and any conditions added under section 7. This requirement modifies the requirement in section 4 to “keep intact all notices”.

   c. You must license the entire work, as a whole, under this License to anyone who comes into possession of a copy. This License will therefore apply, along with any applicable section 7 additional terms, to the whole of the work, and all its parts, regardless of how they are packaged. This License gives no permission to license the work in any other way, but it does not invalidate such permission if you have separately received it.

   d. If the work has interactive user interfaces, each must display Appropriate Legal Notices; however, if the Program has interactive interfaces that do not display Appropriate Legal Notices, your work need not make them do so.
   A compilation of a covered work with other separate and independent works, which are not by their nature extensions of the covered work, and which are not combined with it such as to form a larger program, in or on a volume of a storage or distribution medium, is called an “aggregate” if the compilation and its resulting copyright are not used to limit the access or legal rights of the compilation's users beyond what the individual works permit. Inclusion of a covered work in an aggregate does not cause this License to apply to the other parts of the aggregate.

7. Conveying Non-Source Forms.
   You may convey a covered work in object code form under the terms of sections 4 and 5, provided that you also convey the machine-readable Corresponding Source under the terms of this License, in one of these ways:

a. Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by the Corresponding Source fixed on a durable physical medium customarily used for software interchange.

b. Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by a written offer, valid for at least three years and valid for as long as you offer spare parts or customer support for that product model, to give anyone who possesses the object code either (1) a copy of the Corresponding Source for all the software in the product that is covered by this License, on a durable physical medium customarily used for software interchange, for a price no more than your reasonable cost of physically performing this conveying of source, or (2) access to copy the Corresponding Source from a network server at no charge.

c. Convey individual copies of the object code with a copy of the written offer to provide the Corresponding Source. This alternative is allowed only occasionally and noncommercially, and only if you received the object code with such an offer, in accord with subsection 6b.

d. Convey the object code by offering access from a designated place (gratis or for a charge), and offer equivalent access to the Corresponding Source in the same way through the same place at no further charge. You need not require recipients to copy the Corresponding Source along with the object code. If the place to copy the object code is a network server, the Corresponding Source may be on a different server (operated by you or a third party) that supports equivalent copying facilities, provided you maintain clear directions next to the object code saying where to find the Corresponding Source. Regardless of what server hosts the Corresponding Source, you remain obligated to ensure that it is available for as long as needed to satisfy these requirements.

e. Convey the object code using peer-to-peer transmission, provided you inform other peers where the object code and Corresponding Source of the work are being offered to the general public at no charge under subsection 6d.
A separable portion of the object code, whose source code is excluded from the Corresponding Source as a System Library, need not be included in conveying the object code work.
A “User Product” is either (1) a “consumer product”, which means any tangible personal property which is normally used for personal, family, or household purposes, or (2) anything designed or sold for incorporation into a dwelling. In determining whether a product is a consumer product, doubtful cases shall be resolved in favor of coverage. For a particular product received by a particular user, “normally used” refers to a typical or common use of that class of product, regardless of the status of the particular user or of the way in which the particular user actually uses, or expects or is expected to use, the product. A product is a consumer product regardless of whether the product has substantial commercial, industrial or non-consumer uses, unless such uses represent the only significant mode of use of the product.
“Installation Information” for a User Product means any methods, procedures, authorization keys, or other information required to install and execute modified versions of a covered work in that User Product from a modified version of its Corresponding Source. The information must suffice to ensure that the continued functioning of the modified object code is in no case prevented or interfered with solely because modification has been made.
If you convey an object code work under this section in, or with, or specifically for use in, a User Product, and the conveying occurs as part of a transaction in which the right of

possession and use of the User Product is transferred to the recipient in perpetuity or for a fixed term (regardless of how the transaction is characterized), the Corresponding Source conveyed under this section must be accompanied by the Installation Information. But this requirement does not apply if neither you nor any third party retains the ability to install modified object code on the User Product (for example, the work has been installed in ROM).
The requirement to provide Installation Information does not include a requirement to continue to provide support service, warranty, or updates for a work that has been modified or installed by the recipient, or for the User Product in which it has been modified or installed. Access to a network may be denied when the modification itself materially and adversely affects the operation of the network or violates the rules and protocols for communication across the network.
Corresponding Source conveyed, and Installation Information provided, in accord with this section must be in a format that is publicly documented (and with an implementation available to the public in source code form), and must require no special password or key for unpacking, reading or copying.

8. Additional Terms.
"Additional permissions" are terms that supplement the terms of this License by making exceptions from one or more of its conditions. Additional permissions that are applicable to the entire Program shall be treated as though they were included in this License, to the extent that they are valid under applicable law. If additional permissions apply only to part of the Program, that part may be used separately under those permissions, but the entire Program remains governed by this License without regard to the additional permissions.
When you convey a copy of a covered work, you may at your option remove any additional permissions from that copy, or from any part of it. (Additional permissions may be written to require their own removal in certain cases when you modify the work.) You may place additional permissions on material, added by you to a covered work, for which you have or can give appropriate copyright permission.
Notwithstanding any other provision of this License, for material you add to a covered work, you may (if authorized by the copyright holders of that material) supplement the terms of this License with terms:

a. Disclaiming warranty or limiting liability differently from the terms of sections 15 and 16 of this License; or

b. Requiring preservation of specified reasonable legal notices or author attributions in that material or in the Appropriate Legal Notices displayed by works containing it; or

c. Prohibiting misrepresentation of the origin of that material, or requiring that modified versions of such material be marked in reasonable ways as different from the original version; or

d. Limiting the use for publicity purposes of names of licensors or authors of the material; or

e. Declining to grant rights under trademark law for use of some trade names, trademarks, or service marks; or

f. Requiring indemnification of licensors and authors of that material by anyone who conveys the material (or modified versions of it) with contractual assumptions of liability to the recipient, for any liability that these contractual assumptions directly impose on those licensors and authors.

All other non-permissive additional terms are considered “further restrictions” within the meaning of section 10. If the Program as you received it, or any part of it, contains a notice stating that it is governed by this License along with a term that is a further restriction, you may remove that term. If a license document contains a further restriction but permits relicensing or conveying under this License, you may add to a covered work material governed by the terms of that license document, provided that the further restriction does not survive such relicensing or conveying.
If you add terms to a covered work in accord with this section, you must place, in the relevant source files, a statement of the additional terms that apply to those files, or a notice indicating where to find the applicable terms.
Additional terms, permissive or non-permissive, may be stated in the form of a separately written license, or stated as exceptions; the above requirements apply either way.

9. Termination.
You may not propagate or modify a covered work except as expressly provided under this License. Any attempt otherwise to propagate or modify it is void, and will automatically terminate your rights under this License (including any patent licenses granted under the third paragraph of section 11).
However, if you cease all violation of this License, then your license from a particular copyright holder is reinstated (a) provisionally, unless and until the copyright holder explicitly and finally terminates your license, and (b) permanently, if the copyright holder fails to notify you of the violation by some reasonable means prior to 60 days after the cessation.
Moreover, your license from a particular copyright holder is reinstated permanently if the copyright holder notifies you of the violation by some reasonable means, this is the first time you have received notice of violation of this License (for any work) from that copyright holder, and you cure the violation prior to 30 days after your receipt of the notice.
Termination of your rights under this section does not terminate the licenses of parties who have received copies or rights from you under this License. If your rights have been terminated and not permanently reinstated, you do not qualify to receive new licenses for the same material under section 10.

10. Acceptance Not Required for Having Copies.
You are not required to accept this License in order to receive or run a copy of the Program. Ancillary propagation of a covered work occurring solely as a consequence of using peer-to-peer transmission to receive a copy likewise does not require acceptance. However, nothing other than this License grants you permission to propagate or modify any covered work. These actions infringe copyright if you do not accept this License. Therefore, by modifying or propagating a covered work, you indicate your acceptance of this License to do so.

11. Automatic Licensing of Downstream Recipients.
Each time you convey a covered work, the recipient automatically receives a license from the original licensors, to run, modify and propagate that work, subject to this License. You are not responsible for enforcing compliance by third parties with this License.
An “entity transaction” is a transaction transferring control of an organization, or substantially all assets of one, or subdividing an organization, or merging organizations. If propagation of a covered work results from an entity transaction, each party to that transaction who receives a copy of the work also receives whatever licenses to the work the party's predecessor in interest had or could give under the previous paragraph, plus a right to possession of the Corresponding Source of the work from the predecessor in interest, if the predecessor has it or can get it with reasonable efforts.

You may not impose any further restrictions on the exercise of the rights granted or affirmed under this License. For example, you may not impose a license fee, royalty, or other charge for exercise of rights granted under this License, and you may not initiate litigation (including a cross-claim or counterclaim in a lawsuit) alleging that any patent claim is infringed by making, using, selling, offering for sale, or importing the Program or any portion of it.

12. Patents.
A “contributor” is a copyright holder who authorizes use under this License of the Program or a work on which the Program is based. The work thus licensed is called the contributor's “contributor version”.
A contributor's “essential patent claims” are all patent claims owned or controlled by the contributor, whether already acquired or hereafter acquired, that would be infringed by some manner, permitted by this License, of making, using, or selling its contributor version, but do not include claims that would be infringed only as a consequence of further modification of the contributor version. For purposes of this definition, “control” includes the right to grant patent sublicenses in a manner consistent with the requirements of this License.
Each contributor grants you a non-exclusive, worldwide, royalty-free patent license under the contributor's essential patent claims, to make, use, sell, offer for sale, import and otherwise run, modify and propagate the contents of its contributor version.
In the following three paragraphs, a “patent license” is any express agreement or commitment, however denominated, not to enforce a patent (such as an express permission to practice a patent or covenant not to sue for patent infringement). To “grant” such a patent license to a party means to make such an agreement or commitment not to enforce a patent against the party.
If you convey a covered work, knowingly relying on a patent license, and the Corresponding Source of the work is not available for anyone to copy, free of charge and under the terms of this License, through a publicly available network server or other readily accessible means, then you must either (1) cause the Corresponding Source to be so available, or (2) arrange to deprive yourself of the benefit of the patent license for this particular work, or (3) arrange, in a manner consistent with the requirements of this License, to extend the patent license to downstream recipients. “Knowingly relying” means you have actual knowledge that, but for the patent license, your conveying the covered work in a country, or your recipient's use of the covered work in a country, would infringe one or more identifiable patents in that country that you have reason to believe are valid.
If, pursuant to or in connection with a single transaction or arrangement, you convey, or propagate by procuring conveyance of, a covered work, and grant a patent license to some of the parties receiving the covered work authorizing them to use, propagate, modify or convey a specific copy of the covered work, then the patent license you grant is automatically extended to all recipients of the covered work and works based on it.
A patent license is “discriminatory” if it does not include within the scope of its coverage, prohibits the exercise of, or is conditioned on the non-exercise of one or more of the rights that are specifically granted under this License. You may not convey a covered work if you are a party to an arrangement with a third party that is in the business of distributing software, under which you make payment to the third party based on the extent of your activity of conveying the work, and under which the third party grants, to any of the parties who would receive the covered work from you, a discriminatory patent license (a) in connection with copies of the covered work conveyed by you (or copies made from those copies), or (b) primarily for and in connection with specific products or compilations that contain the covered work, unless you entered into that arrangement, or that patent license was granted, prior to 28 March 2007.

Nothing in this License shall be construed as excluding or limiting any implied license or other defenses to infringement that may otherwise be available to you under applicable patent law.

13. No Surrender of Others' Freedom.
If conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot convey a covered work so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not convey it at all. For example, if you agree to terms that obligate you to collect a royalty for further conveying from those to whom you convey the Program, the only way you could satisfy both those terms and this License would be to refrain entirely from conveying the Program.

14. Use with the GNU Affero General Public License.
Notwithstanding any other provision of this License, you have permission to link or combine any covered work with a work licensed under version 3 of the GNU Affero General Public License into a single combined work, and to convey the resulting work. The terms of this License will continue to apply to the part which is the covered work, but the special requirements of the GNU Affero General Public License, section 13, concerning interaction through a network will apply to the combination as such.

15. Revised Versions of this License.
The Free Software Foundation may publish revised and/or new versions of the GNU General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.
Each version is given a distinguishing version number. If the Program specifies that a certain numbered version of the GNU General Public License “or any later version” applies to it, you have the option of following the terms and conditions either of that numbered version or of any later version published by the Free Software Foundation. If the Program does not specify a version number of the GNU General Public License, you may choose any version ever published by the Free Software Foundation.
If the Program specifies that a proxy can decide which future versions of the GNU General Public License can be used, that proxy's public statement of acceptance of a version permanently authorizes you to choose that version for the Program.
Later license versions may give you additional or different permissions. However, no additional obligations are imposed on any author or copyright holder as a result of your choosing to follow a later version.

16. Disclaimer of Warranty.
THERE IS NO WARRANTY FOR THE PROGRAM, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE PROGRAM “AS IS” WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PROGRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

17. Limitation of Liability.
IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MODIFIES AND/OR CONVEYS THE PROGRAM AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE

THE PROGRAM (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE PROGRAM TO OPERATE WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

18. Interpretation of Sections 16 and 17.
If the disclaimer of warranty and limitation of liability provided above cannot be given local legal effect according to their terms, reviewing courts shall apply local law that most closely approximates an absolute waiver of all civil liability in connection with the Program, unless a warranty or assumption of liability accompanies a copy of the Program in return for a fee.

END OF TERMS AND CONDITIONS