



Overland  
Storage

# SnapSAN™ S1000

*User Guide*



January 2013  
10400310-003



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FM 2.1.1

Overland Storage, Inc.  
9112 Spectrum Center Blvd.  
San Diego, CA 92123  
U.S.A.

Tel: 1.877.654.3429 (toll-free U.S.)  
Tel: +1.858.571.5555, Option 5 (International)  
Fax: +1.858.571.0982 (general)  
Fax: +1.858.571.3664 (sales)  
[www.overlandstorage.com](http://www.overlandstorage.com)

# Preface

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This user guide explains how to install, setup, and use your new Overland Storage SnapSAN S1000 server.

This guide assumes that you are familiar with computer hardware, data storage, and network administration terminology and tasks. It also assumes you have basic knowledge of Fibre Channel, Internet SCSI (iSCSI), Serial-attached SCSI (SAS), Serial ATA (SATA), Storage Area Network (SAN), and Redundant Array of Independent Disks (RAID) technology.

## Product Documentation and Firmware Updates

Overland Storage SnapSAN product documentation and additional literature are available online, along with the latest release of the SnapSAN S1000 software.

Point your browser to:

<http://support.overlandstorage.com/support/snapsan.htm>

Follow the appropriate link on that page to download the **latest** software file or document.

For additional assistance, search at <http://support.overlandstorage.com>.

## Overland Technical Support

For help configuring and using your SnapSAN S1000, email our technical support staff at [techsupport@overlandstorage.com](mailto:techsupport@overlandstorage.com).

You can get additional technical support information on the [Contact Us](#) web page:

<http://docs.overlandstorage.com/support>




For a complete list of support times depending on the type of coverage, visit our website at:

<http://docs.overlandstorage.com/care>

## Conventions

This document exercises several alerts and typographical conventions.

### Alerts

Convention	Description & Usage
 <b>IMPORTANT</b>	An <i>Important</i> note is a type of note that provides information essential to the completion of a task or that can impact the product and its function.
 <b>CAUTION</b>	A <i>Caution</i> contains information that the user needs to know to avoid damaging or permanently deleting data or causing physical damage to the hardware or system.
 <b>WARNING</b>	A <i>Warning</i> contains information concerning personal safety. Failure to follow directions in the warning could result in bodily harm or death.
<b>AVERTISSEMENT</b>	Un Canadien <i>avertissement</i> comme celui-ci contient des informations relatives à la sécurité personnelle. Ignorer les instructions dans l'avertissement peut entraîner des lésions corporelles ou la mort.

### Typographical Conventions

Convention	Description & Usage
<b>Button_name</b>	Words in this special boldface font indicate the names of command buttons found in the Web Management Interface.
Ctrl-Alt-r	This type of format details the keys you press simultaneously. In this example, hold down the Ctrl and Alt keys and press the r key.
NOTE	A Note indicates neutral or positive information that emphasizes or supplements important points of the main text. A note supplies information that may apply only in special cases, for example, memory limitations or details that apply to specific program versions.
Menu Flow Indicator (>)	Words with a greater than sign between them indicate the flow of actions to accomplish a task. For example, Setup > Passwords > User indicates that you should press the <b>Setup</b> button, then the <b>Passwords</b> button, and finally the <b>User</b> button to accomplish a task.
<i>Courier Italic</i>	A variable for which you must substitute a value
<b>Courier Bold</b>	Commands you enter in a command-line interface (CLI)

Information contained in this guide has been reviewed for accuracy, but not for product warranty because of the various environments, operating systems, or settings involved. Information and specifications may change without notice.

## Preface

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## Overland Glossary & Acronym List

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## SnapSAN S1000 Overview

This user guide describes how to set up and use the Overland Storage SnapSAN S1000.



The storage array, available in different configurations of iSCSI, Fibre Channel, and SAS interfaces, together with the SnapSAN S1000 installed software, provides a flexible, intelligent, storage area network (SAN) solution for virtualized server environments and the growing demand for data storage. With a SnapSAN S1000, you can store, share, protect, and manage data through a single easy-to-use web interface.

## Hardware

This section provides basic information about the hardware components.

### Front Panel

The front of a SnapSAN S1000 server with the bezel attached:



The Front Panel Display control panel is located in the upper left corner.

### Front Panel Display

There are five buttons to control SnapSAN S1000 Front Panel Display, including: ▲ (up), ▼ (down), ENT (Enter), ESC (Escape) and MUTE.



NOTE: The buttons are covered when the bezel is installed. However, the Front Panel Display and three LEDs are still visible with the bezel attached.



This table shows the items located on the Front Panel Display:

Number	Description
1	LCD display (0.75" x 2.0"), white text on a blue background
2	Up button (▲)
3	Down button (▼)
4	ENT (Enter) button
5	ESC (Escape) button
6	Mute button
7	Power LED: Green = Power ON Off = Power OFF
8	Status LED: Red = System failure Off = No problems
9	Access LED: Green = Host is accessing storage array Off = No Host access attempts


## Disk Drive Assemblies



**IMPORTANT:** For proper cooling, every slot must have either a disk drive assembly or a blank disk assembly in it.



 Blank Disk Assembly

 Empty Slot

Disk drive assemblies consist of a SnapSAN S1000 disk tray with either SAS, SATA II, or Green SATA II disk drive preinstalled in it. A blank assembly consists of a special empty tray used to ensure proper airflow within the enclosure. Eight blank assemblies are included with the server.



The front of each disk tray has four components:



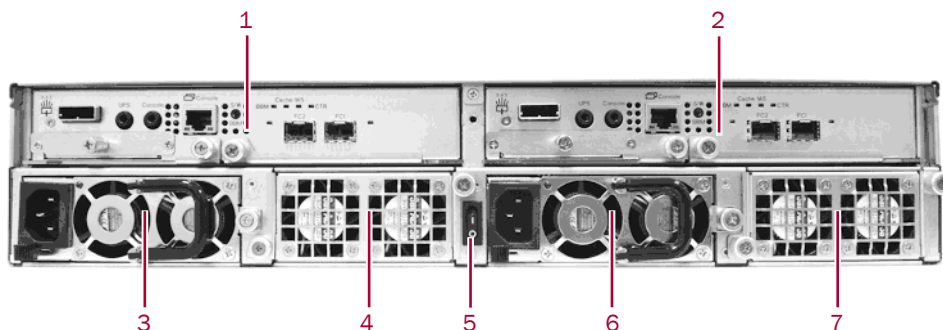
This table provides details about the front components of a disk tray:

Number	Description
1	Tray removal handle.
2	Latch to release the tray and tray handle.
3	Power LED: Green = Drive is inserted and good. Red = Drive has failed. OFF = No disk drive in the tray.
4	Access LED: Blue blinking = The disk drive is being accessed. OFF = The disk drive is not being accessed or there is no disk drive in the tray.

## Rear Panel

**CAUTION:** To prevent data loss, when powering down the SnapSAN S1000, perform a normal shutdown (see “[Powering Down the SnapSAN S1000](#)” on page 2-4) to flush any data from the cache to the physical disks, as opposed to simply turning the power OFF. All active initiators need to be logged off before shutting the server down.

The individual components are all configured as removable modules and are accessible from the rear.



This table describes the rear components:

Callout	Description	Rear Label
1	Controller 2 (Optional)	CL2
2	Controller 1	CL1
3	Power Supply Unit 1	PSU1
4	Fan Module	FAN1/2
5	Power Switch ("I"=ON and "O"=OFF)	(none)
6	Power Supply Unit 2	PSU2
7	Fan Module	FAN3/4

## Controllers

All controllers for the SnapSAN S1000 are shipped in separate packaging. Each comes with its own Battery Backup Module (BBM).

**NOTE:** To facilitate support of your controllers, each BBM must be installed in the controller with which it came packaged. All controllers and batteries must be registered with the SnapSAN S1000 in which they are installed.

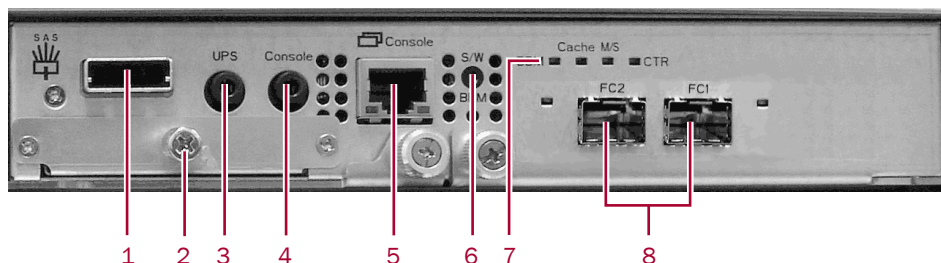
By default, the SnapSAN S1000 is configured as a single controller system. To change it to a dual controller system with Master and Secondary controllers:

1. Install the optional **Secondary** controller.
2. Go to **System Maintenance > Upgrade > Controller Mode**.
3. Using the drop-down list, select **Dual** and click Apply.

For the dual controller setup, both controllers must be the same type (for example, 10Gb iSCSI controllers).

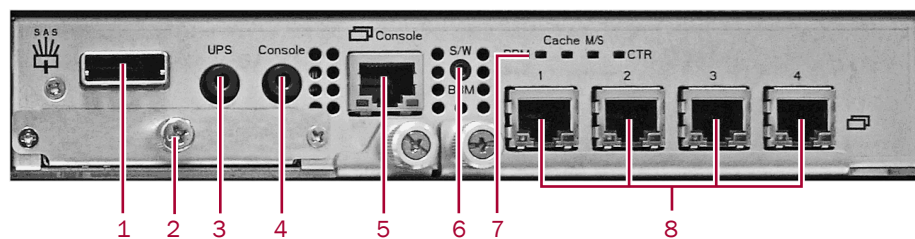
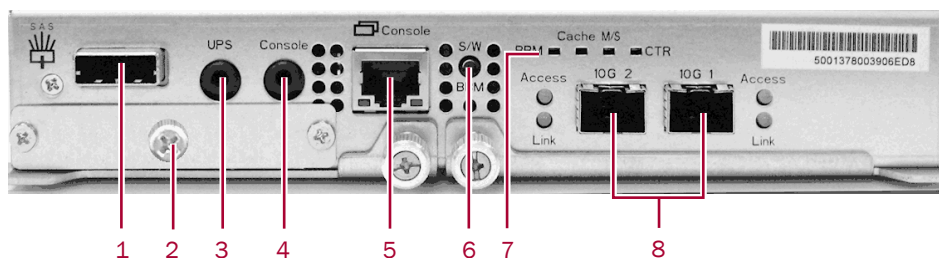
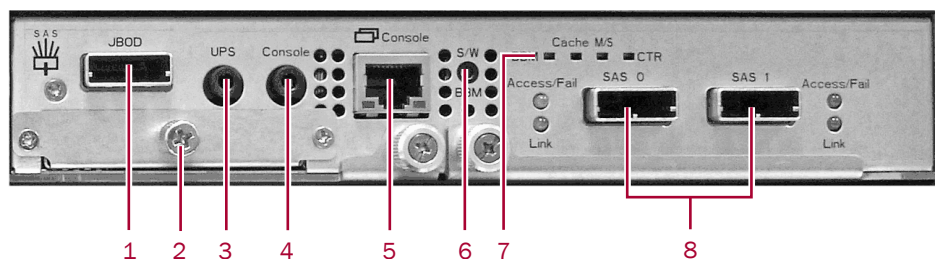
There are four different controllers available for the SnapSAN S1000. With the exception of the host SAN ports, the connections are the same on all four modules:

### Dual-PORT 4Gb Fibre Channel controller:



This table details the items called out in the controller components photos:

Number	Description
1	Expansion array port (SAS)
2	Battery Backup Module (BBM) slot
3	Port for APC Smart-UPS communication
4	Console serial port
5	Management console port
6	BBM status button – used to check the battery when the power is OFF. Press the Status button to activate: <ul style="list-style-type: none"> <li>• If the LED shows Green, then the BBM still has power to keep data in the cache.</li> <li>• If LED stays OFF, then the BBM power has run out and it cannot provide power for the cache anymore. It needs to be recharged or replaced.</li> </ul>
7	LEDs (from left to right): <ul style="list-style-type: none"> <li>• BBM LED (when status button pressed): <ul style="list-style-type: none"> <li>Green = BBM installed and powered.</li> <li>Off = No BBM installed or dead.</li> </ul> </li> <li>• Cache LED: <ul style="list-style-type: none"> <li>Orange = Data on the cache waiting for flush.</li> <li>Off = No data on the cache.</li> </ul> </li> <li>• Master Slave (MS) LED: <ul style="list-style-type: none"> <li>Green = This is the Master controller.</li> <li>Off = This is the Slave controller.</li> </ul> </li> <li>• Controller (CTR) Health LED: <ul style="list-style-type: none"> <li>Green = Controller status normal.</li> <li>Red = System booting or controller is not working properly. For example, a hardware failure or software error causing a hang.</li> </ul> </li> </ul>
8	SAN ports (depending on model): <ul style="list-style-type: none"> <li>• 4Gb Fibre Channel ports (x2) (shown without SFP modules)</li> <li>• Gigabit iSCSI ports (x4)</li> <li>• 10Gb iSCSI ports (x2) (shown without SFP+ modules)</li> <li>• 6Gb SAS ports</li> </ul>

**Four-Port Gigabit (Gb) iSCSI controller:****Dual-Port 10Gb iSCSI controller:****Dual-Port 6Gb SAS controller:**

## RAID Concepts

RAID is the abbreviation of *Redundant Array of Independent Disks*. The basic idea of RAID is to combine multiple individual drives together to form one large logical drive or volume. The operating system detects the RAID drive as a single storage device.

### RAID Levels

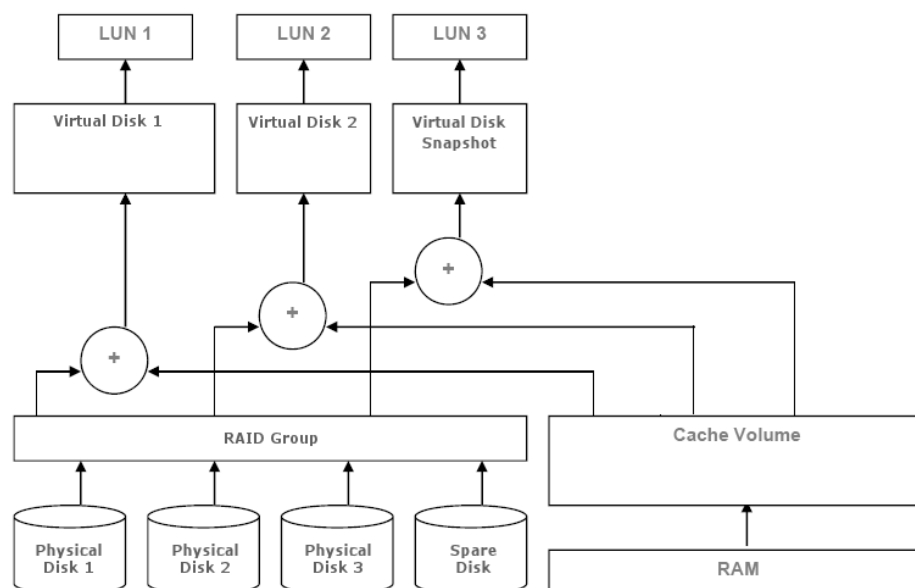
There are different RAID levels with different degrees of data protection, data availability, and performance. A description of supported RAID levels follow:

Type	Description	Min. No. of Drives
RAID 0	Disk striping.	At least one
RAID 1	Disk mirroring over two disks.	At least two
RAID 3	Disk striping with parity on a dedicated disk.	At least three
RAID 5	Disk striping with distributed parity.	At least three
RAID 6	Disk striping with dual-distributed parity.	At least four
RAID 0+1	Disk mirroring of a RAID 0 group.	At least four

Type	Description	Min. No. of Drives
RAID 10	Disk striping of a RAID 1 group.	At least four
RAID 30	Disk striping of a RAID 3 group.	At least six
RAID 50	Disk striping of a RAID 5 group.	At least six
RAID 60	Disk striping of a RAID 6 group.	At least eight
JBOD	Independently address a drive.	At least one

## Volume Relationships

The following graphic describes the relationship of RAID components. One RAID Group consists of a set of virtual disks and owns one RAID level attribute. Each RAID Group can be divided into several virtual disks. The virtual disks in one group share the same RAID level, but may have different volume capacities. All virtual disks share the Cache Volume (CV) to execute the data transaction. Logical Unit Number (LUN) is a unique identifier, in which users can access through SCSI commands.



## Fibre Channel Concepts

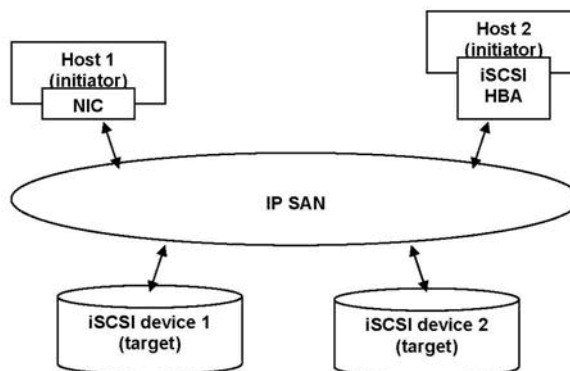
Fibre Channel is a gigabit-speed network technology which transports SCSI commands over Fibre Channel networks. Fibre Channel was primarily concerned with simplifying the connections and increasing distances, but later designers added the goals of connecting SCSI disk storage, providing higher speeds and far greater numbers of connected devices.

The SnapSAN S1000 Fibre Channel controller only supports loop networks. It does not work with Fabric networks.

A Fibre Channel Arbitrated Loop (FC-AL) is a Fibre Channel network in which up to 126 systems and devices are connected in a loop topology, with each transmitter connecting to the receiver of the device on its logical right. The Fibre Channel Arbitrated Loop protocol used for transmission is different from Fibre Channel switched and point-to-point protocols. Multiple FC-AL loops can be connected via a fabric switch to extend the network.

## iSCSI Concepts

Internet SCSI (iSCSI) is a protocol which encapsulates SCSI commands and data in TCP/IP packets for linking storage devices with servers over common IP infrastructures. iSCSI provides high performance Storage Area Networks (SAN) over standard IP networks like LAN, WAN, or the Internet.



IP SANs are true Storage Area Networks which allow several servers to attach to an infinite number of storage volumes by using iSCSI over TCP/IP networks. IP SANs can scale the storage capacity with any type and brand of storage system. In addition, it can be used by any type of network (Ethernet, Fast Ethernet, Gigabit Ethernet, and 10-Gigabit Ethernet) and any combination of operating systems (Microsoft Windows, Linux, Solaris, Mac OS X, etc.) within the SAN network. IP SANs also include mechanisms for security, data replication, multi-path, and high availability.

Storage protocols, such as iSCSI, have “two ends” in the connection. These ends are initiator and target. In iSCSI, they are called the iSCSI initiator and the iSCSI target. The iSCSI initiator requests or initiates any iSCSI communication like read or write. The iSCSI target can be the storage device itself or an appliance which controls and serves volumes or virtual volumes. It performs SCSI commands sent by the initiator or is a bridge to an attached storage device.

The initiator can be either software or hardware (HBA). Refer to the SnapSAN S1000 Compatibility Guide on the Overland Storage web site for the latest certification list. OS native initiators or other software initiators use standard TCP/IP stack and Ethernet hardware, while iSCSI HBAs use their own iSCSI and TCP/IP stacks on board. Hardware iSCSI HBAs also provide their own initiator tool. Please refer to the vendors’ HBA user guide. Microsoft, Linux, Solaris, and Mac provide software versions of iSCSI initiator drivers.

## SAS Concepts

SAS, short for *Serial Attached SCSI*, is a point-to-point serial protocol that replaces parallel SCSI bus technology (multidrop) and uses the standard SCSI command set. It has no termination issues, supports up to 16,384 devices (using expanders), and eliminates clock skew. It consists of an Initiator that originates device service requests, a Target containing logical units that receives device service requests, and a Service Delivery Subsystem that transmits information between the Initiator and the Target.

With the availability of 3Gbps and 6Gbps SAS, performance is now on par with fibre channel design and in highly random read environments can outperform fibre channel.

The number of host computer connections depend on how the SnapSAN S1000 is connected:

- A single SAS controller system supports two (2) direct host connections.
- A dual SAS controller system supports four (4) direct host connections.
- With a switch placed between the SnapSAN S1000 and the host computers, either SAS controller system can support up to 32 host connections.



This chapter explains how to install your SnapSAN S1000. Sections in this chapter include:

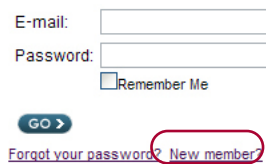
- [First Things First—Activate Your Warranty!](#)
- [Connection Planning](#)
- [Installation Overview](#)
- [Powering ON / OFF](#)

## First Things First—Activate Your Warranty!

Before installing your new SnapSAN S1000, drives, and controllers, it is essential that you activate your Overland warranty. Technical and warranty support are not available until this is done:

**NOTE:** The serial number of the chassis, controllers, and battery backup modules from the attached labels are needed to complete this process.

1. Go to the **Overland Storage** web site at:  
<http://www.overlandstorage.com/>
2. Select **Service & Support > My Products**.
3. At the [Site Login](#), enter your **email address** and **password**.



E-mail:

Password:

Remember Me


[GO >](#)

[Forgot your password?](#) [New member?](#)

**NOTE:** If you are not yet a member, click “New member?” and follow the instructions given. It’s free and easy!

4. Under the My Products tab, click **Register New**.
5. Fill in the Server information and click **Submit**.
6. Repeat [Steps 4–5](#) for all the **drive packs, controllers, and BBMs**.  
Serial numbers can be found on the box labels.

---

 **IMPORTANT:** Within three business days after registering, you will receive an email from Overland with your warranty certificate. Review it carefully and verify that the product and address information is accurate. If errors are found, email us at: [warranty@overlandstorage.com](mailto:warranty@overlandstorage.com).

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The **System Maintenance > System Information** tab also provides useful information for registering the product.

## Connection Planning

Use this checklist to help you plan the incorporation of your single controller SnapSAN S1000 into your SAN network. For a dual-controller system (shown in square brackets), double the number of connections:

Type	Connection
IP Address	DHCP (default) or Static
GbE Switch	One [or two] RJ45
Host:	
Fibre Channel	Two [or four] 4Gbs (SFP) on a Fibre switch
1Gb iSCSI	Four [or eight] 1Gbs (RJ45) on a 1Gb Ethernet switch
10Gb iSCSI	Two [or four] 10Gbs (SFP+) on a 10Gb Ethernet switch
SAS Direct	One [or two] 6Gbs (or 3Gbs) SAS (SFF-8088) available on each host. Two [or four] for connections with redundancy. Maximum of four [or eight] hosts with dual controllers without redundancy or two [or four] with redundancy.
SAS Switched	Two [or four] 6Gbs (or 3Gbs) SAS (SFF-8088) available on SAS switch to desired hosts

## Installation Overview

**WARNING:** It is recommended that a mechanical lifter (or at least two people) be used to raise and align the unit to prevent injury during installation. Use care when inserting or removing a unit into or out of a rack to prevent the accidental tipping of the rack causing damage or personal injury.

**AVERTISSEMENT:** il est recommandé que la mécanique lifter (ou au moins deux personnes) soit utilisé pour élever et d'unifier l'appareil pour éviter des blessures pendant l'installation. Faites attention lorsque vous insérer ou de retirer une unité d'entrée ou de sortie d'un support pour empêcher le déversement accidentel de la crémaillère causant des dommages ou des blessures.

**CAUTION:** Overland strongly recommends that you install the unit in a clean, air-conditioned environment with power conditioning and an adequately rated uninterruptible power supply (UPS). The unit is intended to be grounded.

**IMPORTANT:** Before unpacking the unit, ensure that the area is free from conditions that cause electrostatic discharge (ESD). Discharge static electricity from your body by touching a known grounded surface. Also, avoid touching pins, leads, or circuitry.



Before starting, prepare the following items:

- A host with a Gigabit Ethernet NIC (recommended).
- A management computer on the same network as the SnapSAN S1000.
- Use either CAT 5e or CAT 6 (recommended) network cables for the management port and the iSCSI data ports (10GB and 1Gb controllers only).
- A storage system configuration plan by your network administrator.  
The plan should include network information for the management port and iSCSI data ports. If using static IP addresses, prepare a list of the static IP addresses, the subnet mask, and the default gateway.
- Gigabit switches (recommended) or Gigabit switches with VLAN / LACP / Trunking (optional):
  - For a 4-port Gigabit S1000, 4 or 8 available ports on a Gigabit switch.
  - For a 2-port 10GbE S1000, 2 or 4 available 10Gb ports with SFP+ connections.
  - For a 2-port Fibre Channel S1000, 2 or 4 available 4Gb Fibre Channel ports with SFP connectors.
  - For a 2-port SAS S1000, 2 or 4 available 6Gb SAS ports with SFP connectors (or connect directly to hosts with SFP connectors for Direct Attach Storage (DAS) configuration).
- CHAP security information, including CHAP user name and secret (optional). See [“Overland Glossary & Acronym List”](#) for details.
- For dual-controller systems, it is recommended that the host logon to the target twice (both Controller 1 and Controller 2), and then the MPIO should setup automatically.
- For an iSCSI dual-controller system, install an iSNS server on the same LAN (recommended).

## Drive Slot Numbering

The drives can be installed into any slot in the enclosure. Slot numbering is reflected in Web Management Interface.

1	4	7	10	
2	5	8	11	
3	6	9	12	

Different capacity drives can be installed; however, they should not be in the same RAID set, because capacity usage for all drives in the RAID is limited to the smallest drive capacity.



**IMPORTANT:** Install at least one drive in Slots 1 to 4 (shaded slots). System event logs are saved in these drives. Otherwise, event logs no longer exist after a reboot.

## Installing the SnapSAN S1000

Using detailed instructions from the SnapSAN S1000 *Quick Start Guide* that came in the Accessory Kit, install the unit in the rack as follows:

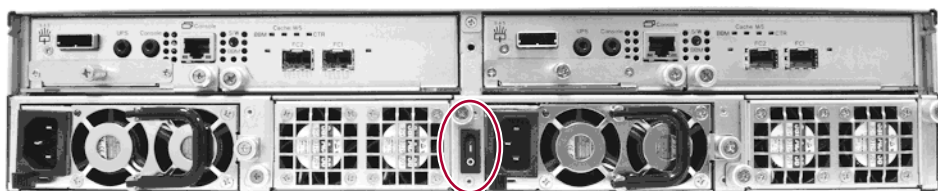
1. Install the **Battery Backup Modules** in their appropriate controllers.
2. At the rear, install the **Master controller** in its slot (CL1).
3. If desired, install the optional **Secondary Controller** in its slot (CL2).

4. Install the **Rail Kit** onto the unit and insert it into the rack.
5. Install the **Disk Drive assemblies**.
6. Connect the data and management **cables** based on the network plan.
7. Attach the **power cords** and power ON the unit.
8. Confirm or set the IP address and start the configuration for your needs.

## Powering ON / OFF

### Power Up the SnapSAN S1000

The power switch is located in the center of the rear panel's lower section. To turn the storage array ON, press “|” (switch top).



After you turn the power ON, the System performs a self-test process, which takes a couple of minutes.

### Powering Down the SnapSAN S1000

If it becomes necessary to power down the system, it is recommended using a normal, controlled shutdown from either the Front Panel Display or the Web Management Interface to ensure all data is flushed from the cache first.

#### Shutdown Using the Web Management Interface

Using the Web Management Interface:

1. Select **System Maintenance > Reboot and Shutdown**.
2. Click the **Shutdown** icon.
3. When the “System Shutdown” message is shown on the Front Panel Display, move the **main power switch** to OFF (O).

#### Shutdown Using Front Panel Display

At the Front Panel Display:

1. Power off the unit using a **normal shutdown**.
  - a. Press **ENT**.
  - b. Press **▼** twice to show **Reboot/Shutdown**, and press **ENT**.
  - c. Press **▼** once to show **Shutdown**, and press **ENT**.
  - d. Press **▲** once to highlight **Yes**, and press **ENT**.

A controlled shutdown begins.

2. When the “System Shutdown” message is shown, move the **main power switch** to OFF (O).

## Management Interfaces

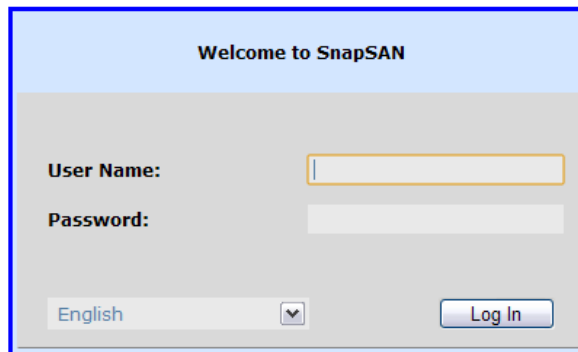
There are two primary methods to manage a SnapSAN S1000—the Web Management Interface and the Front Panel Display.

### Web Management Interface

For remote management and daily usage, the SnapSAN S1000 uses a web graphic user interface called the Web Management Interface. It supports most common web browsers, including Internet Explorer 7 or 8, and Firefox 3.5. JavaScript must be enabled in the browser and a LAN cable connected to the Management port of the SnapSAN S1000.

The default IP setting is DHCP. Check the Front Panel Display to find the DHCP address displayed there. If your network doesn't have a DHCP server, you will need to configure a static IP address using the Front Panel Display (as detailed in the SnapSAN S1000 *Quick Start Guide*).

Enter the unit's IP address into your browser to access the authentication screen. With some browsers, you may need to prefix the address with "http://" (for example, "http://192.168.10.50").



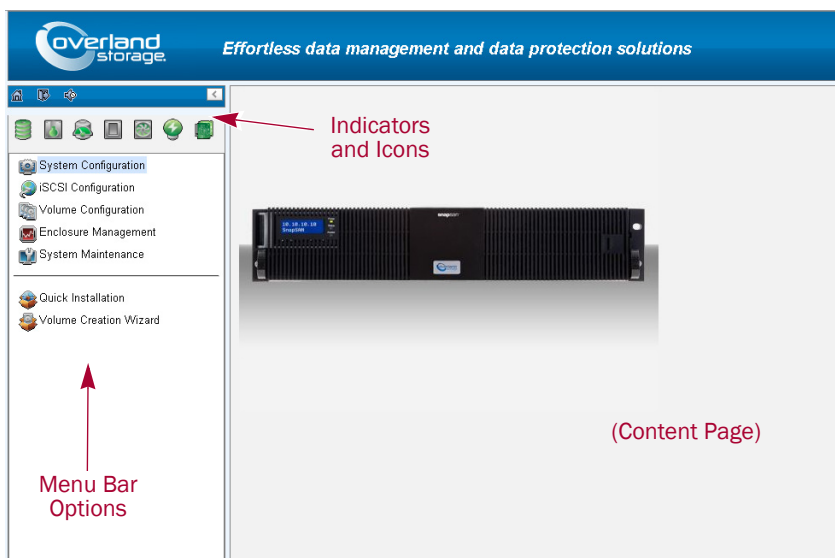
To access the Web Management Interface of the SnapSAN S1000, you must enter a user name and password. The initial defaults for Administrator login are:

User Name: **admin**

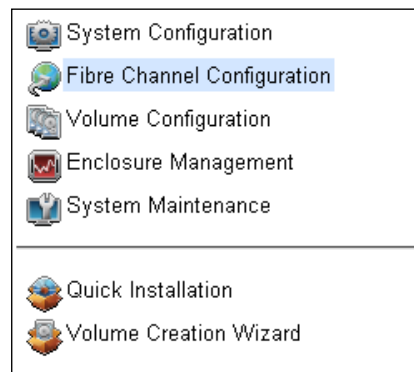
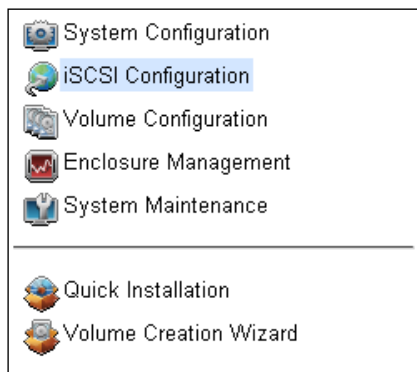
Password: **admin**

**NOTE:** For user level access, enter "user" as the User Name and no password. If needed, you can add a User password by logging on as the Administrator and going to System Configuration > Login Settings.

When the password has been verified, the Home Page is displayed.




Choose the functions from the Menu Bar on the left side of the window to make any configuration changes. The second item changes based on the type of controllers:












**NOTE:** The iSCSI Configuration menu bar option is only shown when iSCSI controllers are used in the S1000. The Fibre Channel Configuration menu appears for Fibre Channel controllers.

There are up to seven indicators and three icons above the Menu Bar. The last indicator (Dual Controller) is only visible when two controllers are installed.



Icon	Description
	RAID light: Green = All RAID Groups are functioning. Red = A RAID Group is degraded or has failed.

Icon	Description
	Temperature light: Green = Temperature is normal. Red = Temperature is high.
	Voltage light: Green = Internal power levels are normal. Red = Internal power levels are abnormal.
	UPS light: Green = UPS functioning or no UPS connected. Red = UPS connection has failed.
	Fan light: Green = Fan working. Red = Fan failed.
	Power light: Green = Both power supplies are connected and working. Red = A power supply has failed or is no longer connected.
	Dual controller light: Green = Dual controllers are active and functioning. Orange = One of the dual controllers has failed.
	Return to Home Page.
	Log out of the Management GUI.
	Mute alarm beeper.

**Tip: Internet Explorer users:** If the status indicators in Internet Explorer (IE) are displayed in gray, but not in blinking red, please enable **Tools > Internet Options > Advanced > Play animations in web pages** options in IE. The default value is enabled, but some applications disable it.

For detailed information on the Web Management Interface, see [Chapter 4, “Web Management Interface.”](#)

## Front Panel Display

**NOTE:** The Front Panel Display bottom row of buttons are only accessible with the bezel removed.

After booting up the system, the Front Panel Display on the front of the unit shows the management port IP and “SnapSAN.”





To access the Front Panel Display options, press the Enter (ENT) button. Use the Up (▲) and Down (▼) arrows to scroll through the functions:

- **System Info** – Displays the firmware version and amount of RAM.
- **Alarm Mute** – Mutes an alarm after an Error occurs.
- **Reboot/Shutdown** – Reboots or shutdowns the system.
- **Quick Install** – Provides steps to create a RAID Group.
- **Volume Wizard** – Provides steps to create a volume.
- **View IP Setting** – Displays current IP address, subnet mask, and gateway.
- **Change IP Config** – Sets IP address, subnet mask, and gateway. There are 2 options: DHCP (Get IP address from DHCP server) or static IP.
- **Enclosure Mgmt** – Shows the enclosure data for disk drive temperatures, fan status, and the power supply status.
- **Reset to Default** – Resets the SnapSAN S1000 to default settings.

The default resets include Administration password set to “admin,” IP address type set to “DHCP,” the DHCP default IP address set to “192.168.10.50,” subnet mask set to “255.255.255.0,” and gateway set to “192.168.10.254.”

Warning or Error events displayed on the Front Panel Display are automatically filtered by the Front Panel Display default filter. It can be changed in the Web Management Interface under **System Configuration > Log and Alert Settings**.

### Front Panel Display Menu Hierarchy

Main	Level 1	Level 2	Level 3	Level 4	Level 5
	[System Info]	[Firmware Version 2.0.2]			
		[RAM Size <i>nnnn</i> MB]			
	[Alarm Mute]	[ ▲ Yes No ▼ ]			
	[Reboot/Shutdown]	[Reboot]	[ ▲ Yes No ▼ ]		
		[Shutdown]	[ ▲ Yes No ▼ ]		
	[Quick Install] (only available if not already set)	RAID 0 RAID 1 RAID 3 RAID 5 RAID 6 RAID 0+1 <i>nnn</i> GB	[Apply The Config]	[ ▲ Yes No ▼ ]	
	[Volume Wizard] (only available if not already set)	[Head Unit] RAID 0 RAID 1 RAID 3 RAID 5 RAID 6 RAID 0+1	[Use Default Algorithm]	[Volume Size <i>nnn</i> GB]	[Apply The Config] [ ▲ Yes No ▼ ]
		[JBOD <i>n</i> ] ▲ ▼ RAID 0 RAID 1 RAID 3 RAID 5 RAID 6 RAID 0+1	[New <i>n</i> Disk] ▲ ▼ <i>nnn</i> GB	Adjust Volume Size	[Apply The Config] [ ▲ Yes No ▼ ]
[<IP Addr> SnapSAN ▲ ▼	[View IP Setting]	[IP Config] [Static IP] or [DHCP]			
		[IP Address] [192.168.010.050]			
		[IP Subnet Mask] [255.255.255.0]			
		[IP Gateway] [192.168.010.254]			
		[DHCP]	[ ▲ Yes No ▼ ]		
		[BOOTP]	[ ▲ Yes No ▼ ]		
	[Change IP Config]	[Static IP]	[IP Address]	Adjust IP Address	
			[IP Subnet Mask]	Adjust Submask IP	
			[IP Gateway]	Adjust Gateway IP	
			[Apply IP Setting]	[ ▲ Yes No ▼ ]	
	[Enclosure Mgmt]	[Phy Disk Temp]	[Local] Slot <i>n:nn</i> (C)		
		[Cooling]	[Local (Q212)] FAN <i>n:nnnn</i> RPM		
		[Power Supply]	[Local] PSU <i>n:&lt;status&gt;</i>		
	[Reset to Default]	[ ▲ Yes No ▼ ]			



**CAUTION:** To prevent data loss, when powering down the SnapSAN S1000, perform a normal shutdown (Reboot/Shutdown > Shutdown > Yes) to flush any data from the cache to the physical disks, as opposed to simply turning the power OFF.

## Front Panel Display Usage

Press the ENT button to access the options shown in the next column to the right. Use the ▲ and ▼ buttons to move up and down the list.

Press ESC to return to the next higher level shown in the column to the left.

At an option that requires a Yes or No response (▲Yes No▼), press the ▲ button for Yes and the ▼ button for No.

To change IP addresses, use ▲ to increase the number, ▼ to decrease the number, ENT to move to the right, and ESC to move to the left. After changing the last digit on the right, press ENT to accept the change and return to the higher level.

## Serial Console

Should the need arise, use the provided console cable (NULL modem cable) to connect from console port of the SnapSAN S1000 to the RS-232 port of management computer. The console settings are:

**Baud rate:** 115200, 8 data bit, no parity, 1 stop bit, and no flow control.

**Terminal type:** vt100

**Login name:** admin

**Default password:** admin

## Secure Shell Remote Access

If desired, SSH (secure shell) software can be also used for remote login.

**Host name:** The DHCP address from the Front Panel Display

**Login name:** admin

**Default password:** admin

**Tip:** When using SSH, the IP address and password are required for login.

# Web Management Interface

The Web Management Interface is a web-based GUI accessed through your browser. This chapter reviews all the options available in the Web Management Interface. Refer to “Web Management Interface” on page 3-1 for details on logging in and using the interface.

## Interface Hierarchy

This table shows the hierarchy of the Web Management Interface:

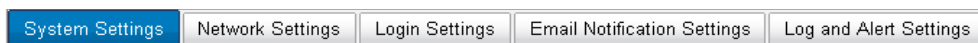
Menu Bar Item	Level 1	Level 2, Button, or Menu (▼)
System Configuration	System Settings	System Name / Date and Time / System Identification
	Network Settings	MAC Address / IP Address / DNS Server Address / Service Ports
	Login Settings	Login Options / Admin Password / User Password
	Email Notification Settings	Email Settings
	Log and Alert Settings	SNMP Trap Settings / Windows Messenger / Syslog Server Settings / Admin Interface and Front Display Alerts / Device Buzzer
Fibre Channel Configuration <i>(This option is only visible when using Fibre Channel controllers)</i>	Fibre Channel	Change the link speed.
iSCSI Configuration <i>(This option is only visible when using iSCSI controllers)</i>	Network Setup	Menu options: iSCSI Bonding Settings / iSCSI IP Address Settings / Make Default Gateway / Enable Jumbo Frames / Ping Host  Link Aggregation button: Bonding Method / IP Address / Subnet Mask / Gateway / Network Setup
	Entity and iSNS Settings	Entity Name / iSNS IP Address
	iSCSI Nodes	Menu options: Authentication Method / Change Portal / Rename Alias/ Users
	Active Sessions	Menu options: List Connections / Delete
	CHAP Accounts	Menu options: Modify User Information / Delete  Create button: User Name / Secret / Re-type Secret / Nodes

Menu Bar Item	Level 1	Level 2, Button, or Menu (▼)
Volume Configuration	Physical Disks	Menu options: Set Free Disk / Set Global Spare / Set Dedicated Spare / Upgrade / Disk Scrub / Turn On (Off) the Indication LED / More Information
	RAID Groups	Menu options: Migrate RAID Level / Move RAID Level / Activate / Deactivate / Verify Parity / Delete / [Change Preferred Controller] / Change RAID Options / More Information  NOTE: Change Preferred Controller option is only shown when two controllers are installed.  Create button: Create RAID Group dialog box
	Virtual Disks	Menu options: Extend / Verify Parity / Delete / Set Properties / Attach LUN / Detach LUN / List LUNs / Set Clone / Set Snapshot Space / Cleanup Snapshots / Take a Snapshot / Scheduled Snapshots / List Snapshots / More Information  Create button: Create a Virtual Disk dialog box  Cloning Options button: Snapshot Space / Threshold / Restart the task an hour later if failed
	Snapshots	Set Snapshot Space button: Virtual Disk / Size / Free Capacity  Scheduled Snapshots button: Months to Take Snapshots / Weeks to Take Snapshots / Days to Take Snapshots / Hours to Take Snapshots  Take a Snapshot button: Virtual Disk / Snapshot Name  Cleanup Snapshots button
	Logical Units	Attach button: Virtual Disk / Allowed Hosts / Target / LUN / Permission  Menu options (when LUN attached): Delete
Enclosure Management	Hardware Monitor	Controller 1 Monitors / Controller 2 Monitors / Internal Monitors / Auto Shutdown
	UPS	UPS Type / Shutdown Battery Level (%) / Shutdown Delay (Seconds) / Shutdown UPS / UPS Status / UPS Battery Level
	SES	Enable (Disable)
	S.M.A.R.T.	S.M.A.R.T. Information ( <i>Only for SATA disk drives</i> )
System Maintenance	System Information	( <i>Information tables shown for the unit selected</i> )
	Event Log	Event Log Level to Show / Download / Mute / Clear
	Upgrade	RAID Controller/Systems / JBOD Controller/Systems / Controller Mode
	Firmware Synchronization	NOTE: Only shown when dual controllers are installed.  Synchronize the Slave Controller's Firmware Version with the Master's version.
	Reset to Factory Defaults	(Reset button)
	Configuration Backup	Import or Export / Import File
	Reboot and Shutdown	(Reboot button) / (Shutdown button)
Quick Installation Tool	(Four step wizard. See "Quick Installation Tool" on page 4-40 for details.)	

Menu Bar Item	Level 1	Level 2, Button, or Menu (▼)
Volume Creation Wizard		(Three step wizard. See "Volume Creation Wizard" on page 4-42 for details.)

## System Configuration

The System Configuration menu option is for accessing the System Settings, Network Settings, Login Settings, Email Notification Settings, and Log and Alert Settings option tabs.



### System Settings

The System Settings tab on the System Configuration screen is used to setup the system name and date. The default System Name is the SnapSAN model name.

Options available on this screen:

- To change the **System Name**, highlight the old name and type in a new one.
- To change the current date, time, and time zone settings, check **Change Date And Time**. The changes can be done manually or you can synchronize the time from an NTP (Network Time Protocol) server.
- To locate this server in the racks, click the **Flash** button in the System Indication section to flash the array's drive LEDs. Click it again to turn them off.
- To disable the Front Panel Display buttons, click Yes in that section.

When done, click **Apply**.

## Network Settings

The Network Settings tab on the System Configuration screen allows you to view the MAC address and change basic network settings:

- IP Address – change the address used for remote access by an administrator. There are three address options: DHCP (default), BOOTP, and Specify a Static IP Address.
- DNS Server Address – If necessary, the IP address of the DNS server can be entered or changed here.
- Service Ports – If the default HTTP, HTTPS, and SSH port numbers are not allowed on your network, they can be changed here.

System Settings	Network Settings	Login Settings	Email Notification Settings	Log and Alert Settings
<b>Change Network Settings</b>				
On this screen change the network settings for the administration port.				
<b>MAC Address</b>				
MAC Address:		00:13:78:BB:04:10		
<b>IP Address</b>				
<input checked="" type="radio"/> Use DHCP <input type="radio"/> Use BOOTP <input type="radio"/> Specify a static IP Address				
IP Address:		10.20.13.31		
Subnet Mask:		255.255.0.0		
Gateway:		10.20.8.1		
<b>DNS Server Address</b>				
Address:		127.0.0.1		
<b>Service Ports</b>				
HTTP Port:		80		
HTTPS Port:		443		
SSH Port:		22		
Apply				

## Login Settings

The Login Setting tab on the System Configuration screen is used to control access to the SnapSAN S1000. Use it to set an auto logout time, to limit access to just one administrator at a time, and to change the Admin and User passwords.

System Settings	Network Settings	Login Settings	Email Notification Settings	Log and Alert Settings
<b>Change Login Options and Passwords</b>				
When the auto logout option is enabled, you will be logged out of the admin interface after the time specified. The login lock option prevents multiple people from administering at the same time.				
<b>Login Options</b>				
Auto Logout:		- Disable -		
Login In Lock:		- Disable -		
<b>Admin Password</b>				
<input type="checkbox"/> Change admin password				
Current Password:				
New Password:				
Re-type New Password:				
<b>User Password</b>				
<input type="checkbox"/> Change user password				
New Password:				
Re-type New Password:				
Apply				

The specific options available are:

- **Login Options:**
  - **Auto Logout** – Choose from Disabled, 5 minutes, 30 minutes, or 1 hour. The system automatically logs the user out of the Web Management Interface when they are inactive for the stated period of time.
  - **Login Lockout** – Choose either Disabled or Enabled. When the login lock is enabled, the system allows only one user to login to the Web Management Interface at a time.
- **Admin Password** – Check Change Admin Password to change the administrator password. The maximum password length is 12 alphanumeric characters or spaces.
- **User Password** – Check Change User Password to change the user password. The maximum length of a password is 12 alphanumeric characters or spaces.

## Email Notification Settings

The Email Notification Settings on the System Configuration screen is used to enter up to three email addresses for receiving event notifications. Fill in the necessary fields and click **Send Test Email** to test whether email functions are available.

**NOTE:** Some email servers check the From Email Address and need authentication for anti-spam.

You can also select which levels of event logs you would like to include with the email. The default setting only includes Warning and Error event logs.

The screenshot displays the 'Email Notification Settings' configuration page. At the top, there are tabs for 'System Settings', 'Network Settings', 'Login Settings', 'Email Notification Settings' (which is active), and 'Log and Alert Settings'. Below the tabs, the title is 'Configure Email Notification Settings' with a sub-note: 'You can specify up to three email addresses for email notifications. You should use the SMTP Server option to specify a specific email server that you would like to use for sending email notifications (required if your network will not allow this device to send the email directly).' The main form area is titled 'Email Settings' and contains the following fields and options:

- From Email Address:** mailman@SnapSAN
- To Email Address #1:** [Empty field]
- To Email Address #2:** [Empty field]
- To Email Address #3:** [Empty field]
- For each 'To Email Address' field, there are checkboxes for 'Info', 'Warning', and 'Error'. In the screenshot, 'Warning' and 'Error' are checked for all three addresses.
- Specify a SMTP Server**
- SMTP Server Address:** [Empty field]
- Use Authentication:** No (dropdown menu)
- User Name:** [Empty field]
- Password:** [Empty field]
- Re-type Password:** [Empty field]
- Send Test Email** button

An 'Apply' button is located at the bottom left of the configuration area.

## Log and Alert Settings


Log and Alert Settings on the System Configuration screen are used to configure SNMP traps (for alerting via SNMP), pop-up messages via Windows Messenger (not MSN), alerts via the syslog protocol, and the event log filter. The unit buzzer is also managed here.



System Settings	Network Settings	Login Settings	Email Notification Settings	Log and Alert Settings
<b>SNMP Trap Settings</b> ▾				
Host Address #1:		<input type="text"/>		
Host Address #2:		<input type="text"/>		
Host Address #3:		<input type="text"/>		
Community:		<input type="text" value="public"/>		
MIB file download:		<input type="button" value="Download"/>		
Alert Levels To Send:		<input type="checkbox"/> Info <input checked="" type="checkbox"/> Warning <input checked="" type="checkbox"/> Error		
<b>Windows Messenger</b> ▾				
Host Address #1:		<input type="text"/>		
Host Address #2:		<input type="text"/>		
Host Address #3:		<input type="text"/>		
Alert Levels To Send:		<input type="checkbox"/> Info <input checked="" type="checkbox"/> Warning <input checked="" type="checkbox"/> Error		
<b>Syslog Server Settings</b> ▾				
Host Address or Name:		<input type="text"/>		
UDP Port:		<input type="text" value="514"/>		
Facility:		<input type="text" value="User"/>		
Alert Levels To Log:		<input type="checkbox"/> Info <input checked="" type="checkbox"/> Warning <input checked="" type="checkbox"/> Error		
<b>Admin Interface and Front Display Alerts</b> ▾				
Admin Interface Popup Alerts:		<input type="checkbox"/> Info <input type="checkbox"/> Warning <input type="checkbox"/> Error		
Alerts to Show on Front Display:		<input type="checkbox"/> Info <input checked="" type="checkbox"/> Warning <input checked="" type="checkbox"/> Error		
<b>Device Buzzer</b> ▾				
Disable the device buzzer:		<input type="checkbox"/>		
<input type="button" value="Apply"/>				

- **SNMP Trap Settings** – The SnapSAN S1000 allows up to three SNMP trap addresses. The default community setting is **public**. You can choose the SNMP alert levels you want to receive. The default setting is for only Warning and Error alerts. There are many SNMP tools available on the web including:
  - SNMPc: <http://www.snmpc.com/>
  - Net-SNMP: <http://net-snmp.sourceforge.net/>
- **Windows Messenger** – You must enable the Messenger service in Windows (**Start > Control Panel > Administrative Tools > Services > Messenger**) for alerts to be received. The SnapSAN S1000 allows up to three Messenger addresses. You can choose the messenger alert levels you want to receive. The default setting is for only Warning and Error alerts.
- **Syslog Server Settings** – The default port of syslog is 514. You can choose the system alert levels you want to have logged. The default setting is for only Warning and Error alerts. There are syslog server tools available on the web for Windows including:
  - WinSyslog: <http://www.winsyslog.com/>
  - Kiwi Syslog Daemon: <http://www.kiwisyslog.com/>
 Most UNIX systems build in syslog daemon.
- **Admin Interface and Front Panel Display Alerts** – You can choose the alert levels you want to have pop up in the Web Management Interface and shown on the Front Panel Display. The default setting for the Web Management Interface is no alerts while the default setting for the Front Panel Display is for only Warning and Error alerts.
- **Device Buzzer** – Check the box to disable the buzzer. Uncheck it to reactivate the buzzer.


## Fibre Channel Configuration

 **IMPORTANT:** This section is only visible when one or more of the Fibre Channel controller modules are used in the SnapSAN S1000.

The Fibre Channel menu option lets you access the Fibre Channel tab to change the link speed. Click the Fibre Channel menu button (▼) next to the port name to access the option to change the link speed for that particular port.

Fibre Channel						
	Name	Port ID	Connection Mode	Data Rate	WWNN/WWPN	Link
▼	Port 1	NA	NA	NA	WWNN: 200000C0B624A430 WWPN: 210000C0B624A430	Down
▼	Port 2	EF	Arbitrated Loop	2 Gb/s	WWNN: 200000C0B624A430 WWPN: 220000C0B624A430	Up

## iSCSI Configuration

 **IMPORTANT:** This section is only visible when one or more of the iSCSI controller modules are used in the SnapSAN S1000.

The iSCSI Configuration menu option is for accessing the Network Setup, Entity and iSNS Settings, iSCSI Nodes, Active Sessions, and CHAP Accounts option tabs.

Network Setup	Entity and iSNS Settings	iSCSI Nodes	Active Sessions	CHAP Accounts
---------------	--------------------------	-------------	-----------------	---------------

### Network Setup

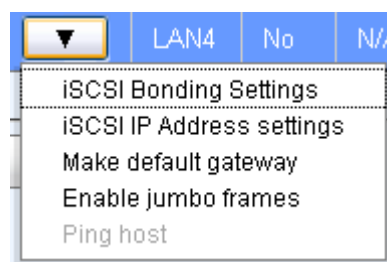
The Network Setup tab on the iSCSI Configuration screen is used to change IP addresses of iSCSI data ports. A SnapSAN S1000 with iSCSI gigabit controllers has four ports on each controller to transmit data. Each port must be assigned its own IP address. They need to be configured in multi-homed mode or a preset link aggregation / trunking mode. When multiple iSCSI data ports are set up in link aggregation or trunking mode, all the data ports share a single IP address.

Network Setup									
	Name	LAG	LAG No	Use DHCP	IP Address	Netmask	Gateway	Jumbo Frames	MAC Address
▼	LAN1	No	N/A	No	192.168.1.1	255.255.255.0	192.168.1.254	Disabled	00:13:78:bb:04:18
▼	LAN2	No	N/A	No	192.168.2.1	255.255.255.0	192.168.2.254	Disabled	00:13:78:bb:04:19
▼	LAN3	No	N/A	No	192.168.3.1	255.255.255.0	192.168.3.254	Disabled	00:13:78:bb:04:1a
▼	LAN4	No	N/A	No	192.168.4.1	255.255.255.0	192.168.4.254	Disabled	00:13:78:bb:04:1b

Link Aggregation

**NOTE:** This figure shows four iSCSI data ports on each controller. The four 1Gb data ports are set up with a static IP address. For iSCSI 10Gb controllers, each controller has two optical ports that can be set up the same way.

Clicking the menu button (▼) displays the options for each LAN:



### iSCSI Bonding Settings

The default mode of each iSCSI data port is that it is individually connected (multi-homed) without any link aggregation and trunking. This function is also for Multipath functions.

Trunking and LACP (Link Aggregation Control Protocol) settings can be set or changed by selecting the iSCSI Bonding Settings menu option from the drop-down list. Select the bonding method and its options:

- **Trunking** – Configures multiple iSCSI data ports to act in parallel to increase the link speed beyond the limits of any single port.
- **LACP** – This is part of the IEEE specification 802.3ad that allows several physical ports to be bundled together to form a single logical channel. This increases the bandwidth and provides automatic failover when link status fails on a port.

**NOTE:** You must select at least two iSCSI NICs for iSCSI bonding to work.

To remove a Trunking or LACP setting, click the menu button (▼) for the specific LAN port and select **Delete Link Aggregation**. Click **OK** at the confirmation message.

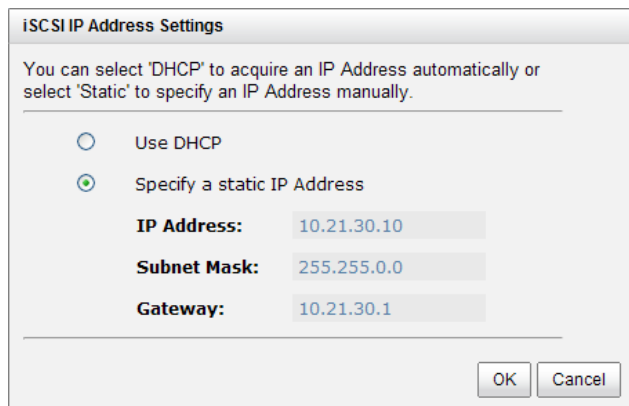
For example, LAN1 and LAN2 are set as Trunking mode. LAN3 and LAN4 are set as LACP mode.

Network Setup		Entity and iSNS Settings	iSCSI Nodes	Active Sessions	Ch
Name	LAG	LAG No	Use DHCP	IP Address	
LAN1	Trunking	0	No	192.168.	
LAN2	Trunking	0	No	192.168.	
LAN3	Link Aggregation (802.3ad)	1	No	192.168.	
LAN4	Link Aggregation (802.3ad)	1	No	192.168.	

**NOTE:** After removing the bonding, the secondary LAN is reset to use a static IP address but no address is configured. You must manually reset the address.

## iSCSI IP Address Settings

To change an iSCSI IP address, click the menu button (▼) for the LAN port and select iSCSI IP Address Settings. There are two options: DHCP or Static. You can select DHCP to acquire an IP address automatically or Static to set the IP address manually:



The dialog box titled "iSCSI IP Address Settings" contains the following text and controls:

You can select 'DHCP' to acquire an IP Address automatically or select 'Static' to specify an IP Address manually.

Use DHCP

Specify a static IP Address

**IP Address:** 10.21.30.10

**Subnet Mask:** 255.255.0.0

**Gateway:** 10.21.30.1

OK Cancel

## Default Gateway

The default gateway can be changed by clicking the menu button (▼) for the LAN port that you want as the gateway and selecting **Make Default Gateway**. There can be only one default gateway.

To remove the default gateway, click the menu button (▼) of the LAN that is currently the gateway, and select **Remove Default Gateway**.

## Jumbo Frames (MTU)

The MTU (Maximum Transmission Unit) size can be enabled by clicking the menu button (▼) of a LAN port and then clicking **Enable Jumbo Frames**. Maximum jumbo frame size is 9000 bytes.

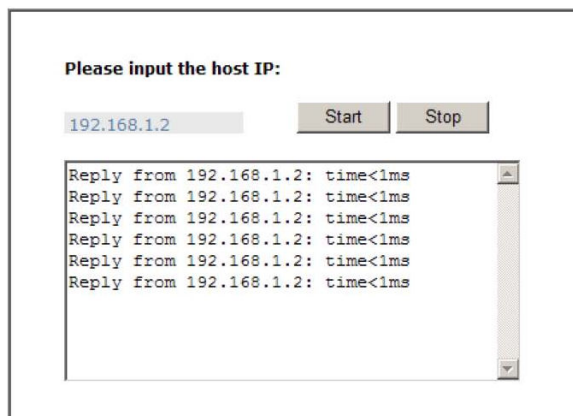


**CAUTION:** Jumbo frames for both the switching hub and HBA on the host computer must be enabled. Otherwise, the LAN connection will not work properly.

To disable jumbo frames, click the menu button (▼) of the LAN that uses jumbo frames, and select **Disable Jumbo Frames**.

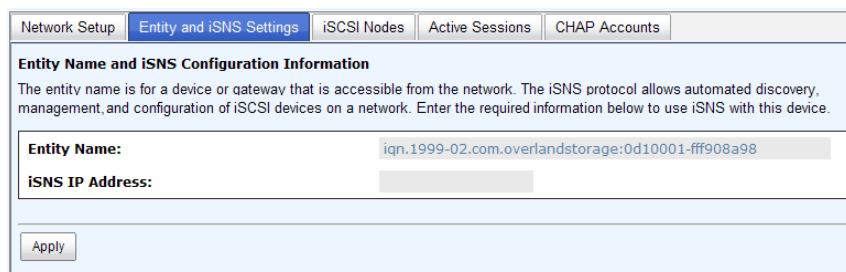
## Ping Host

To verify that the port connection from a target to the corresponding host data port is good, click Ping Host. Enter the IP address and click Start. The unit sends out six pings (or you can stop it by clicking Stop).

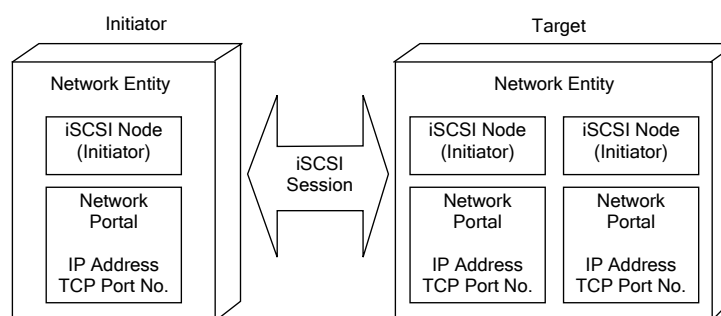


## Entity and iSNS Settings

Use Entity and iSNS Settings tab on the iSCSI Configuration screen to view or change the entity name of the system and setup an iSNS IP for the iSNS (Internet Storage Name Service) protocol.



The entity name is a name for a device or gateway that is accessible from the iSCSI network.



The iSNS protocol allows automated discovery, management, and configuration of iSCSI devices on a TCP/IP network. To use iSNS, an iSNS server needs to be added to the SAN. Once this is done, the iSNS server IP address must be added to the SnapSAN S1000 for the iSCSI initiator service to send queries to it.

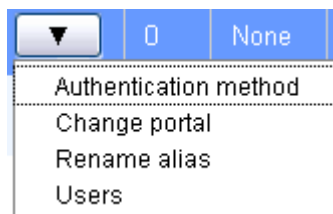
To make changes, enter the Entity Name and the iSNS IP Address, then click Apply.

## iSCSI Nodes

The iSCSI Node tab on the iSCSI Configuration screen is used to view the target name for iSCSI initiators. SnapSAN S1000 supports up to 32 nodes on each controller.

Network Setup   Entity and iSNS Settings   <b>iSCSI Nodes</b>   Active Sessions   CHAP Accounts					
<< first < prev 1 2 3 next > last >>					
	ID	Auth	Node Name	Portal	Alias
▼	0	None	iqn.1999-02.com.overlandstorage:0d10001-ff908a98:dev0.ctr1	10.21.30.10:3260, 10.21.30.12:3260	
▼	1	None	iqn.1999-02.com.overlandstorage:0d10001-ff908a98:dev1.ctr1	10.21.30.10:3260, 10.21.30.12:3260	
▼	2	None	iqn.1999-02.com.overlandstorage:0d10001-ff908a98:dev2.ctr1	10.21.30.10:3260, 10.21.30.12:3260	
▼	3	None	iqn.1999-02.com.overlandstorage:0d10001-ff908a98:dev3.ctr1	10.21.30.10:3260, 10.21.30.12:3260	
▼	4	None	iqn.1999-02.com.overlandstorage:0d10001-ff908a98:dev4.ctr1	10.21.30.10:3260, 10.21.30.12:3260	
▼	5	None	iqn.1999-02.com.overlandstorage:0d10001-ff908a98:dev5.ctr1	10.21.30.10:3260, 10.21.30.12:3260	
▼	6	None	iqn.1999-02.com.overlandstorage:0d10001-ff908a98:dev6.ctr1	10.21.30.10:3260, 10.21.30.12:3260	
▼	7	None	iqn.1999-02.com.overlandstorage:0d10001-ff908a98:dev7.ctr1	10.21.30.10:3260, 10.21.30.12:3260	
▼	8	None	iqn.1999-02.com.overlandstorage:0d10001-ff908a98:dev8.ctr1	10.21.30.10:3260, 10.21.30.12:3260	
▼	9	None	iqn.1999-02.com.overlandstorage:0d10001-ff908a98:dev9.ctr1	10.21.30.10:3260, 10.21.30.12:3260	
▼	10	None	iqn.1999-02.com.overlandstorage:0d10001-ff908a98:dev10.ctr1	10.21.30.10:3260, 10.21.30.12:3260	
▼	11	None	iqn.1999-02.com.overlandstorage:0d10001-ff908a98:dev11.ctr1	10.21.30.10:3260, 10.21.30.12:3260	

Clicking the menu button (▼) displays the options for each initiator.



### Authentication Method

CHAP (Challenge Handshake Authentication Protocol) is a strong authentication method used in point-to-point for user login. It's a type of authentication in which the authentication server sends the client a key to be used for encrypting the user name and password. CHAP enables the user name and password to transmit in an encrypted form for protection.



**IMPORTANT:** A CHAP account must be active before you can use this authentication method. Please refer to "CHAP Accounts" on page 4-15 to create an account if one doesn't exist.

To use CHAP authentication:

1. Select **one** of 32 default nodes from one controller.
2. Click the menu button (▼) and select **Authentication Method**.

3. Select **CHAP** from the drop-down list:

4. Click **OK** to change the Authentication Method (Auth) to CHAP:

	ID	Auth	Node Name	Portal
▼	0	CHAP	iqn.1999-02.com.overlandstorage:snapsans1000-ff908a98:dev0.ctr1	192.168.1.1:3260, 192.168.1.1:3261
▼	1	CHAP	iqn.1999-02.com.overlandstorage:snapsans1000-ff908a98:dev1.ctr1	192.168.1.1:3260, 192.168.1.1:3261
▼	2	None	iqn.1999-02.com.overlandstorage:snapsans1000-ff908a98:dev2.ctr1	192.168.1.1:3260, 192.168.1.1:3261
▼	3	None	iqn.1999-02.com.overlandstorage:snapsans1000-ff908a98:dev3.ctr1	192.168.1.1:3260, 192.168.1.1:3261
▼	4	None	iqn.1999-02.com.overlandstorage:snapsans1000-ff908a98:dev4.ctr1	192.168.1.1:3260, 192.168.1.1:3261

5. Click the menu button (▼) again and select **Users**.
6. Select all the **CHAP users** which will be used.  
It can be more than one, but it must be at least one for CHAP to work.

7. Click **OK**.

To delete the CHAP authentication, from the drop-down menu, select Authentication Methods and change it to **None**.

**Tip:** After setting CHAP authentication, the host initiator should be set with the same CHAP account. Otherwise, a user cannot login.

### Change Portal

Use this iSCSI Node option to change the network ports available:

1. Click the menu button (▼) of the node and select **Change Portal**.

## 2. Check the portals you want for the controller:

**Change Network Portal**

Assign or change LAN portal  
Select the network ports that you would like to be available for this iSCSI node.

**Available On:**

- 192.168.1.1:3260 ( LAN 1, Use DHCP: No, Jumbo Frames: Disabled )
- 192.168.2.1:3260 ( LAN 2, Use DHCP: No, Jumbo Frames: Disabled )
- 192.168.3.1:3260 ( LAN 3, Use DHCP: No, Jumbo Frames: Disabled )
- 192.168.4.1:3260 ( LAN 4, Use DHCP: No, Jumbo Frames: Disabled )

## 3. Click OK.

### Rename Alias

This option is used to create an alias to one device node. To add or change an alias name, enter the name and click OK. To delete the alias, clear the current name and click OK.

**iSCSI Alias**

Add or change iSCSI alias.  
To add or change the alias name, enter the name below and press OK. To remove an alias, clear out the current name and press OK.

**Alias Name:**

After creating an alias, it is shown at the end of the portal information.

	ID	Auth	Node Name	Portal	Alias
▼	0	CHAP	iqn.1999-02.com.overlandstorage:snapans1000-#906a98:dev0.ctr1	192.168.1.1:3260, 192.168.2.1:3260, 192.168.3.1:3260, 192.168.4.1:3260	main1
▼	1	CHAP	iqn.1999-02.com.overlandstorage:snapans1000-#906a98:dev1.ctr1	192.168.1.1:3260, 192.168.2.1:3260, 192.168.3.1:3260, 192.168.4.1:3260	
▼	2	None	iqn.1999-02.com.overlandstorage:snapans1000-#906a98:dev2.ctr1	192.168.1.1:3260, 192.168.2.1:3260, 192.168.3.1:3260, 192.168.4.1:3260	
▼	3	None	iqn.1999-02.com.overlandstorage:snapans1000-#906a98:dev3.ctr1	192.168.1.1:3260, 192.168.2.1:3260, 192.168.3.1:3260, 192.168.4.1:3260	
▼	4	None	iqn.1999-02.com.overlandstorage:snapans1000-#906a98:dev4.ctr1	192.168.1.1:3260, 192.168.2.1:3260, 192.168.3.1:3260, 192.168.4.1:3260	

### Users

Select the CHAP users for access to the highlighted node. CHAP users must previously have been created.

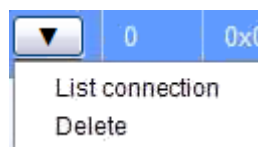
### Active Sessions

The Active Sessions tab on the iSCSI Configuration screen displays all currently active iSCSI sessions and their connection information.

Network Setup   Entity and iSNS Settings   iSCSI Nodes   <b>Active Sessions</b>   CHAP Accounts										
Show information for: Controller 1										
	No.	TSIH	Initiator name	Target name	InitialR2T	Immed. data	MaxOutR2T	MaxDataBurstLen	DataSeqInOrder	DataPDU
▼	0	0x0001	iqn.1991-05.com.microsoft.qsan	iqn.2004-08.tw.com.qsan.dev0.ctr1	Yes	Yes	1	262144	Yes	Yes
<input type="button" value="List connection"/> <input type="button" value="Delete"/>										



Clicking the menu button (▼) displays the options for each session.



This table shows the column descriptions for this tab. Most of the options are standard parameters used in the negotiation between the initiator and target when a iSCSI connection is created:

Column Name	Description
TSIH	(Target Session Identifying Handle) The name used for this active session.
Initiator Name	The host computer name
Target Name	The controller name
InitialR2T	(Initial Ready to Transfer) This is used to turn off either the use of a unidirectional R2T command or the output part of a bidirectional command. Default: Yes.
Immed. Data	(Immediate Data) This sets the support for immediate data between the initiator and the target. Both must be set to the same setting. Default: Yes.
MaxDataOutR2T	(Maximum Data Outstanding Ready to Transfer) This is the MaxOutstanding R2T setting which determines the maximum number of outstanding R2Ts per task. Default: 1.
MaxDataBurstLen	(Maximum Data Burst Length) This determines the maximum SCSI data payload. Default: 256Kb.
DataSeqInOrder	(Data Sequence in Order) This determines if the Protocol Data Units (PDUs) are transferred in continuously non-decreasing sequence offsets. Default: Yes.
DataPDUInOrder	(Data PDU in Order) This determines if the data PDUs within sequences are to be in order and overlays forbidden. Default: Yes.
Detail of Authentication Status and Source IP: <port#>	More information about Port <#>.

Click the menu button (▼) of session number and select **Connection Details**. It lists all connections of that session.

No.	Initiator IP	Initiator name	MaxRecvDataSegLen	MaxTransDataSegLen	Authentication
1	192.168.10.121	iqn.1991-05.com.microsoft:qsan	16384	65536	No

OK

To terminate a session, click the menu button (▼) and select **Disconnect**. Click OK to confirm.

## CHAP Accounts

The CHAP Accounts tab on the iSCSI Configuration screen displays all CHAP Users configured on the system.

Network Setup	Entity and iSNS Settings	iSCSI Nodes	Active Sessions	CHAP Accounts				
<p><b>Challenge Handshake Authorization Protocol(CHAP).</b> You can create CHAP users to protect your iSCSI Targets from unauthorized access. To create a user, click on the Create User button below.</p> <table border="1"> <thead> <tr> <th>Users</th> <th>Access to Nodes</th> </tr> </thead> <tbody> <tr> <td>▼ CHAP_01</td> <td>0</td> </tr> </tbody> </table> <p>Create User</p>					Users	Access to Nodes	▼ CHAP_01	0
Users	Access to Nodes							
▼ CHAP_01	0							

Clicking the menu button (▼) displays the options for each user.

▼	CHAP_01	0
Modify user information Delete user		

Use CHAP Accounts to create a CHAP account for system user authentication. A SnapSAN S1000 can have multiple CHAP accounts.

To create a CHAP account:

1. Click **Create User**. The creation dialog box opens.
2. Enter data for **User**, **Secret**, and **Confirm** (secret).

- If desired, select one or more nodes.

If selecting none, they can be added later by going to **iSCSI configuration > Node > User**.

- Click **OK**.

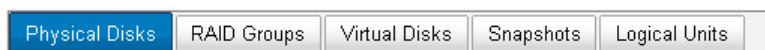
To modify a CHAP account, click the menu button (▼) of the account and select **Modify User Information**. Enter the new data and click **OK**.

**NOTE:** To change the nodes accessible by this user, go to iSCSI Configuration > iSCSI Node. To add the user, click the menu button for that node, and select the user. To delete the user, click the menu button for that node and uncheck the user.

To delete a CHAP account, click the menu button (▼) of the account and select **Delete User**. At the confirmation message, click **OK**.

## Volume Configuration

The Volume Configuration menu option is for accessing the Physical Disks, RAID Groups, Virtual Disks, Snapshots, and Logical Units option tabs.



### Physical Disks

The Physical Disks tab on the Volume Configuration screen provides the status of the disk drives in the system. The two drop-down lists at the top enable you to switch between the head unit and any expansion units attached and to change the drive size units (MB and GB).

	Slot	Size (GB)	RAID Group	Status	Health	Usage	Vendor	Interface
▼	1	372	RG1R5	Online	Good	RAID	SEAGATE	SAS
▼	2	372	RG1R5	Online	Good	RAID	SEAGATE	SAS
▼	3	372	RG1R5	Online	Good	RAID	SEAGATE	SAS

This table shows the column descriptions for this tab:

Column Name	Description
Slot	The slot position of a disk drive. See <a href="#">“Drive Slot Numbering” on page 2-3</a> for details.
Size (GB) [or (MB)]	Capacity of the disk drive. The number can be displayed in GB or MB (depending on the size setting).
RAID Group	RAID Group name.
Status	The status of the disk drive: <ul style="list-style-type: none"> <li>• Online – The disk drive is online.</li> <li>• Rebuilding – The disk drive’s data is being rebuilt.</li> <li>• Transition – The disk drive’s data is being migrated or is replaced by another disk.</li> <li>• Scrubbing – The disk drive’s data is being scrubbed.</li> </ul>
Health	The health of disk drive: <ul style="list-style-type: none"> <li>• Good – The disk drive is functioning normally.</li> <li>• Failed – The disk drive has failed.</li> <li>• Error Alert – S.M.A.R.T. error detected.</li> <li>• Read Errors – The disk drive has had an unrecoverable read error.</li> </ul>
Usage	The usage of disk drive: <ul style="list-style-type: none"> <li>• RAID – This disk drive is part of a RAID Group.</li> <li>• Free – This disk drive is free for use.</li> <li>• Dedicated spare – This disk drive is set up as dedicated spare of a RAID Group.</li> <li>• Global spare – This disk drive is set up as global spare for any RAID Group.</li> </ul>
Vendor	The disk drive vendor.

Column Name	Description
Interface	The disk drive type: <ul style="list-style-type: none"> <li>• SATA2 – It is a SATA II disk.</li> <li>• SAS – It is a SAS disk.</li> </ul>

Menu options for the Physical Disks tab are accessed by clicking the menu button (▼). Active functions can be selected while inactive functions appear grayed out and cannot be selected.

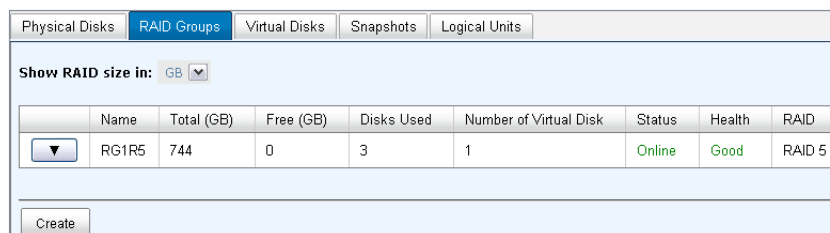


This table shows the available functions and their descriptions:

Menu Item	Description
Set Free Disk	Make the selected disk drive available for use.
Set Global Spare	Set the selected disk drive to global spare of all RAID Groups.
Set Dedicated Spare	Set a disk drive to dedicated spare of the selected RAID Group.
Upgrade	Upgrade the firmware on selected disks.
Disk Scrub	Scrub the disk drive.
Turn On/Off the Indication LED	Turn on the indication LED of the disk drive. Click again to turn it off.
More Information	Show disk drive detail information.

## RAID Groups

The RAID Groups tab on the Volume Configuration screen enables you to create, modify, or view the status of the RAID Groups. Use the drop-down list at the top to change the drive size units (MB or GB).

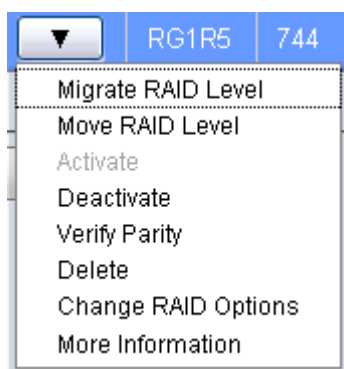


This table shows the column descriptions for this tab:

Column Name	Description
Name	The RAID Group name.

Column Name	Description
Total (GB) [or (MB)]	The total capacity of this RAID Group. The number can be displayed in GB or MB (depends on the size setting).
Free (GB) [or (MB)]	The free capacity of this RAID Group. The number can be displayed in GB or MB (depends on the size setting).
Disks Used	The number of physical disks in a RAID Group.
Number of Virtual Disks	The number of virtual disks using this RAID Group.
Status	The status of RAID Group: <ul style="list-style-type: none"> <li>• Online – The RAID Group is online and functioning normally.</li> <li>• Offline – The RAID Group is offline.</li> <li>• Rebuild – The RAID Group is being rebuilt.</li> <li>• Migrate – The RAID Group is being migrated.</li> <li>• Scrubbing – The RAID Group is being scrubbed.</li> </ul>
Health	The health of RAID Group: <ul style="list-style-type: none"> <li>• Good – The RAID Group is working normally with all disk drives.</li> <li>• Failed – The RAID Group is no longer functional.</li> <li>• Degraded – The RAID Group has lost a disk drive and is no longer at the desired level.</li> </ul>
RAID	The RAID type of the RAID Group.
Current Controller	<b>NOTE:</b> This option only appears with dual controllers. The controller to which the RAID Group is currently assigned. Default: Controller 1.
Preferred Controller	<b>NOTE:</b> This option only appears with dual controllers. The controller that is the preferred manager of the RAID Group. Default: Controller 1.

Menu options for RAID Groups are accessed by clicking the menu button (▼). Active functions can be selected while inactive functions appear grayed out and cannot be selected.



This table shows the available functions and their descriptions:

Menu Item	Description
Migrate RAID Level	Change the RAID level of a RAID Group. Please refer to “ <a href="#">Migrate a RAID Level</a> ” on page 4-21.

Menu Item	Description
Move RAID Level	Use this option to move the RAID from one set of disk drives to another.
Activate	Activate the RAID Group after disk roaming. It can be executed when the RAID Group status is offline.
Deactivate	Deactivate the RAID Group before disk roaming. It can be executed when RAID Group status is online.
Verify Parity	Regenerate parity for the RAID Groups that support parity drives (RAID 3 / 5 / 6 / 30 / 50 / 60).
Delete	Delete the RAID Group.
Change Preferred Controller	<b>NOTE:</b> This option only appears with dual controllers. Set the RAID Group ownership to the other controller.
Change RAID Options	Change the disk properties of the RAID: <ul style="list-style-type: none"> <li>• Write Cache – Cache Enabled (default) / Disabled.</li> <li>• Standby – Disabled (default) / Enabled. Disk drive auto spindown is used to save power when not accessed after a certain period of time (30 sec / 1 min. / 5 min. / 30 min.).</li> </ul> <p><b>NOTE:</b> Using the Standby option may cause some applications to time out while they wait for the disks to spin back up.</p> <ul style="list-style-type: none"> <li>• Read-Ahead – Disk read-ahead feature Enabled (default) / Disabled.</li> <li>• Command Queuing – Disk command queue Enabled (default) / Disabled.</li> </ul>
More Information	Show detailed information for a RAID Group.

## Create a RAID Group

1. Click the **Create** button.
2. Use the **Create RAID Groups** dialog to configure the group:

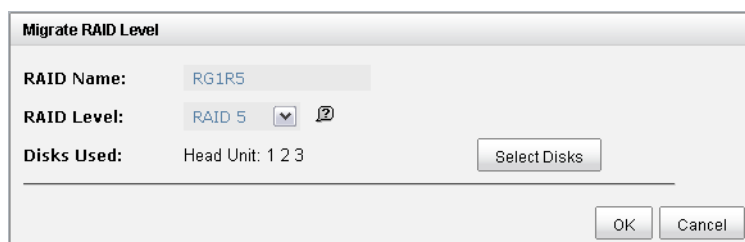
- Enter a **RAID Name** for the group.
- Use the drop-down list to select a **RAID Level**.
- Click the **Select Disks** button, select disks from either the Head Unit or Expansion units for use, and click **OK** to complete the selection. The selected disks are shown under Disks Used.



- **Optionally**, configure the following:
    - **Write Cache** usage.
    - **Standby** option.
    - **Read-Ahead** option.
    - **Command Queuing** option.
3. Click **OK** to create the RAID Group.
  4. At the confirmation message, click **OK**.

### Migrate a RAID Level

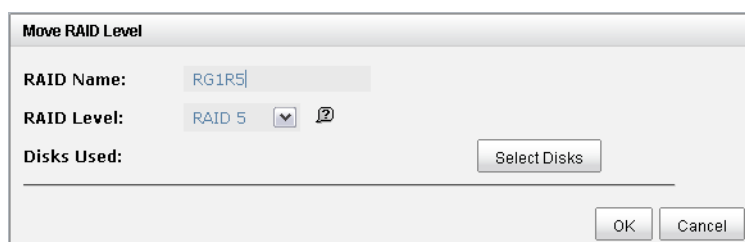
1. Select **Migrate RAID Level** from the menu.
2. Configure the **options**:



- Enter a **RAID Name**.
  - From the drop-down list, select the new **RAID Level**.
  - Click the **Select Disks** button, select disks from either the Head Unit or Expansion units for use, and click **OK** to complete the selection. The selected disks are shown under Disks Used.
3. Click **OK** to complete the RAID migration.

### Move RAID Level

1. Select **Move RAID Level** from the menu.
2. Configure the **options**:



- Enter a **RAID Name**.
- From the drop-down list, select the new **RAID Level**.



- Click the **Select Disks** button, select disks from either the Head Unit or Expansion units for use, and click **OK** to complete the selection. The selected disks are shown under Disks Used.

3. Click **OK** to complete the RAID move.

## Virtual Disks

The Virtual Disks tab on the Volume Configuration screen enables you create, modify, or view the status of virtual disks. Use the drop-down list at the top to change the drive size units (MB and GB).

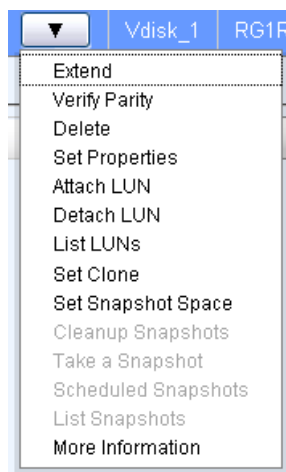
Name	RAID Group	Size (GB)	Interface	Status	Health	R %	Snapshot Space (GB)	Snapshot #	Clone	S
Vdisk_1	RG1R5	744	RAID	Online	Optimal		0/0	0	N/A	N

This table shows the column descriptions for this tab:

Column Name	Description
Name	The virtual disk name.
RAID Group	The RAID Group to which the virtual disk belongs.
Size (GB) [or (MB)]	The total capacity of the virtual disk. The number can be displayed in GB or MB (depends on the size setting).
Interface	Type of interface (RAID or Backup) used by the virtual disk.
Status	Shows the current status of a virtual disk: <ul style="list-style-type: none"> <li>• Online – The virtual disk is online and active.</li> <li>• Offline – The virtual disk is offline.</li> <li>• Initiating – The virtual disk is being initialized for use.</li> <li>• Rebuild – The virtual disk is being rebuilt.</li> <li>• Migrate – The virtual disk is being migrated to a different RAID level.</li> <li>• Rollback – The virtual disk is being rolled back to a previous version.</li> <li>• Scrubbing – The virtual disk is being scrubbed.</li> <li>• Parity checking – The virtual disk is being parity check.</li> </ul>
Health	Shows the health of a virtual disk: <ul style="list-style-type: none"> <li>• Optimal (<b>green</b>) – The virtual disk is working well and there are no failed disks in the RAID Group.</li> <li>• Degraded (<b>orange</b>) – At least one disk in the RAID Group used by the virtual disk has failed or has been removed.</li> <li>• Failed (<b>red</b>) – One or more disks in the RAID Group used by the virtual disk has failed or has been removed and this is more than its RAID level can recover from to prevent loss of data.</li> <li>• Partially Optimal – The virtual disk has experienced recoverable read errors.</li> </ul>
R %	The percent completed of an initializing (or rebuilding) of the virtual disk.

Column Name	Description
Snapshot Space (GB) [or (MB)]	The RAID Group space that is used for Snapshots. The number means used or total Snapshot space. The number can be displayed in GB or MB (depending on the size setting).
Snapshot #	The number of snapshots that have been taken of the virtual disk.
Clone	The Virtual Disk that the current disk was setup to be cloned from. When you have several virtual disks, you can tell one disk to be the clone of another. The clone process creates a snapshot of the other virtual disk. To be able to clone a VD, it must be of the type backup.
Schedule	An icon is used to show the time when clones are scheduled to run.

Menu options for virtual disks are accessed by clicking the menu button (▼). Active functions can be selected while inactive functions appear grayed out and cannot be selected:




This table shows the available functions and their descriptions:

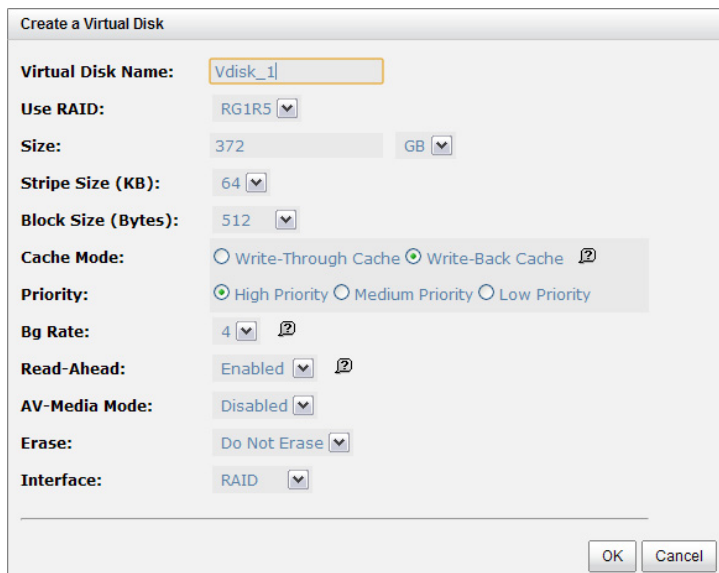
Menu Item	Description
Extend	Extend the virtual disk capacity. The new size must be larger than the current size. See <a href="#">“Virtual Disk Extension”</a> on page 5-4 for details.
Verify Parity	Verify the parity for the virtual disk. It supports any RAID Group with a parity disk (3 / 5 / 6 / 30 / 50 / 60). <ul style="list-style-type: none"> <li>• Regenerate parity when parity/data inconsistency is found– Regenerate the RAID parity and write it to the parity disk.</li> <li>• Check parity/data consistency only– Only verify the parity to find mismatches. When the mismatch count reaches the number selected from the drop-down list, the process stops.</li> </ul>
Delete	Delete the virtual disk.

Menu Item	Description
Set Properties	Change the properties of a virtual disk: <ul style="list-style-type: none"> <li>• Virtual Disk Name</li> <li>• Cache Mode</li> <li>• Priority</li> <li>• Bg Rate (Background Rate)</li> <li>• Read-Ahead</li> </ul>
Attach LUN	Attach a LUN to a virtual disk.
Detach LUN	Detach a LUN from a virtual disk.
List LUNs	List all LUNs attached to a virtual disk.
Set Clone	Use to set the target.
Set Snapshot Space	Reserve space for taking snapshots. The minimum size is suggested to be 20% of the RAID Group size. See more under <a href="#">“Create the Snapshot Space” on page 5-5.</a>
Cleanup Snapshots	Deletes all snapshots of a virtual disk and frees up the snapshot space for use.
Set Snapshot Space	Reserve RAID Group space for snapshots.
Scheduled Snapshots	Schedule times for automatic snapshots.
Take a Snapshot	Manually create a snapshot.
Cleanup Snapshots	Remove/delete all existing snapshot

## Create a Virtual Disk

 **IMPORTANT:** If you plan to take snapshots, you must leave space in the RAID Group for the Snapshot Pool. It is recommended that you leave at least 20% of the space for snapshots and use the remaining 80% for virtual disks. Refer to [“Snapshots” on page 5-4.](#)

This example shows the basic steps needed to create a virtual disk from a RAID Group using the Create a Virtual Disk dialog:



The screenshot shows the 'Create a Virtual Disk' dialog box with the following configuration:

- Virtual Disk Name: vdisk\_1
- Use RAID: RG1R5
- Size: 372 GB
- Stripe Size (KB): 64
- Block Size (Bytes): 512
- Cache Mode: Write-Back Cache
- Priority: High Priority
- Bg Rate: 4
- Read-Ahead: Enabled
- AV-Media Mode: Disabled
- Erase: Do Not Erase
- Interface: RAID

1. Click the **Create** button below the table.

2. Use the **Create a Virtual Disk** dialog to configure the disk:
  - Enter a **Volume Name** for the virtual disk.
  - Use the drop-down list to select a **RAID** to use.
  - Enter the **Size** and select the size **units**.
  - Use the drop-down list to select a **Stripe Size**.
  - Use the drop-down list to select a **Block Size**.
  - Select a **Cache Mode** and **Priority**.
  - Choose a **Background Rate** (Bg Rate) from the drop-down list.
  - If desired, change the **Read-Ahead Cache** setting from the default.
3. Click **OK**.
4. At the confirmation message, click **OK** to begin the initialization:

	Name	RAID Group	Size (GB)	Interface	Status	Health	R %	Snapshot Space (GB)	Snapshot #	Clone	Schedule
▼	Vdisk_1	RG1R5	744	RAID	Initializing	Optimal	10	0/0	0	N/A	N/A

## Snapshots

The Snapshots tab on the Volume Configuration screen enables you create, modify, or view the status of snapshots. Use the drop-down list at the top to change the virtual disk and drive size units (MB and GB). For more detailed information, refer to “Snapshots” on page 5-4.

	No.	Name	Used (GB)	Status	Health	Exposure	Cache Mode	LUN #	Time Created
▼	1	Initial1	3	N/A	Good	No	N/A	N/A	Thu Mar 17 11:06:17 2011

This table shows the column descriptions for this tab:

Column Name	Description
No.	Lists the snapshot number.
Name	Shows the name given to the snapshot.
Used (GB) [or (MB)]	Lists the amount of snapshot space that has been used. The number can be displayed in GB or MB (depending on the disk size setting).
Status	Shows the current status of a virtual disk: <ul style="list-style-type: none"> <li>• Replicated – Being cloned or replicated.</li> <li>• Aborted – Failed to be cloned or replicated.</li> <li>• Undeletable – Not able to delete the replication.</li> <li>• N/A – The snapshot status is not available.</li> </ul>
Health	Provides the health of snapshot: <ul style="list-style-type: none"> <li>• Good – The snapshot was successful.</li> <li>• Failed – The snapshot failed.</li> </ul>

Column Name	Description
Exposure	Tells if the snapshot was completed or not.
Write	Lists the write status of the snapshot: <ul style="list-style-type: none"> <li>• Read-write – The snapshot can be read or written to.</li> <li>• Read-only – The snapshot is read-only.</li> </ul>
Cache Mode	Displays the type of cache used: <ul style="list-style-type: none"> <li>• Read-write – The cache can be read or written to.</li> <li>• Read-only – The cache is read-only.</li> </ul>
LUN #	Shows the number of LUN that is attached to the snapshot.
Time Created	States the time when the snapshot was created.

Menu options for snapshots are accessed by clicking the menu button (▼). Active functions can be selected while inactive functions appear grayed out and cannot be selected.

This table shows the available functions and their descriptions:

Menu Item	Descriptions
Set Quota	Set the size of the snapshot.
Rollback	Rollback the snapshot.
Delete	Delete all the snapshots.
Attach LUN	Attach a LUN to the snapshot.
Detach LUN	Detach the LUN from the snapshot.
List LUNs	List the attached LUNs.

This table shows the available buttons (under the table) and their descriptions:

Menu Item	Descriptions
Set Snapshot Space	Reserve RAID Group space for snapshots.
Scheduled Snapshots	Schedule times for automatic snapshots.
Take a Snapshot	Manually create a snapshot.
Cleanup Snapshots	Remove/delete all existing snapshot



**IMPORTANT:** For complete details and procedures used with SnapShots on a SnapSAN S1000 including automatically scheduled snapshots, refer to [“Snapshots” on page 5-4](#).

### Take a Snapshot

1. Click the **Take a Snapshot** button below the table.
2. Select a **Virtual Disk**, enter a **Snapshot Name**, and click **OK**.
3. Click to the menu button (▼) next to the snapshot number and select **Set Quota** (size).

4. Enter the snapshot **Size**, and click **OK**.  
The size must not exceed the available space. If size is zero, the exposed snapshot will be read-only. Otherwise, the exposed snapshot can be read or written to and the size will be the maximum capacity for those rights.
5. Click to the menu button (▼) next to the snapshot number and select **Attach LUN**.  
Wait while the information is accessed.
6. Enter the **information** requested and click **OK**.  
See “[Attach a LUN](#)” on page 4-27 for details.

The snapshot is ready for access.

## Logical Units

The Logical Units tab on the Volume Configuration screen enables you create, modify, or view the status of the attached logical unit numbers for each virtual disk.

Physical Disks	RAID Groups	Virtual Disks	Snapshots	Logical Units		
					Allowed Hosts	Target
					LUN	Permissions
					Virtual Disk	Number of Session
					▼	*
					0	1
					Read-write	Seconds
					0	
					▼	*
					3	5
					Read-write	Seconds
					0	
Attach LUN						

**NOTE:** Although you can log on to any target, you will not see the LUN if the IQN does not match. If you do not want a host to be able to log on to a target, you should use the CHAP mechanism to filter out the connection, not the IQN. The IQN is used to control what LUN a host will see after it has logged on to the target.

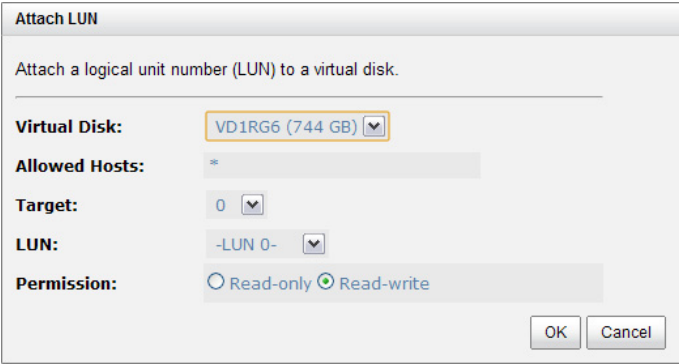
This table shows the column descriptions for this tab:

Column Name	Description
Allowed Hosts	The iSCSI node name for access control or a wildcard (*) for access by all hosts.
Target	The number of the target.
LUN	The number of the LUN assigned.
Permissions	Shows permission level (Read-only or Read-write).
Virtual Disk	The name of the virtual disk assigned to this LUN.
Number of Session	The number of the active connection linked to the logical unit.

### Attach a LUN

1. Click the **Attach LUN** button below the table.

2. At the dialog box, enter or select the options:



The image shows a dialog box titled "Attach LUN". The text inside says "Attach a logical unit number (LUN) to a virtual disk." Below this, there are several fields:

- Virtual Disk:** A dropdown menu showing "VD1RG6 (744 GB)".
- Allowed Hosts:** A text input field containing an asterisk (\*).
- Target:** A dropdown menu showing "0".
- LUN:** A dropdown menu showing "-LUN 0-".
- Permission:** Two radio buttons: "Read-only" (unselected) and "Read-write" (selected).

At the bottom right of the dialog box are "OK" and "Cancel" buttons.

- a. Select the **Virtual Disk** from the drop-down list.
- b. Enter the **Host** name.  
Each Host must have either an iSCSI node name for access control or a wildcard (\*) to allow access by every host.
- c. Select the **Target** number from the drop-down list.
- d. Select the **LUN** number from the drop-down list.
- e. Choose the **Permission** level.
- f. Click **OK**.

### Detach a LUN

Click the menu button (▼) of the LUN being detached and select Delete LUN. Click OK to confirm.

## Volume Creation Example

The following is an example on how to create volumes. This example will create two virtual disks in one RAID Group with each virtual disk sharing the cache volume. The cache volume is created after system boots up automatically. Then a global spare disk will be set up. Last, all of them will be deleted.

### Create the Virtual Disks and RAID Groups

1. Create a **RAID Group**:
  - a. Go to **Volume Configuration > RAID Group**.
  - b. Click **Create**.

- c. At the Create RAID Group dialog, enter or select the **options**, using the data in this graphic.

**Create a RAID Groups**

RAID Name: RAID-R5

RAID Level: RAID 5

RAID Disks: Head Unit: 4 Select Disks

Write Cache: Enabled

Standby: Disabled

Read-Ahead: Enabled

Command Queuing: Enabled

OK Cancel

For **Select Disks**, choose disks from either the Head Unit or Expansion units for use, and click **OK** to complete the disk selection.

**Select Disks**

Show available disk for: Head Unit

Slot	Size (GB)	RAID Group	Status	Health	Usage	Vendor	Serial Number	Interface
<input checked="" type="checkbox"/>	4	372	Online	Good	Free	SEAGATE	3RJ03VX50000	SAS

OK Cancel

- d. Verify the settings and click **OK** to accept.  
A RAID Group has been created.

Physical Disks **RAID Groups** Virtual Disks Snapshots Logical Units

Show RAID size in: GB

Name	Total (GB)	Free (GB)	Disks Used	Number of Virtual Disk	Status	Health	RAID
RG1R5	744	0	3	1	Online	Good	RAID 5

Create

2. Create a **virtual disk** named “VD-R5-1” using about 40% of the RAID Group:
  - a. Select the **Virtual Disk** tab.
  - b. Click **Create**.



- c. At the Create a Virtual Disk dialog, enter or select the **options**.

3. Repeat [Step 2](#) to create another **virtual disk** named “VD-R5-2” using about 40% of the RAID Group.

You now have virtual disks named VD-R5-1 and VD-R5-2. There are no LUNs attached.

4. Attach a **LUN** to a virtual disk.

There are two methods to attach a LUN to a virtual disk:

- From Volume Configuration > Virtual Disks, click the menu button (▼) next to the virtual disk number and select **Attach LUN**.
- From Volume Configuration > Logical Unit, click **Attach LUN**.

We will use both procedures:

- Select the **Virtual Disks** tab.
- Click to the menu button (▼) next to the virtual disk Name and select **Attach LUN**.
- At the Attach LUN dialog, enter or select the **options**.

- Click **OK**.
- Select the **Logical Unit** tab.

- f. Select the second virtual disk.
- g. Click **Attach LUN**.
- h. Enter or select the following **options**:
  - Host **name** of Target 1.
  - Target number **1**.
  - LUN number **LUN 1**.
  - **Read-write** permissions.

- i. Click **OK**.

VD-R5-1 is now attached to LUN 0 and VD-R5-2 is attached to LUN 1.

**Tip:** The matching rules of access control are from the LUNs' created time, the earlier created LUN is prior to the matching rules.

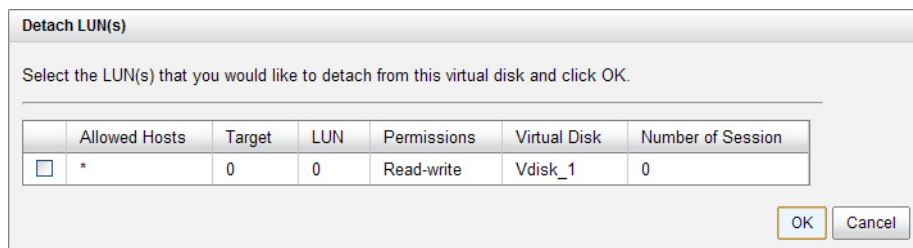
**5. Set a global spare disk:**

- a. Select the **Physical Disk** tab.
- b. Click the menu button (▼) next to the free Physical Disks slot number and select **Set Global Space**.

### Delete Virtual Disks and RAID Groups

**1. Detach the LUNs from the virtual disks:**

- a. Select the **Logical Unit** tab.
- b. Click the menu button (▼) next to the first Host name and select **Detach LUN**.



- c. At the confirmation message, click **OK**.
  - d. Repeat [Steps a–c](#) for the **second** LUN.
- 2. Delete the virtual disks:**
- a. Select the **Virtual Disks** tab.
  - b. Click the menu button (▼) next to the first virtual disk and select **Delete**.
  - c. At the confirmation message, click **OK**.
  - d. Repeat [Steps a–c](#) for the **second** virtual disk.

**Tip:** When deleting the virtual disks directly, the attached LUNs are detached at the same time.

**3. Delete the RAID Group:**

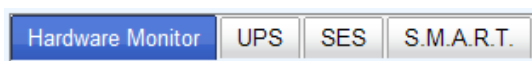
- a. Select the **RAID Group** tab.
- b. Verify that all **virtual disks** for this RAID Group are deleted. Otherwise, the RAID Group cannot be deleted.
- c. Click the menu button (▼) next to the RAID Group Name and select **Delete**.

- d. At the confirmation message, click **OK**.
4. Release the **Global Spare Disk**:
    - a. Select the **Physical Disk** tab.
    - b. Click the menu button (▼) next to the Physical Disks used as the spare and select **Set Free Disk**.

All volumes have now been deleted.

## Enclosure Management

The Enclosure Management menu option is for accessing the Hardware Monitor, UPS, SES, and S.M.A.R.T. option tabs.



For the purpose of enclosure management, many different sensors are used (such as, temperature sensors, voltage sensors, hard disk status, fan sensors, power sensors, and LED status sensors). Due to the different hardware characteristics among these sensors, they have different polling intervals:

- Temperature sensors – 1 minute.
- Voltage sensors – 1 minute.
- Hard disk sensors – 10 minutes.
- Fan sensors – 10 seconds. When there are three (3) errors consecutively, the system logs an error event.
- Power sensors – 10 seconds, when there are three (3) errors consecutively, the system logs an error event.
- LED status sensors – 10 seconds.

## Hardware Monitor

The Hardware Monitor tab on the Enclosure Management screen shows the information of current voltages and temperatures, and provides an Auto Shutdown option.

Hardware Monitor | UPS | SES | S.M.A.R.T.

Show information for:  Temperature:

### Controller 1 Monitors

Interface	Item	Value	Status
Voltage	Onboard +1.2V	+1.18 V (min = +1.08 V, max = +1.32 V)	OK
Voltage	Onboard +3.3V	+3.34 V (min = +3.04 V, max = +3.56 V)	OK
Voltage	Onboard +5V	+5.10 V (min = +4.60 V, max = +5.40 V)	OK
Voltage	Onboard +12V	+12.08 V (min = +11.04 V, max = +12.96 V)	OK
Voltage	Onboard +1.8V	+1.81 V (min = +1.62 V, max = +1.98 V)	OK
Temperature	Core Processor	+43.5 C (hyst = +0.0 C, high = +80.0 C)	OK
Temperature	iSCSI NIC 1	+33.5 C (hyst = +0.0 C, high = +65.0 C)	OK
Temperature	iSCSI NIC 2	+33.5 C (hyst = +0.0 C, high = +65.0 C)	OK
Temperature	SAS Controller	+35.0 C (hyst = +0.0 C, high = +65.0 C)	OK
Temperature	SAS Expander	+31.0 C (hyst = +0.0 C, high = +65.0 C)	OK
Battery	Battery Backup Module	100 %	OK

### Internal Monitors

Interface	Item	Value	Status
Voltage	PSU +5V	+5.14 V (min = +4.60 V, max = +5.40 V)	OK
Voltage	PSU +12V	+12.27 V (min = +11.04 V, max = +12.96 V)	OK
Voltage	PSU +3.3V	+3.44 V (min = +3.04 V, max = +3.56 V)	OK
Temperature	Location 1	+33.0 C (hyst = +0.0 C, high = +55.0 C)	OK
Temperature	Location 2	+23.5 C (hyst = +0.0 C, high = +55.0 C)	OK
Temperature	Location 3	+22.0 C (hyst = +0.0 C, high = +55.0 C)	OK
Power Supply	PSU1	N/A	OK
Power Supply	PSU2	N/A	OK
Cooling	FAN1	10546 RPM	OK
Cooling	FAN2	11250 RPM	OK
Cooling	FAN3	10546 RPM	OK
Cooling	FAN4	10546 RPM	OK

**Auto Shutdown:**

If Auto Shutdown is enabled, the system will shutdown automatically when the internal power levels

If Auto Shutdown is enabled, the system will shutdown automatically when the internal power levels or temperature are not with normal levels. For better data protection, it is recommended to check Auto Shutdown.

For better protection and avoiding single short period of high temperature that could trigger an automatic shutdown, the system uses rules to gauge if a shutdown is needed. This is done using several sensors placed on key systems that the system checks every 30 seconds for preset temperatures:

- The core processor temperature limit is 80° C.
- The iSCSI NIC temperature limit is 65° C.
- The SAS expander and SAS controller temperature limits are 65° C.

When one of these sensors reports a temperature above the threshold for three (3) continuous minutes, the system automatically shuts down. If a high temperature situation doesn't last for at least three minutes, the system will not trigger a shutdown.

## UPS

The UPS tab on the Enclosure Management screen can be used to set up a Uninterruptible Power Supply (UPS).

Currently, the system only supports and communicates with Smart-UPS systems by APC (American Power Conversion Corp.). Please review the details from their webbiest: <http://www.apc.com/>.

First, connect the system and APC UPS via the included cable for communication. (The SnapSAN S1000 cable plugs into the APC serial cable that comes with the UPS.) Then set up the shutdown values (shutdown battery level %) for when the power goes out.

**NOTE:** UPS systems from other companies will work, but they cannot communicate with the SnapSAN S1000.

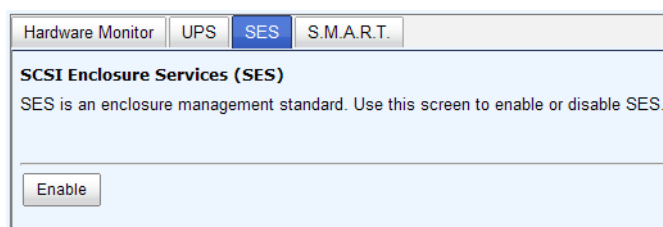
This table shows the available options and their descriptions.

Options	Description
UPS Type	Select UPS Type. <ul style="list-style-type: none"> <li>• Smart-UPS – APC UPS</li> <li>• None – UPS from other vendors or no UPS.</li> </ul>
Shutdown Battery Level (%)	When below the setting level, system will shutdown. Setting level to “0” will disable UPS.
Shutdown Delay (Seconds)	If power failure occurs, and system power can not recover, the system will shutdown at the time specified. Setting delay to “0” will disable the function.
Shutdown UPS	If you select ON, when power is gone, the UPS will shutdown by itself after the system successfully shuts down. When the power comes back, the UPS will start working and notify the unit to start up. Selecting OFF has no impact on the system.
UPS Status	The status of UPS: <ul style="list-style-type: none"> <li>• Detecting...</li> <li>• Running</li> <li>• Unable to detect UPS</li> <li>• Communication lost</li> <li>• UPS reboot in progress</li> <li>• UPS shutdown in progress</li> <li>• The batteries in the UPS have failed. Please change them immediately.</li> </ul>

Options	Description
UPS Battery Level	Current power percentage of battery level.

## SES

The SES tab on the Enclosure Management screen addresses the SCSI Enclosure Services, one of the enclosure management standards. This tab can be used to enable or disable the management of SES.



To enable the feature:

1. Click the **Enable** button.
2. At the options screen, enter either an **iSCSI node name** for access control (or a wildcard (\*) to allow access by every host).

3. Select the **Target** name from the drop-down list.

The above figures shows SES enabled in LUN 0. Because of the wildcard (\*), it can be accessed from every host.

4. Click **OK**.

SES client software is available at the following web site:

SANtools: <http://www.santools.com/>

## S.M.A.R.T.

The S.M.A.R.T. tab on the Enclosure Management screen manages the S.M.A.R.T. (Self-Monitoring Analysis and Reporting Technology) diagnostic tool for disk drives. It is used to deliver a warning in advance of a possible drive failure. S.M.A.R.T. provides users a chance to take actions before a possible drive failure.

Slot	HDD Type	Read Error (Rate)	Spin Up (Time)	Reallocated Sector (Count)	Seek Error (Rate)	Spin Up (Retries)	Calibration (Retries)	Tem
1	SATA2	200(51)	253(21)	200(140)	200(0)	100(0)	100(0)	34
2	SATA2	200(51)	253(21)	200(140)	200(0)	100(0)	100(0)	34
3	SATA2	200(51)	253(21)	200(140)	200(0)	100(0)	100(0)	32
4	SATA2	200(51)	253(21)	200(140)	200(0)	100(0)	100(0)	31

S.M.A.R.T. measures many attributes of the disk drive all the time and inspects the properties of disk drives which may be close to being out of tolerance. The advanced notice provided by S.M.A.R.T. can allow users to back up or replace the disk drive in question. This is better than a disk drive crash while it is writing data or rebuilding another failed disk drive which would result in data loss.

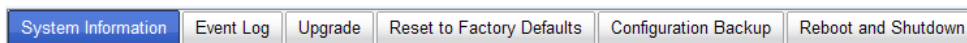
This tool displays S.M.A.R.T. information of the disk drives. The each column shows number that is the current S.M.A.R.T. value while the threshold value is shown in parenthesis. Different disk drive vendors use different threshold values; please refer to disk drive vendors' specification for details.

S.M.A.R.T. only supports SATA drives. SAS drives do not have this function and will show "N/A" in the web page:

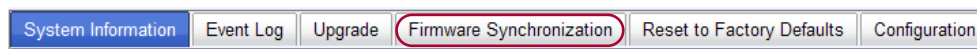
Slot	HDD Type	Read Error (Rate)	Spin Up (Time)	Reallocated Sector (Count)	Seek Error (Rate)	Spin Up (Retries)	Calibration (Retries)	Ten
1	SAS	N/A	N/A	N/A	N/A	N/A	N/A	34
2	SAS	N/A	N/A	N/A	N/A	N/A	N/A	37
3	SAS	N/A	N/A	N/A	N/A	N/A	N/A	34
4	SAS	N/A	N/A	N/A	N/A	N/A	N/A	31

## System Maintenance

The System Maintenance menu option is for accessing the System Information, Event Log, Upgrade, Reset to Factory Defaults, Configuration Backup, and Reboot and Shutdown option tabs.



Dual controllers have an extra option for Firmware Synchronization:



## System Information

The System Information tab on the System Maintenance screen is used to display system information (including CPU type), installed system memory, firmware version, serial numbers of the controllers, backplane ID, and system status.

Item	Information
CPU Type	XSC3-IOP8134x Family rev 9 (v51)
System Memory	ECC Unbuffered DDR-II 2048MB
Firmware Version	SnapSAN 2.0.1 (build 201011192100)
Serial Number(s)	00C0B624A3E0 (Controller 1 : 5001378003E02618 , Controller 2 : 5001378003E01F58 )
Backplane ID	2U12-OD10001
Expansion Unit Serial Number(s)	No Expansion Unit connected
Status	Normal

Show disks for:

Slot	Size (GB)	Status	Health	Vendor	Serial Number	Interface
1	931	Online	Good	WDC	WD-WMATV3597376	SATA2
2	931	Online	Good	WDC	WD-WMATV3526754	SATA2
3	931	Online	Good	WDC	WD-WMATV3554243	SATA2
4	931	Online	Good	WDC	WD-WMATV3554049	SATA2

## Event Log

The Event Log tab on the System Maintenance screen provides a log of event messages. Choose Info, Warning, or Error levels to display those particular events.

Event Log Level to Show:

<< first < prev 1 2 3 4 next > last >>

Type	Time	Content
Info	Fri, 05 Nov 2010 14:59:37	[CTR1] Virtual Disk VD1RG6 starts migration.
Info	Fri, 05 Nov 2010 14:59:37	[CTR1] RAID Group RG1R6 starts migration.
Info	Fri, 05 Nov 2010 09:29:05	[CTR1] LUN 1 is attached to Virtual Disk VD1RG6.
Info	Fri, 05 Nov 2010 09:28:42	[CTR1] LUN 0 is detached from Virtual Disk VD1RG6.
Info	Fri, 05 Nov 2010 09:27:18	[CTR1] LUN 0 is attached to Virtual Disk VD1RG6.
Info	Fri, 05 Nov 2010 08:11:36	[CTR1] admin login from 10.1.28.18 via Web UI
Info	Fri, 05 Nov 2010 08:03:31	[CTR1] All volumes in controller 1 completed failover process.
Info	Fri, 05 Nov 2010 08:03:11	[CTR1] Battery backup module is detected
Info	Fri, 05 Nov 2010 08:03:11	[CTR1] Battery backup feature is enabled.
Info	Fri, 05 Nov 2010 08:03:10	[CTR1] ECC memory is installed
Info	Fri, 04 Nov 2010 16:46:04	[CTR1] System shutdown from 10.1.28.18 via Web UI

## Action Buttons

Three special action buttons are located at the bottom of the screen.

- Click the **Download** button to save the whole event log as a text file with file name log-ModelName-SerialNumberDate-Time.txt.
- Click the **Mute** buzzer button to stop system alarms.
- Click the **Clear** button to clear all event logs.



The event log is displayed in reverse order which means the latest events are at the top of the page. The event logs are saved in the first four disk drives; each disk drive has one copy of the logs. For one system, there are four copies of event logs to make sure users can check event log any time when there are failed disks.

## Upgrade



**IMPORTANT:** It is recommended to export your system configuration before upgrading the firmware. Use the Configuration Backup tab (see [page 4-39](#)).

The Upgrade tab on the System Maintenance screen is used to upgrade the SnapSAN S1000 or SnapDisk E1000 firmware. Save a new firmware file named “xxxx.bin” in local disk drive, click **Browse** to select the file, click **Apply** to begin, and click **OK** at the confirmation message to start to upgrade firmware.

The screenshot shows the 'Upgrade' tab in the System Maintenance interface. It contains three main sections:

- Controller Module Firmware Update:** Includes a label 'Select the firmware file for the upgrade:', a 'Choose File' button, and a 'No file chosen' status. Below this is an 'Apply' button.
- Expansion Unit Firmware Update:** Includes a 'Choose a Expansion Unit:' dropdown menu, a 'Select the firmware file for the upgrade:' label, a 'Choose File' button, and a 'No file chosen' status. Below this is an 'Apply' button.
- Controller Mode:** Includes an 'Operation Mode:' label and a dropdown menu with 'Single' selected and 'Dual' as an option. Below this is an 'Apply' button.

While upgrading, there is a progress bar running. After the upgrade is finished, the system must be restarted manually (Reboot and Shutdown tab) for the new firmware to take effect.

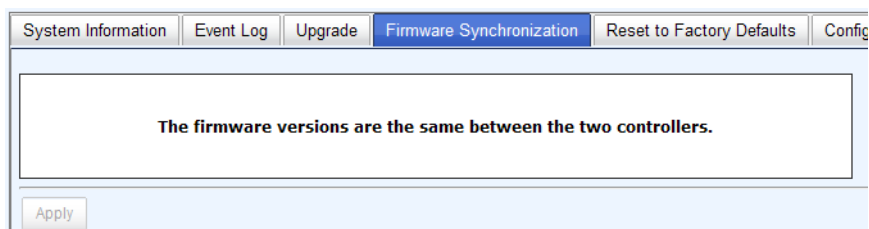
**NOTE:** Please check the [Overland Technical Support website](#) for the latest firmware.

## Firmware Synchronization

The Firmware Synchronization tab on the System Maintenance screen is used on dual controller systems to synchronize the controller firmware versions when the firmware of the Master controller and the Secondary controller are different. The firmware of the Secondary controller is always changed to match the firmware of the Master controller. It doesn't matter if the firmware version of the Secondary controller is newer or older than that of the Master controller.

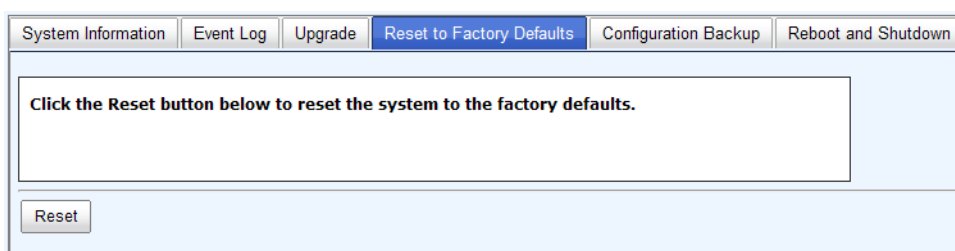
**NOTE:** This tab is not visible on single controller systems.

Normally, the firmware versions in both controllers are the same.



## Reset to Factory Defaults

The Reset to Factory Defaults tab on the System Maintenance screen allows users to reset the controller values back to the factory default settings.



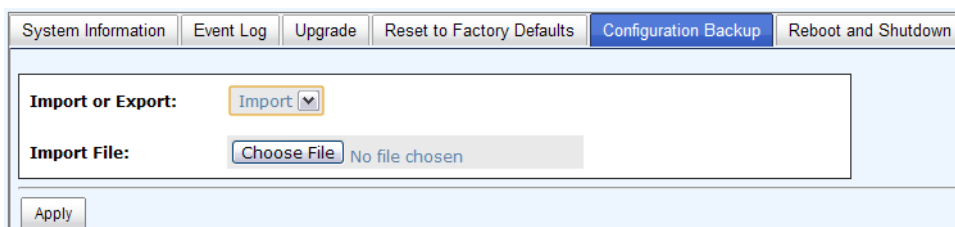
The default values are:

- Administrator name – admin
- Password – admin
- IP address type – DHCP

**NOTE:** Defaults for IP address, subnet mask, and gateway are DHCP provided.

## Configuration Backup

The Configuration Backup tab on the System Maintenance screen is used to either save system configuration values (export) or apply a saved configuration (import).



While the volume configuration settings are available for exporting, to prevent conflicts and overwriting existing data, they cannot be imported.

Choose what you want to do:

- **Import** – All system configurations imported (excluding volume configuration).
- **Export** – All configurations exported to a chosen file.



**CAUTION:** Import will import all system configurations excluding volume configuration and the current system configurations will be replaced.

## Reboot and Shutdown

The Reboot and Shutdown tab on the System Maintenance screen is used to reboot or shutdown the system in a controlled manner. Before turning off the unit, it is highly recommended to use the Shutdown feature to flush the data from cache onto the physical disks and make sure your data is safe.



## How To Use the Guided Configurations

To help get the SnapSAN S1000 up and running quickly, two different guided configuration tools are available in the Web Management Interface: Quick Installation and Volume Creation Wizard. If you are an advanced user you can skip these guided configurations.

### Quick Installation Tool

This tool on the menu bar manually guides you through the process of setting up basic array information, configuring network settings, and the creation of a RAID Group on your SnapSAN S1000:

1. Click **Quick Installation** from the Menu Bar.
2. At the Step 1 screen, enter a **System Name** and verify the **Date and Time**. Click **Next** to proceed.

The screenshot shows a web interface window titled "Quick Installation". The main heading is "Step 1: System Settings". There are two main sections: "System Name" and "Date and Time". The "System Name" section has a text input field containing "SnapSAN". The "Date and Time" section has a checkbox for "Change date and time" which is checked. Below this, it shows "Current time: 2010/11/4 16:23:45" and "Time zone: (GMT-08:00) Pacific Time(US & Canada)". There are two radio buttons: "Setup date and time manually" (which is selected) and "NTP". Under "Setup date and time manually", there are dropdown menus for "Date" (2010 / 11 / 4) and "Time" (16 : 20 : 29). Under "NTP", there is a "Server:" text input field. At the bottom of the window, there are "Cancel" and "Next >>" buttons.

To specify a valid Network Time Protocol (NTP) server, click Change Date and Time, select NTP, and enter the Server address.

- At the next screen, confirm or change the **Management port** information:

The screenshot shows a dialog box titled "Quick Installation" with the subtitle "Step 2: Network Settings". It contains several sections for network configuration:

- MAC Address:** A text field containing "00:13:78:BB:04:10".
- IP Address:** A section with three radio buttons: "Use DHCP" (unselected), "Use BOOTP" (unselected), and "Specify a static IP Address" (selected). Below these are three text fields: "IP Address" with "10.20.34.146", "Subnet Mask" with "255.255.0.0", and "Gateway" with "10.20.8.1".
- DNS Server Address:** A section with a text field "Address" containing "10.20.8.22".
- Service Ports:** A section with three text fields: "HTTP Port" with "80", "HTTPS Port" with "443", and "SSH Port" with "22".

At the bottom of the dialog are three buttons: "Cancel", "<< Back", and "Next >>".

If you don't want to use the default DHCP setting, choose either BOOTP, or Specify a Static IP Address. If needed, the IP address of the DNS server can be entered here. If the default HTTP, HTTPS, and SSH port numbers are not allowed on your network, they can be changed here as well.

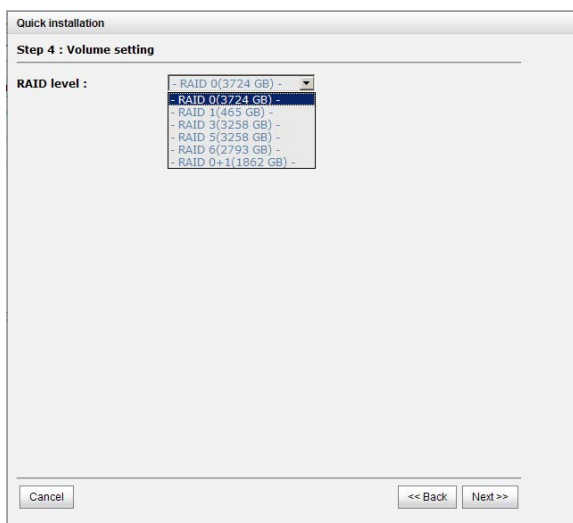
- For iSCSI configurations, use this screen to set up the **Data** port iSCSI IP address, and then click **Next**.

The screenshot shows a dialog box titled "Quick Installation" with the subtitle "Step 3: iSCSI IP Address Settings". It contains a section for "LAN1:" with the following options and fields:

- Two radio buttons: "Use DHCP" (unselected) and "Specify a static IP Address" (selected).
- Three text fields: "IP Address" with "10.21.30.10", "Subnet Mask" with "255.255.0.0", and "Gateway" (empty).

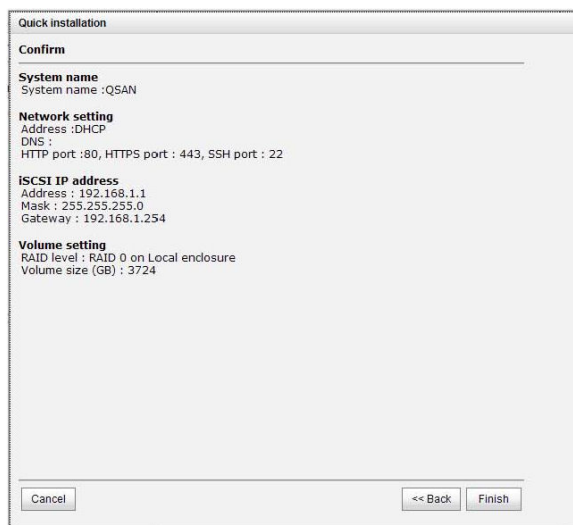
At the bottom of the dialog are three buttons: "Cancel", "<< Back", and "Next >>".

- At this screen, choose a **RAID level** and volume size and click **Next**.



This step utilizes all drives in the S1000 array as well as any E1000 expansion arrays present. There is a maximum limit of 32 drives in a RAID Group. If there are more than 32 drives available, this option allows the selection of the RAID type and the number of drives in each array.

- At the final screen, verify all items, and then click **Finish** to complete the set up.



The iSCSI information is only displayed when iSCSI controllers are used. Use the Back button to return to a previous page to change any settings.

## Volume Creation Wizard

The Volume Creation Wizard on the menu bar uses an advanced policy to determine all the possibilities and volume sizes in the different RAID levels that can be created using the existing free disk drives. This way, after choosing a RAID level, you may find that some disk drives are available (free status). It provides:

- Largest capacity for each RAID level from which to choose.
- The fewest number of disks for each RAID level / volume size.

To use the Volume Creation Wizard:

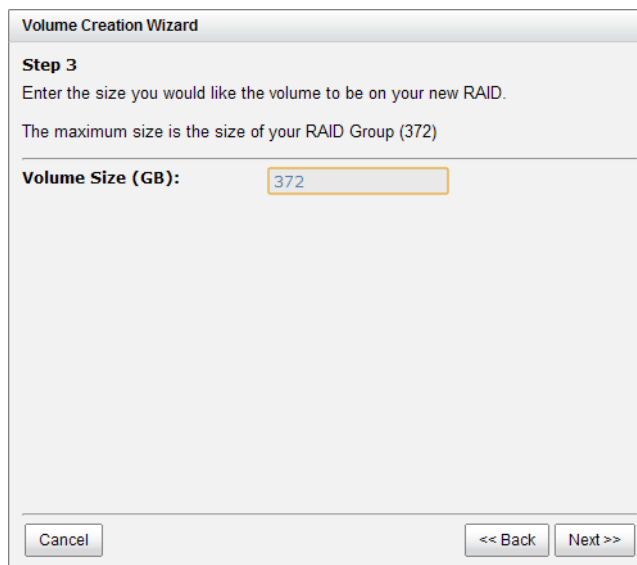
1. Select **Volume Creation Wizard** in the Menu Bar.
2. For Step 1, choose the **RAID** level desired, then click **Next**.

The screenshot shows the 'Volume Creation Wizard' dialog box at Step 1. The title bar reads 'Volume Creation Wizard'. Below the title, it says 'Step 1' and provides instructions: 'The dropdown list below contains the levels and the amount of storage that will be available using that RAID method. Please select the option that best suits your storage needs.' There are two labels: 'Enclosure:' and 'Head Unit', both of which are currently blank. Below these is the 'RAID Level:' label, followed by a dropdown menu showing '- RAID 0 (372 GB) -'. At the bottom of the dialog, there are two buttons: 'Cancel' on the left and 'Next >>' on the right.

3. For Step 2, from the drop-down list, select either the RAID Group capacity combination desired or the **Use default algorithm** for maximum RAID Group capacity. Click **Next**.

The screenshot shows the 'Volume Creation Wizard' dialog box at Step 2. The title bar reads 'Volume Creation Wizard'. Below the title, it says 'Step 2' and provides instructions: 'You can either have the enclosure automatically maximize the size of your RAID group based on the available disks or you can select the number of disks that you would like to include.' A note is displayed: 'Note: The maximum number of disk in a RAID group is 32.' There are two radio button options: 'Maximize the size of the RAID group' (which is selected) and 'Select the number of disk to use'. Below these is the 'RAID Group:' label, followed by a dropdown menu showing 'New 1 Disk (372 GB)'. At the bottom of the dialog, there are three buttons: 'Cancel' on the left, '<< Back' in the middle, and 'Next >>' on the right.

- For Step 3, enter the **virtual disk size** desired that is less than or equal to the default available size shown. Then click **Next**.



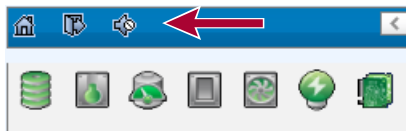
- Finally, at Step 4, verify your selections and click **Finish** if they are correct.

**NOTE:** Use the [Back](#) button to return to a page and change any settings.

The virtual disk is created and automatically named by the system. It is now available on the system.

## Home/Logout/Mute Icons

In the upper-left corner of Menu Bar, there are three special icons: Home, Logout, and Mute.



### Home

Click Home to return to home page of the Web Management Interface.

### Logout

For security reasons, use Logout to exit the Web Management Interface. To re-login the system, enter your user name and password again.

### Mute

Click Mute to stop the buzzer alarm when a system error occurs.

## Volume Auto-Rebuild

SnapSAN S1000 supports the Auto-Rebuild feature. If one disk drive of a protected RAID Group (for example, RAID 3, RAID 5, or RAID 6) either fails, is unplugged, or is removed, then the status of RAID Group is automatically changed to degraded mode. The system then searches for a spare disk to rebuild the group. It will first look for a spare disk dedicated to the RAID Group, and then for a global spare disk.

The following examples are scenarios for a RAID 6 group:

- **No dedicated or global spare disk drive** – The RAID Group is set to degraded mode and waits to start Auto-Rebuild until:
  - There is a disk drive assigned as a spare disk drive (dedicated or global).
  - The failed disk is removed and replaced with new disk drive. The new disk automatically becomes a spare disk to the original RAID Group.

If the newly added disk drive comes with information from an existing RAID Group on it, the disk drive is marked as RS (reserved) and the system does not start the Auto-Rebuild.

If the new disk drive does not belong to any existing RAID Group, it is marked as a FR (Free) disk drive and the system starts the Auto-Rebuild.

If the failed disk drive is removed and then plugged back into the same slot, the Auto-Rebuild will start running.



**CAUTION:** Rebuilding the same failed disk may impact customer data if the status of disk is unstable. It is highly recommended not to rebuild a failed disk for better data protection.

- **Enough dedicated or global spare disks exist** – The system starts the Auto-Rebuild immediately. In RAID 6, if another disk failure occurs during rebuilding the disk drives, the system will start the previous Auto-Rebuild process as well.

The Auto-Rebuild feature only works when the status of the RAID Group is Online. It does not work with it Offline. That way, it does not conflict with the Online Roaming feature.

While in degraded mode, the status of RAID Group is shown as Degraded. When rebuilding, the status of RAID Group changes to Rebuild and the column R % on the Virtual Disks page displays the rebuild ratio as a percentage. After the rebuilding is complete, the status returns to Online.

**NOTE:** The Set Dedicated Spare option is not available if there is no RAID Group or the only RAID Groups are RAID 0 or expansion arrays. A dedicated spare disk cannot be set for a RAID 0 or expansion array.

This table shows the relationship between RAID levels and a rebuild (recovery):



Type	Description	Min. No. of Drives
RAID 0	Disk striping. No protection for data. RAID Group fails if any disk drive fails or unplugs.	At least one
RAID 1	Disk mirroring over 2 disks. RAID 1 allows one disk drive fails or unplugging. Need one new disk drive to insert to the system and rebuild to be completed.	At least two
RAID 3	Striping with parity on the dedicated disk. RAID 3 allows one disk drive failure or unplugging.	At least three
RAID 5	Striping with interspersed parity over the member disks. RAID 5 allows one disk drive failure or unplugging.	At least three
RAID 6	2-dimensional parity protection over the member disks. RAID 6 allows two disk drives failure or unplugging. If it needs to rebuild two disk drives at the same time, it will rebuild the first one, then the other in sequence.	At least four
RAID 0+1	Mirroring of RAID 0 volumes. RAID 0+1 allows two disk drive failures or unplugging, but at the same array.	At least four
RAID 10	Striping over the member of RAID 1 volumes. RAID 10 allows two disk drive failure or unplugging, but in different arrays.	At least four
RAID 30	Striping over the member of RAID 3 volumes. RAID 30 allows two disk drive failure or unplugging, but in different arrays.	At least six
RAID 50	Striping over the member of RAID 5 volumes. RAID 50 allows two disk drive failures or unplugging, but in different arrays.	At least six
RAID 60	Striping over the member of RAID 6 volumes. RAID 60 allows four disk drive failures or unplugging, every two in different arrays.	At least eight
JBOD	The abbreviation of "Just a Bunch Of Disks". No data protection. RAID Group fails if any disk drive failures or unplugs.	At least one

## RAID Group Migration



**CAUTION:** RAID Group Migration cannot be executed during the rebuilding or extension of a virtual disk.

1. Select **Volume Configuration > RAID Groups**.
2. Click the menu button (▼) next to the RAID Group number and select **Migrate RAID Level**.

3. Select your **options**:

- a. If desired, change the default **RAID Name**.
- b. Use the drop-down list to select the **RAID Level**.
- c. Click the **Select Disks** button to change the disks used with this RAID.
- d. Click **OK**.

If the number of disk drives is not enough to support the new RAID level, a warning is displayed. Click Select Physical Disks to increase the number of disk drives and then click OK.

**NOTE:** When doing migration to lower RAID level (such as, RAID 6 down to RAID 0), the system will evaluate whether this operation is safe or not. If not, it displays a warning message. Double-check the setting of RAID level and RAID Physical Disks slot. If there is no problem, click OK.

4. At the confirmation page, verify the new RAID information. If there is no problems, click **OK**.
5. At the power failure impact message, click **OK** to start the migration.  
System displays a message to remind the user that the data is a risk should the power fail during the migration.

The migration begins and the status of the RAID Group changes to Migrating.

The screenshot shows the RAID Groups configuration page. The 'RAID Groups' tab is selected. A table lists the RAID groups. The first entry, 'RG1R5', has a 'Status' of 'Migrating', which is circled in red. Other columns include Name, Total (GB), Free (GB), Disks Used, Number of Virtual Disk, Health (Good), and RAID (RAID 5).

Name	Total (GB)	Free (GB)	Disks Used	Number of Virtual Disk	Status	Health	RAID
RG1R5	744	0	3	1	Migrating	Good	RAID 5

Also, at Volume Configuration > Virtual Disks, the status displays Migrating and the percent completed is shown under R %.

The screenshot shows the Virtual Disks configuration page. The 'Virtual Disks' tab is selected. A table lists the virtual disks. The first entry, 'Vdisk\_1', has a 'Status' of 'Migrating', which is circled in red. Other columns include Name, RAID Group, Size (GB), Interface, Health (Optimal), R %, Snapshot Space (GB), Snapshot #, Clone, and Schedule.

Name	RAID Group	Size (GB)	Interface	Status	Health	R %	Snapshot Space (GB)	Snapshot #	Clone	Schedule
Vdisk_1	RG1R5	744	RAID	Migrating	Optimal	10	0/0	0	N/A	N/A

To perform a migration, the total size of RAID Group must be larger or equal to the original RAID Group. It does not allow expanding the same RAID level with the same hard disks of original RAID Group.

The operations listed are not allowed when a RAID Group is being migrated:

- Add a dedicated spare.
- Remove a dedicated spare.
- Create a new virtual disk.
- Delete a virtual disk.
- Extend a virtual disk.
- Scrub a virtual disk.
- Perform another migration operation.

- Scrub an entire RAID Group.
- Take a snapshot.
- Delete a snapshot.
- Expose a snapshot.
- Rollback to a snapshot.

## Virtual Disk Extension



**CAUTION:** A virtual disk extension cannot be executed during the rebuilding or migration of a virtual disk.

To extend a virtual disk's size:

1. Select **Volume Configuration > Virtual Disks**.
2. Click the menu button (▼) next to the virtual disk number and select **Extend**.
3. Change the **size** (and units if necessary), then click **OK** to start extension.

**NOTE:** The new size must be larger than the original size.

The extension process starts. If the virtual disk needs initialization, it displays Initiating for the status and completion percentage in R %.

Physical Disks   RAID Groups   <b>Virtual Disks</b>   Snapshots   Logical Units											
Show size in: GB ▼											
	Name	RAID Group	Size (GB)	Interface	Status	Health	R %	Snapshot Space (GB)	Snapshot #	Clone	Schedule
▼	Vdisk_1	RG1R5	744	RAID	Initializing	Optimal	10	0/0	0	N/A	N/A

Create Cloning Options

## Snapshots

In a logical sense, snapshots capture an instant state of data of the target volume. The underlying logic is Copy-on-Write—copying the data that is being written at the time of the data capture.

Snapshots are stored in a reserved space set up within the RAID Group (similar to a virtual disk). Each RAID Group on the system contains only one such Snapshot Pool. This pool contains all snapshot data for all virtual disk volumes on the RAID Group.

The Rollback option restores the data back to the state at the time when it was captured if it should become damaged (for example, a virus attack, data corruption, or human error).

## Create the Snapshot Space

Snapshot data grows dynamically for as long as a snapshot is active and as long as there is enough space available in the Snapshot Pool to store the data. When the Snapshot Pool approaches its capacity (at about 95 percent), the oldest snapshot's data is deleted to create space for more recent snapshot data. Only the latest 32 snapshots are kept.

To set up space for snapshots:

1. Use one of these **two methods** to create the snapshot space:
  - Under the Virtual Disks tab, click the menu button (▼) next to the disk name and select **Take a Snapshot**.
  - Under the Snapshot tab, click the **Take a Snapshot** button.

The screenshot shows a dialog box titled "Set Snapshot Space". It contains the following fields and values:

- Virtual Disk:** A dropdown menu showing "Vdisk\_1".
- Size:** A text input field containing "120" and a unit dropdown menu showing "GB".
- Free Capacity:** A text input field containing "644GB".
- Available:** "644GB"
- Minimum:** "1GB"

At the bottom right, there are two buttons: "OK" and "Cancel".

2. Choose the **size** of the snapshot, the size **unit** type, and then click **OK**.

The minimum space size is suggested to be 20% of the RAID Group size and not to exceed the Free Capacity.

On the Virtual Disks tab, the size is shown in Snapshot Space column. It may not be the exact same number entered because some size is reserved for internal snapshot usage. There are two numbers shown in Snapshot Space column separated by a slash. These numbers refer to snapshot space used and total snapshot space allocated.

## Take a Snapshot

To manually take a snapshot of data:

1. Use one of these **two methods** to take snapshot:
  - Under the Virtual Disks tab, click the menu button (▼) next to the disk name and select **Take a Snapshot**.
  - Under the Snapshot tab, click the **Take a Snapshot** button.

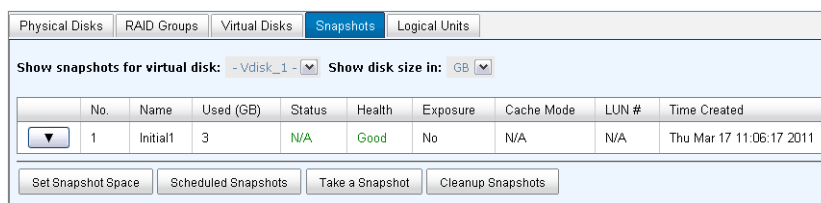
The screenshot shows a dialog box titled "Take a Snapshot". It contains the following fields and values:

- Snapshot Name:** A text input field that is currently empty.

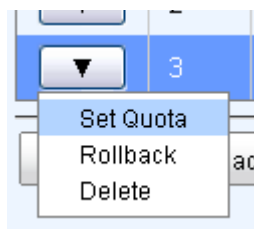
At the bottom right, there are two buttons: "OK" and "Cancel".

2. Enter a **Snapshot Name**, then click **OK**.

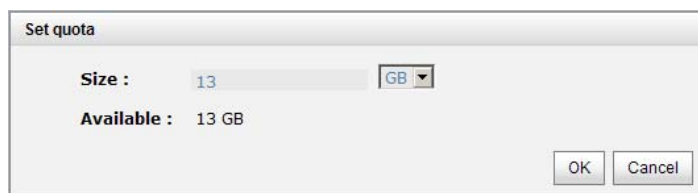
3. Select the **Snapshots** tab to display all snapshots taken from the virtual disk.



4. Click to the menu button (▼) next to the snapshot number and select **Set Quota**.



5. Enter the snapshot **Size**.



The size must not exceed the available space. If size is zero, the exposed snapshot will be read-only. Otherwise, the exposed snapshot can be read or written to and the size will be the maximum capacity for those rights.

6. Click to the menu button (▼) next to the snapshot number and select **Attach LUN**.
7. Enter the **information** requested and click **OK**.  
See “[Attach a LUN](#)” on page 4-27 for details.

The snapshot is ready for access.

## Clean (Delete) Snapshots

There are two methods to clean (delete) all snapshots:

- Under Volume Configuration > Virtual Disks, click the menu button (▼) next to the virtual disk number and select **Cleanup Snapshots**.
- Under Volume Configuration > Snapshots, click the **Cleanup** button.

Cleanup Snapshots deletes all snapshots and releases the snapshot space.

## Schedule Automatic Snapshots

The snapshots of the data can be taken automatically, such as hourly or daily.



**IMPORTANT:** The RAID Group must already have space reserved from its free space for storing snapshots.

1. There are **two methods** to set an scheduled snapshot:

- Under Volume Configuration > Virtual Disks, click the menu button (▼) next to the virtual disk number and select **Scheduled Snapshots option**.
  - Under Volume Configuration > Snapshots, click the **Scheduled Snapshots button** below the table.
2. Select the scheduled snapshot **time interval** of monthly, weekly, daily, or hourly.

**Scheduled Snapshots**

Months to Take Snapshots:  All  
 01  02  03  04  
 05  06  07  08  
 09  10  11  12

Weeks to Take Snapshots:  All  
 1  2  3  4  
 5

Days to Take Snapshots:  All  
 Sun  Mon  Tue  Wed  
 Thu  Fri  Sat

Hours to Take Snapshots:  All  
 00  01  02  03  
 04  05  06  07  
 08  09  10  11  
 12  13  14  15  
 16  17  18  19  
 20  21  22  23

OK Cancel

Specific times within the overall time frame can be selected/deselected by clicking the checkbox.

3. Click **OK**.

Snapshots are taken automatically based on the time interval selected. The last 32 snapshot copies are kept (space permitting).

**Tip:** Daily snapshots are taken at midnight (00:00). Weekly snapshots are taken every Sunday at midnight. Monthly snapshots are taken the first day of every month at midnight.

## Rollback



**CAUTION:** Before executing rollback, it is better to dismount the file system to flush the data from cache to the disk drives first. The SnapSAN S1000 displays a message to remind the user when they execute the rollback function.

The data in a snapshot can be used to roll back the existing information to the original virtual disk data:

1. Select **Volume Configuration > Snapshots**.
2. Click the menu button (▼) next to the snapshot number that the user wants to roll the data back for, and select **Rollback**.

The data in the virtual disk is rolled back to original data.

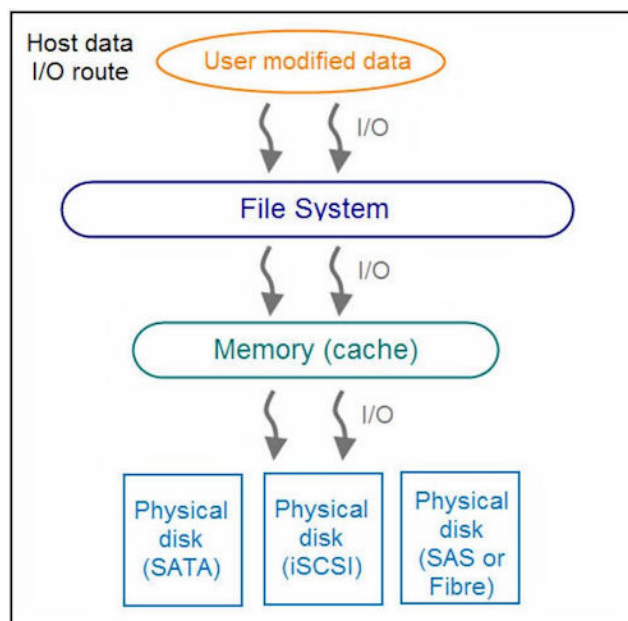
## Snapshot Constraints

The Snapshot function applies Copy-on-Write technique on UDV/virtual disk and provides a quick and efficient backup methodology. When taking a snapshot, it does not copy any data at first time until a request of data modification comes in. The original data is copied to the

Snapshot Pool space and then the original data is overwritten with the new changes. With this technique, only the changed data is copied instead of all the data, thus saving disk space.

### Creating an Accurate Snapshot

Before using Snapshot, it helps to know why the data sometimes corrupts after the rollback of snapshot.



When the data from the host is modified, the data passes through the file system and the host memory (write caching). Then the host flushes the data from memory to the physical disks, regardless if the storage device is a local disk (IDE or SATA), a DAS (SCSI or SAS), or a SAN (fibre or iSCSI). From the viewpoint of storage device, it can not control the behavior of host side. Sometimes, when a snapshot is taken, some data remains in memory and is not flushed to the storage device, causing the snapshot to have an incomplete image of original data. This is not a problem with the storage device. To avoid this inconsistent data issue between the snapshot and the original data, the operating system must flush the data from the memory of host onto the disk **before** taking the snapshot.

For a Linux/UNIX platform, the command named “sync” can be used to make the operating system flush data from the write caching onto the disk. For a Windows platform, Microsoft also provides a sync tool, which can do exactly the same thing as the sync command in Linux/UNIX. It tells the OS to flush the data on demand. For more detail about Microsoft sync tool, please refer to:

<http://technet.microsoft.com/enus/sysinternals/bb897438.aspx>

Besides the sync tool, Microsoft has the VSS (Volume Shadow copy Service) to prevent this issue. VSS is a mechanism for creating consistent point-in-time copies of data known as shadow copies. It is a coordinator between backup software, applications (SQL or Exchange), and storage devices to make sure the snapshot doesn't have a problem of inconsistent data. The SnapSAN S1000 supports VSS (See [Appendix 7, “VSS Installation.”](#)). For more details about the VSS, please refer to:

<http://technet.microsoft.com/en-us/library/cc785914.aspx>

## Snapshot Space Management

Before creating a snapshot, space for the snapshot is needed in the RAID Group. After a period of creating snapshots, the snapshot space might be less than what is needed for the current snapshot. This is handled automatically by the SnapSAN S1000 depending on the situation:

- If there are **two or more snapshots** in the space, the system tries to remove the oldest snapshots one at a time until enough space is released for the current snapshot.
- If there is **only one snapshot** in the space, the current snapshot fails due to lack of space.

For example, there are two or more snapshots and the latest snapshot keeps growing using up the remaining space. When the current snapshot runs out of space, the system tries to remove the oldest snapshot to release more space for it. As the latest snapshot continues growing, the system keeps removing the old snapshots. When only the latest snapshot is left in the space, then there is no more snapshot space which can be released and the new snapshot will fail.

## Maximum Number of Snapshots

Up to 32 snapshot can be created on a virtual disk. If a 33rd snapshot has been taken, there are two different situations and possible results:

- If the snapshot is configured as **Scheduled Snapshots**, the latest one (the 33rd snapshot) replaces the first one (the oldest snapshot), and so on.
- If the 33rd snapshot was taken **manually**, the snapshot fails and a warning message is showed in the Web Management Interface.

## Rollback or Delete Snapshots

When a snapshot has been rolled back, any other snapshots which are earlier than it are removed. But the remaining later snapshots are kept after rollback. If a snapshot is deleted, the other snapshots which are earlier than it are also deleted. The space occupied by these snapshots is released after the deletion.

## VSS Software

For customers using the integrated Microsoft VSS provider for snapshots, it is recommended that you do not also use the Web Management Interface to take snapshots. For more information on VSS, please see [Appendix 7, "VSS Installation."](#)

# Disk Roaming

Physical disks can be re-sequenced in the same system or all physical disks in the same RAID Group can be moved from one system to another. This is called disk roaming. The SnapSAN S1000 can execute disk roaming online:

1. Select **Volume Configuration > RAID Groups**.
2. Click the menu button (▼) next to the RAID Group number and select **Deactivate**.
3. Move all physical disks of this RAID Group to another system.
4. When done, click the menu button (▼) again and select **Activate**.

Disk roaming has some constraints:



- Check the firmware version of two systems first. It is better that both systems have the same firmware version or that the second system's firmware version is newer.
- All physical disks of the RAID Group should be moved from the first system to the second system together. The configuration of both the RAID Group and the virtual disk is kept, but the LUN configuration is cleared to avoid conflict with the second system's original setting.

## Expansion Arrays

The SnapSAN S1000 storage space can be expanded by adding up to four SnapDisk E1000 expansion arrays.

### Connecting Expansion Arrays

The SnapSAN S1000 controllers support SnapDisk E1000 expansion arrays with SAS connections. When connecting to an expansion array, it is displayed in **Volume Configuration > Physical Disks**.

An example, shows the physical disks for the head unit and expansion arrays. The disk drives in the expansion units can be used as local disks.

Physical Disks								
RAID Groups								
Virtual Disks								
Snapshots								
Logical Units								
Show disks for: - Head Unit - Show disk size in: GB								
	Slot	Size (GB)	RAID Group	Status	Health	Usage	Vendor	Interface
▼	1	372	RG1R5	Online	Good	RAID	SEAGATE	SAS
▼	2	372	RG1R5	Online	Good	RAID	SEAGATE	SAS
▼	3	372	RG1R5	Online	Good	RAID	SEAGATE	SAS
▼	4	372		Online	Good	Global Spare	SEAGATE	SAS

Enclosure Management > Hardware Monitor can display the hardware status of the expansion arrays:

Hardware Monitor | UPS | SES | S.M.A.R.T.

Show information for: -- Head Unit - Temperature: C

**Controller 1 Monitors**

Interface	Item	Value	Status
Voltage	Onboard +1.2V	+1.18 V (min = +1.08 V, max = +1.32 V)	OK
Voltage	Onboard +3.3V	+3.34 V (min = +3.04 V, max = +3.56 V)	OK
Voltage	Onboard +5V	+5.10 V (min = +4.60 V, max = +5.40 V)	OK
Voltage	Onboard +12V	+12.08 V (min = +11.04 V, max = +12.96 V)	OK
Voltage	Onboard +1.8V	+1.81 V (min = +1.62 V, max = +1.98 V)	OK
Temperature	Core Processor	+43.5 C (hyst = +0.0 C, high = +80.0 C)	OK
Temperature	iSCSI NIC 1	+33.5 C (hyst = +0.0 C, high = +65.0 C)	OK
Temperature	iSCSI NIC 2	+33.5 C (hyst = +0.0 C, high = +65.0 C)	OK
Temperature	SAS Controller	+35.0 C (hyst = +0.0 C, high = +65.0 C)	OK
Temperature	SAS Expander	+31.0 C (hyst = +0.0 C, high = +65.0 C)	OK
Battery	Battery Backup Module	100 %	OK

**Internal Monitors**

Interface	Item	Value	Status
Voltage	PSU +5V	+5.14 V (min = +4.60 V, max = +5.40 V)	OK
Voltage	PSU +12V	+12.27 V (min = +11.04 V, max = +12.96 V)	OK
Voltage	PSU +3.3V	+3.44 V (min = +3.04 V, max = +3.56 V)	OK
Temperature	Location 1	+33.0 C (hyst = +0.0 C, high = +55.0 C)	OK
Temperature	Location 2	+23.5 C (hyst = +0.0 C, high = +55.0 C)	OK
Temperature	Location 3	+22.0 C (hyst = +0.0 C, high = +55.0 C)	OK
Power Supply	PSU1	N/A	OK
Power Supply	PSU2	N/A	OK
Cooling	FAN1	10546 RPM	OK
Cooling	FAN2	11250 RPM	OK
Cooling	FAN3	10546 RPM	OK
Cooling	FAN4	10546 RPM	OK

Auto Shutdown:

If Auto Shutdown is enabled, the system will shutdown automatically when the internal power level:

Apply

Hardware Monitor | UPS | SES | S.M.A.R.T.

Show information for: -- Head Unit - Temperature: C

**Controller 1 Monitors**

Interface	Item	Value	Status
Voltage	Onboard +1.2V	+1.18 V (min = +1.08 V, max = +1.32 V)	OK
Voltage	Onboard +3.3V	+3.36 V (min = +3.04 V, max = +3.56 V)	OK
Voltage	Onboard +5V	+5.10 V (min = +4.60 V, max = +5.40 V)	OK
Voltage	Onboard +12V	+12.08 V (min = +11.04 V, max = +12.96 V)	OK
Voltage	Onboard +1.8V	+1.84 V (min = +1.62 V, max = +1.98 V)	OK
Temperature	Core Processor	+39.5 C (hyst = +0.0 C, high = +80.0 C)	OK
Temperature	Fibre Daughter Board	+33.5 C (hyst = +0.0 C, high = +65.0 C)	OK
Temperature	SAS Controller	+36.0 C (hyst = +0.0 C, high = +65.0 C)	OK
Temperature	SAS Expander	+32.0 C (hyst = +0.0 C, high = +65.0 C)	OK
Battery	Battery Backup Module	100 %	OK

**Controller 2 Monitors**

Interface	Item	Value	Status
Voltage	Onboard +1.2V	+1.20 V (min = +1.08 V, max = +1.32 V)	OK
Voltage	Onboard +3.3V	+3.38 V (min = +3.04 V, max = +3.56 V)	OK
Voltage	Onboard +5V	+5.14 V (min = +4.60 V, max = +5.40 V)	OK
Voltage	Onboard +12V	+12.08 V (min = +11.04 V, max = +12.96 V)	OK
Voltage	Onboard +1.8V	+1.84 V (min = +1.62 V, max = +1.98 V)	OK
Temperature	Core Processor	+36.0 C (hyst = +0.0 C, high = +80.0 C)	OK
Temperature	Fibre Daughter Board	+29.0 C (hyst = +0.0 C, high = +65.0 C)	OK
Temperature	SAS Controller	+34.0 C (hyst = +0.0 C, high = +65.0 C)	OK
Temperature	SAS Expander	+29.0 C (hyst = +0.0 C, high = +65.0 C)	OK
Battery	Battery Backup Module	100 %	OK

**Internal Monitors**

Interface	Item	Value	Status
Voltage	PSU +5V	+5.10 V (min = +4.60 V, max = +5.40 V)	OK
Voltage	PSU +12V	+12.08 V (min = +11.04 V, max = +12.96 V)	OK

Enclosure Management > S.M.A.R.T. displays the S.M.A.R.T. information of all Physical Disks, including head units and expansion arrays.

Hardware Monitor   UPS   SES   <b>S.M.A.R.T.</b>								
Self-Monitoring Analysis and Reporting Technology (S.M.A.R.T.)								
Below is the current S.M.A.R.T. information for the drives attached to this device.								
Show information for: - Head Unit - Temperature: C								
Slot	HDD Type	Read Error (Rate)	Spin Up (Time)	Reallocated Sector (Count)	Seek Error (Rate)	Spin Up (Retries)	Calibration (Retries)	Ten
1	SATA2	200(51)	253(21)	200(140)	200(0)	100(0)	100(0)	34
2	SATA2	200(51)	253(21)	200(140)	200(0)	100(0)	100(0)	34
3	SATA2	200(51)	253(21)	200(140)	200(0)	100(0)	100(0)	32
4	SATA2	200(51)	253(21)	200(140)	200(0)	100(0)	100(0)	31

S.M.A.R.T. only supports SATA drives. SAS drives do not have this function and will show "N/A" in the web page:

Hardware Monitor   UPS   SES   <b>S.M.A.R.T.</b>								
Self-Monitoring Analysis and Reporting Technology (S.M.A.R.T.)								
Below is the current S.M.A.R.T. information for the drives attached to this device.								
Show information for: - Head Unit - Temperature: C								
Slot	HDD Type	Read Error (Rate)	Spin Up (Time)	Reallocated Sector (Count)	Seek Error (Rate)	Spin Up (Retries)	Calibration (Retries)	Ten
1	SAS	N/A	N/A	N/A	N/A	N/A	N/A	34
2	SAS	N/A	N/A	N/A	N/A	N/A	N/A	37
3	SAS	N/A	N/A	N/A	N/A	N/A	N/A	34
4	SAS	N/A	N/A	N/A	N/A	N/A	N/A	31

SnapDisk E1000 expansion arrays have some constraints:

- Up to four SnapDisk E1000 expansion arrays can be connected providing up to 48 additional disk drives.
- While RAID Groups can be created among the multiple chassis, the maximum number of disks in a single RAID Group is 32.
- A Global Spare Disk can support all RAID Groups located in the different chassis.

## Upgrade Firmware of SnapDisk E1000

To download the latest firmware, go to the Overland Storage web page for the SnapSAN products (<http://support.overlandstorage.com/support/SnapSAN.htm>). After downloading, follow the normal upgrade function to install it.

## MPIO and MC/S

MPIO (Multi-Path Input/Output) and MC/S (Multiple Connections per Session) use multiple physical paths to create logical "paths" between the server and the storage device. In the case which one or more of these components fails, causing the path to fail, multi-path logic uses an alternate path for I/O. So applications can still access their data.

A Microsoft iSCSI initiator supports multi-path. Please follow this procedure to use MPIO feature with the initiator:

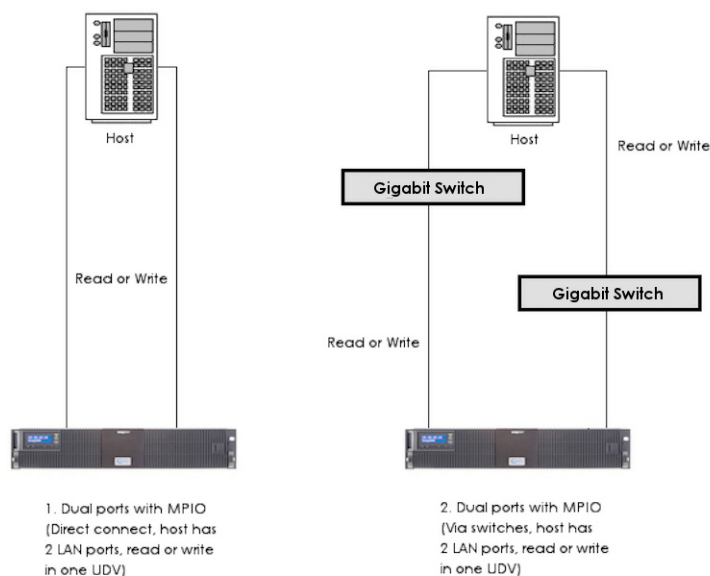
1. A **host** with two or more LAN ports is connected to the SnapSAN S1000.
2. Create a RAID Group / virtual disk and attach this **virtual disk** to the host.
3. When installing the Microsoft iSCSI initiator, install **MPIO driver** at the same time.
4. Log on to the target separately on each port. When logging on, check the **Enable Multi-path** option.

5. MPIO mode can be selected from **Targets > Details > Devices > Advanced** options for the Microsoft iSCSI initiator.

6. **Rescan** the disk.

There will be one disk running MPIO.

Here is the instructions to setup MPIO or MC/S on the SnapSAN S1000. The following network diagrams are the examples to follow to setup the environment. Remember that the host must have multiple NICs which are set up as different IP addresses.



The MPIO setup instructions:

1. Create a RAID Group and a virtual disk, and then attach a LUN.
2. Add the first Target Portal on Microsoft iSCSI initiator.
3. Add the second Target Portal on Microsoft iSCSI initiator.
4. Log on.
5. Check the Enable Multi-path box. Then click Advanced.
6. Select the first Source IP and Target Portal to iSCSI data port 1. Then click OK.
7. Log on again.
8. Check Enable Multi-path box. Then click Advanced.
9. Select the second Source IP and Target Portal to iSCSI data port 2. Then click OK.
10. iSCSI device is connected. Click Details.
11. Click Device tab, then click Advanced.
12. Click MPIO tab, select Load Balance Policy to Round Robin.
13. Click Apply.
14. Run Device Manage in Windows. Make sure MPIO device is available.


The MC/S setup instructions:

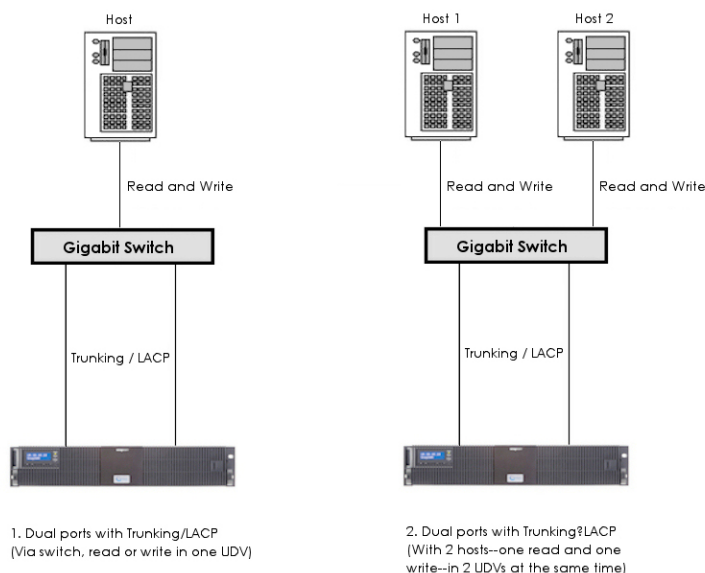
1. Create RAID Group / virtual disk, and then attach LUN.

2. Add the first Target Portal on Microsoft iSCSI initiator. For MC/S, there is only ONE Target Portals in the Discovery tab.
3. Logon.
4. Then click Advanced.
5. Select the first Source IP and Target Portal to iSCSI data port 1. Then click OK.
6. After connected, click Details, then in the Session tab, click Connections.
7. Choose Round Robin in Load Balance Policy.
8. Add Source Portal for the iSCSI data port 2.
9. Select the second Source IP and Target Portal to iSCSI data port 2. Then select OK.


## Trunking and LACP

Use the following instructions to setup Trunking and LACP on the SnapSAN S1000. The network diagrams can be used as examples to follow to setup the environment.

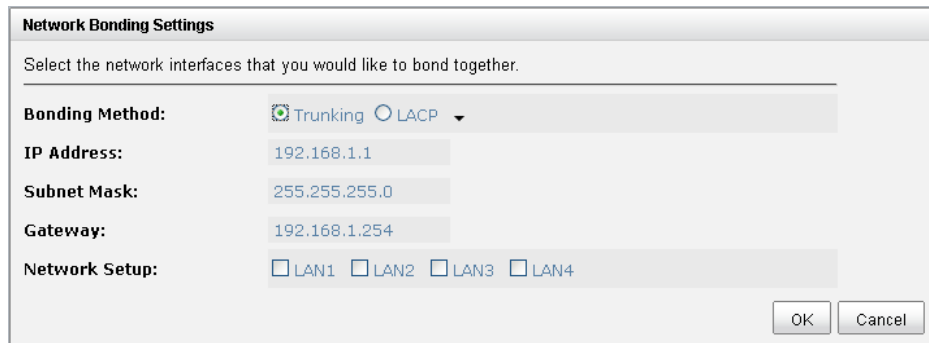
 **IMPORTANT:** A gigabit switch must support trunking or LACP; otherwise, these functions will not work. The running path in trunking or LACP mode is decided by an operation of MAC addresses of host and target. It's better to prepare two or more hosts.



The setup instructions are as follows:

 **CAUTION:** Before using trunking or LACP, the gigabit switch must support trunking or LACP and enabled. Otherwise, host can not connect the link with storage device.

1. Select **iSCSI Configuration > Network Setup**.
2. Click the **Link Aggregation** button to open the Network Bonding Settings screen.



The image shows a 'Network Bonding Settings' dialog box. At the top, it says 'Select the network interfaces that you would like to bond together.' Below this, there are several fields: 'Bonding Method' with radio buttons for 'Trunking' (selected) and 'LACP'; 'IP Address' with the value '192.168.1.1'; 'Subnet Mask' with '255.255.255.0'; 'Gateway' with '192.168.1.254'; and 'Network Setup' with four checkboxes for 'LAN1', 'LAN2', 'LAN3', and 'LAN4'. At the bottom right, there are 'OK' and 'Cancel' buttons.

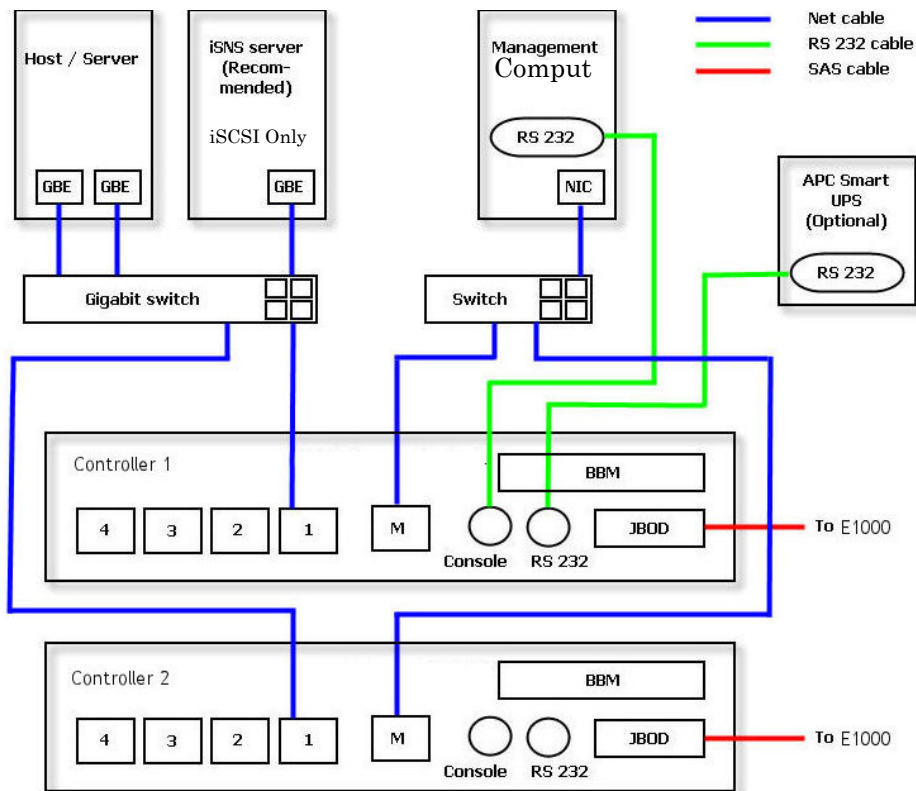
3. Select either **Trunking** or **LACP**, and then select at least **two LANs** for link aggregation. Click **OK**.
4. Enable Trunking or LACP on the **ports** which are connected to the target iSCSI ports on the gigabit switch.
5. Create a **RAID Group** and a **virtual disk**.
6. Attach a **LUN** to the virtual disk.
7. Logon by **Microsoft iSCSI initiator**.

## Dual Controllers

The SnapSAN S1000 supports dual controllers of the same type for redundancy. Controller 1 (CTR1) is the Master controller and Controller 2 (CTR2) is the Secondary controller.

## Perform I/O

To perform I/O using dual controllers, the host should setup an MPIO policy. An MPIO policy will keep I/O running and prevent connection failures that might happen when a single controller fails. Please refer to the following topology and have all the connections ready when configuring the system.



## Ownership

When creating a RAID Group, it is assigned with a preferred owner. The default owner is Controller 1 (Master). To change the RAID Group ownership:

1. Select **Volume Configuration > RAID Groups**.
2. Click the menu button (▼) next to the RAID Group name and select **Change Preferred Owner**.

The ownership of the RAID Group will be switched to the other controller.

### 3. Verify the transfer.

The first screenshot shows the RAID Groups table with RAID 3 highlighted. A context menu is open over RAID 3, and the 'Current Controller' and 'Preferred Controller' columns for RAID 3 are circled in red, both showing 'Controller 1'.

Name	Total (GB)	Free (GB)	Disks Used	Number of Virtual Disk	Status	Health	RAID	Current Controller	Preferred Controller
Raid0	931	791	1	10	Online	Good	RAID 0	Controller 1	Controller 1
Raid1	931	931	2	0	Online	Good	RAID 1	Controller 1	Controller 1
Raid3	1862	1862	3	0	Online	Good	RAID 3	Controller 1	Controller 1
		1862	3	0	Online	Good	RAID 5	Controller 1	Controller 1

The second screenshot shows the RAID Groups table after the transfer. RAID 3 is now circled in red, and its 'Current Controller' and 'Preferred Controller' columns now show 'Controller 2'.

Name	Total (GB)	Free (GB)	Disks Used	Number of Virtual Disk	Status	Health	RAID	Current Controller	Preferred Controller
Raid0	931	791	1	10	Online	Good	RAID 0	Controller 1	Controller 1
Raid1	931	931	2	0	Online	Good	RAID 1	Controller 1	Controller 1
Raid3	1862	1862	3	0	Online	Good	RAID 3	Controller 2	Controller 2
Raid5	1862	1862	3	0	Online	Good	RAID 5	Controller 1	Controller 1

## Controller Status

There are four statuses found under **System Maintenance > System Information**:

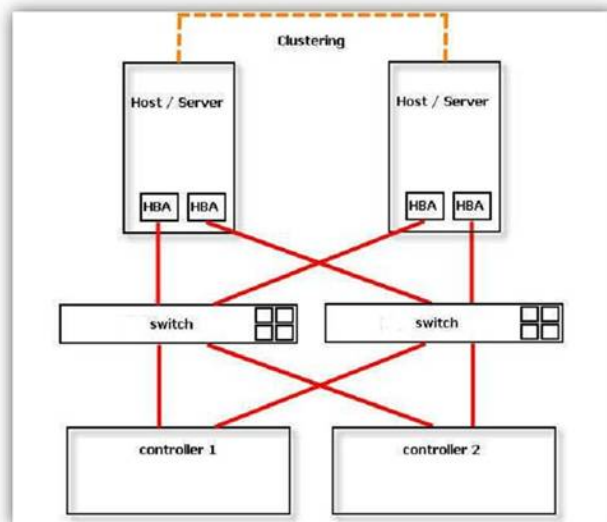
- **Normal** – Dual controller mode. Both of controllers are functional.
- **Degraded** – Dual controller mode. When one controller fails or has been unplugged, the system will become degraded. I/O will force the usage of write through for protected data and the ownership of RAID Group will switch to the good controller. For example: If Controller 1 which owns the RAID Group RG1 fails, the ownership of RG1 will be switched to Controller 2 automatically. And the system and data can keep functioning. After Controller 1 is fixed or replaced, all RAID Groups will be reassigned back to the preferred Controller 1.
- **Lockdown** – Dual controller mode. The firmware of two controllers is different or the size of memory of two controllers is different. In this stage, only master controller can work and I/O will force the usage of write through for protected data.
- **Single** – Single controller mode. The controller must be in slot CTR 1. There are no error messages regarding the lack of a Secondary controller. Also, there is no ownership of a RAID Group. Single controller mode can be upgraded to dual controller mode by installing a second controller of the same type. Contact your distributor for details.

In addition, an iSNS server is recommended for a dual controller system. It's important for keeping I/O running smoothly when RAID Group ownership is switching or when a single controller has failed. Without an iSNS server, if Controller 1 fails, the running I/O from host to Controller 1 may fail because the time it takes for the host to switch to the new portal is slower than an I/O time out. With iSNS server, this does not happen.



## Redundancy

For better data service availability, all the connections among host servers, GbE switches, and the dual controllers are recommended as redundant as below.



## System Buzzer

The system buzzer features:

- The system buzzer sounds for one second when system boots successfully.
- The system buzzer sounds continuously when a system error occurs. The alarm will stop after the error is resolved or it is muted. A mute icon is located in the top right corner of the Web Management Interface.
- The alarm is muted automatically when the error is resolved. For example, if RAID 5 becomes degraded, the alarm sounds immediately. The user changes or adds one physical disk for rebuilding. When the rebuilding is done, the alarm is muted automatically.

## Event Notifications

Level	Type	Description
Info	Disk inserted	Disk <slot> is inserted into system.
Warning	Disk removed	Disk <slot> is removed from system.
Error	Disk read error	Disk <slot> read block error
Error	Disk write error	Disk <slot> write block error
Error	Disk drive failure	Disk <slot> is disabled.
Error	Disk drive failure	Disk <slot> gets no response

Level	Type	Description
Warning	Memory error	Single-bit memory error is detected at <address>.
Error	Memory error	Multi-bit memory error is detected at <address>.
Info	ECC info	Error-Correcting Code (ECC) memory is installed.
Info	ECC info	Non-ECC memory is installed.
Info	SCSI info	Received SCSI Bus Reset event at the SCSI Bus <number>.

**Table 6-1: EMS Events**

Level	Type	Description
Info	Power supply present	Power <item> is installed.
Error	Power supply not present	Power <item> is absent.
Info	Power supply restored	Power <item> function is restored.
Error	Power supply warning	Power <item> is not functioning.
Warning	Power supply signal detected	PSU signal detection <item>.
Info	Fan restored	Fan <item> function is restored.
Error	Fan warning	Fan <item> is not functioning.
Info	Fan present	Fan <item> is installed.
Error	Fan not present	Fan <item> is not present.
Warning	Thermal warning	System temperature <item> is above normal range.
Error	Thermal state critical	System Overheated <item>!!!
Error	Thermal critical shutdown	System Overheated <item>!!! The system will auto-shutdown immediately.
Warning	Thermal ignored value	Unable to update thermal value on <item>.
Warning	Voltage warning	System voltage <item> is outside normal range.
Error	Voltage critical	System voltages <item> failed!!!
Error	Voltage critical shutdown	System voltages <item> failed!!! The system will auto-shutdown immediately.
Info	UPS detected	UPS detection succeeded.
Warning	UPS detection failure	UPS detection failed.
Error	UPS not working	UPS AC loss for the system is detected.
Error	UPS low power	UPS Power Low!!! The system will auto-shutdown immediately.
Warning	S.M.A.R.T. T.E.C.	Disk <slot> S.M.A.R.T. Threshold Exceed Condition occurred for attribute <item>.
Warning	S.M.A.R.T. failure	Disk <slot>: Failure to get S.M.A.R.T information.

**Table 6-2: RMS Events**

Level	Type	Description
Info	Console Login	<user_name> login from <IP or serial console> via Console UI.
Info	Console Logout	<user_name> logout from <IP or serial console> via Console UI.
Info	Web Login	<user_name> login from <IP> via Web UI.
Info	Web Logout	<user_name> logout from <IP> via Web UI.

**Table 6-3: LVM3 Events**

Level	Type	Description
Info	RAID Group created	RAID Group <name> has been created.
Info	RAID Group creation failed	Failed to create RAID Group <name>.
Info	RAID Group deleted	RAID Group <name> has been deleted.
Info	Virtual Disk created	Virtual disk <name> has been created.
Info	Virtual Disk creation failed	Failed to create virtual disk <name>.
Info	Virtual Disk deleted	Virtual disk <name> has been deleted.
Info	Virtual Disk renamed	Name of virtual disk <name> has been renamed to <name>.
Info	Read-only caching enabled	Cache policy of virtual disk <name> has been set as read only.
Info	Write-back caching enabled	Cache policy of virtual disk <name> has been set as write-back.
Info	Write-through caching enabled	Cache policy of virtual disk <name> has been set as write-through.
Info	Virtual Disk extended	Size of virtual disk <name> extends.
Info	Virtual Disk initialization started	Virtual disk <name> starts initialization.
Info	Virtual Disk initialization finished	Virtual disk <name> completes the initialization.
Warning	Virtual Disk initialization failed	Failed to complete initialization of virtual disk <name>.
Info	Virtual Disk rebuild started	Virtual disk <name> starts rebuilding.
Info	Virtual Disk rebuild finished	Virtual disk <name> completes rebuilding.
Warning	Virtual Disk rebuild failed	Failed to complete rebuild of virtual disk <name>.
Info	Virtual Disk migration started	Virtual disk <name> starts migration.
Info	Virtual Disk migration finished	Virtual disk <name> completes migration.
Error	Virtual Disk migration failed	Failed to complete migration of virtual disk <name>.
Info	Virtual Disk scrubbing started	Virtual disk <name> starts scrubbing.
Info	Virtual Disk scrubbing finished	Virtual disk <name> completes scrubbing.
Info	RAID Group migration started	RAID Group <name> starts migration.
Info	RAID Group migration finished	RAID Group <name> completes migration.
Info	RAID Group activated	RAID Group <name> has been manually activated.
Info	RAID Group deactivated	RAID Group <name> has been manually deactivated.
Info	Virtual Disk rewrite started	Rewrite at LBA <address> of virtual disk starts.

**Table 6-3: LVM3 Events (Continued)**

Level	Type	Description
Info	Virtual Disk rewrite finished	Rewrite at LBA <address> of virtual disk completes.
Warning	Virtual Disk rewrite failed	Rewrite at LBA <address> of virtual disk failed.
Warning	RAID Group degraded	RAID Group <name> is in degraded mode.
Warning	Virtual Disk degraded	Virtual disk <name> is in degraded mode.
Error	RAID Group failed	RAID Group <name> is failed.
Error	Virtual Disk failed	Virtual disk <name> is failed.
Warning	Recoverable read error occurred	Recoverable read error occurred at LBA <address>-<address> of virtual disk <name>.
Warning	Recoverable write error occurred	Recoverable write error occurred at LBA <address>-<address> of virtual disk <name>.
Error	Unrecoverable read error occurred	Unrecoverable read error occurred at LBA <address>-<address> of virtual disk <name>.
Error	Unrecoverable write error occurred	Unrecoverable write error occurred at LBA <address>-<address> of virtual disk <name>.
Info	Dedicated spare configured	Physical disks <slot> has been configured to RAID Group <name> as a dedicated spare disk.
Info	Global spare configured	Physical disks <slot> has been configured as a global spare disk.
Warning	Physical Disks read error occurred	Read error occurred at LBA <address>-<address> of Physical Disks <slot>.
Warning	Physical Disks write error occurred	Write error occurred at LBA <address>-<address> of Physical Disks <slot>.
Warning	Parity wrong when scrubbing	The parity data is wrong at LBA <address>-<address> when scrubbing virtual disk <name>.
Warning	Data recovered when scrubbing	Data at LBA <address>-<address> has been recovered when scrubbing virtual disk <name>.
Info	Physical Disks removed from RAID Group	Physical Disks <slot> has been removed from RAID Group <name>.
Info	RAID Group imported	Configuration of RAID Group <name> has been imported.
Info	RAID Group restored	Configuration of RAID Group <name> has been restored.
Info	Virtual Disk restored	Configuration of virtual disk <name> has been restored.

**Table 6-3: LVM3 Events (Continued)**

Level	Type	Description
Info	RAID Group owner changed	The preferred owner of RAID Group <name> has been changed to controller <number>.
Info	Controller failover	Controller <number> forced to adopt write-through mode on failover.
Info	Controller failback	Controller <number> restored to previous caching mode on failback.
Info	Controller failover complete	All volumes in controller <number> completed failover process.
Info	Controller failback complete	All volumes in controller <number> completed failback process.
Info	Disk scrubbing started	Physical Disks <slot> starts disk scrubbing process.
Info	Disk scrubbing finished	Physical Disks <slot> completed disk scrubbing process.
Info	RAID Group created	A large RAID Group <name> with <number> disks included is created.
Info	RAID Group created across units	A RAID Group <name> made up disks across <number> chassis is created.

**Table 6-4: Snapshot Events**

Level	Type	Description
Info	Snapshot deleted	The snapshot <name> has been deleted.
Info	Snapshot auto-deleted	The oldest snapshot <name> has been deleted to obtain extra snapshot space.
Info	Snapshot taken	A snapshot on virtual disk <name> has been taken.
Info	Snapshot space configured	Set the snapshot space of virtual disk <name> to <number> <units>.
Info	Snapshot rollback started	Snapshot rollback of virtual disk <name> has been started.
Info	Snapshot rollback finished	Snapshot rollback of virtual disk <name> has been finished.
Warning	Snapshot quota reached	The quota assigned to snapshot <name> is reached.

**Table 6-5: iSCSI Events**

Level	Type	Description
Info	iSCSI login succeeded	iSCSI login from <IP> succeeds.

**Table 6-5: iSCSI Events (Continued)**

Level	Type	Description
Info	iSCSI login rejected	iSCSI login from <IP> was rejected, reason [<string>]
Info	iSCSI logout	iSCSI logout from <IP> was received, reason [<string>].

**Table 6-6: Battery Backup Events**

Level	Type	Description
Info	BBM sync data started	Abnormal shutdown detected, start flushing battery-backed data (<number> KB).
Info	BBM sync data finished	Abnormal shutdown detected, flushing battery-backed data finished.
Info	BBM detected	Battery backup module is detected.
Info	BBM is good	Battery backup module is good.
Info	BBM is charging	Battery backup module is charging.
Warning	BBM has failed	Battery backup module is failed.
Info	BBM feature	Battery backup feature is <item>.

**Table 6-7: Expansion Array Events**

Level	Type	Description
Info	Disk inserted	JBOD <number> disk <slot> is inserted into system.
Warning	Disk removed	JBOD <number> disk <slot> is removed from system.
Error	Disk read error	JBOD <number> disk <slot> read block error
Error	Disk write error	JBOD <number> disk <slot> write block error
Error	Disk drive failure	JBOD <number> disk <slot> is disabled.
Error	Disk drive failure	JBOD <number> disk <slot> gets no response.
Info	Expansion unit added	JBOD <number> is inserted into system.
Warning	Expansion unit removed	JBOD <number> is removed from system.
Warning	S.M.A.R.T. T.E.C	JBOD <number> disk <slot>: S.M.A.R.T. Threshold Exceed Condition occurred for attribute percent.
Warning	S.M.A.R.T. Failure	JBOD <number> disk <slot>: Failure to get S.M.A.R.T information.
Info	Dedicated spare configured	JBOD <number> Physical Disks <slot> has been configured to RAID Group <name> as a dedicated spare disk.

**Table 6-7: Expansion Array Events (Continued)**

Level	Type	Description
Info	Global spare configured	JBOD <number> Physical Disks <slot> has been configured as a global spare disk.
Warning	Physical Disks read error occurred	Read error occurred at LBA <address>-<address> of JBOD <number> Physical Disks <slot>.
Warning	Physical Disks write error occurred	Write error occurred at LBA <address>-<address> of JBOD <number> Physical Disks <slot>.
Info	Physical Disks removed from RAID Group	JBOD <number> Physical Disks <slot> has been removed from RAID Group <name>.
Info	Physical Disks scrubbing started	JBOD <number> Physical Disks <slot> starts disk scrubbing process.
Info	Physical Disks scrubbing finished	JBOD <number> Physical Disks <slot> completed disk scrubbing process.
Warning	Power Supply failure	Power Supply of <item> in JBOD <name> is FAIL
Info	Power Supply working normally	Power Supply of <item> in JBOD <name> is NORMAL
Warning	Fan failure	Cooling fan of <item> in JBOD <name> is FAIL
Info	Fan working normally	Cooling fan of <item> in JBOD <name> is NORMAL
Warning	Voltage above normal	Voltage of <item> read as <value> in JBOD <name> is WARN OVER
Warning	Voltage below normal	Voltage of <item> read as <value> in JBOD <name> is WARN UNDER
Warning	Voltage critically above normal	Voltage of <item> read as <value> in JBOD <name> is CRIT OVER
Warning	Voltage critically below normal	Voltage of <item> read as <value> in JBOD <name> is CRIT UNDER
Info	Voltage back to normal	Voltage of <item> in JBOD <name> is NORMAL
Warning	High temperature	Temperature of <item> read as <value> in JBOD <name> is OT Warning
Warning	Low temperature	Temperature of <item> read as <value> in JBOD <name> is UT Warning
Warning	High temperature failure	Temperature of <item> read as <value> in JBOD <name> is OT FAILURE
Warning	Low temperature failure	Temperature of <item> read as <value> in JBOD <name> is UT FAILURE
Info	Temperature back to normal	Temperature of <item> in JBOD <name> is NORMAL



**Table 6-8: System Maintenance Events**

Level	Type	Description
Info	System shutdown	System shutdown.
Info	System reboot	System reboot.
Info	Firmware upgrade start	Firmware upgrade start.
Info	Firmware upgrade success	Firmware upgrade success.
Warning	Firmware upgrade failure	Firmware upgrade failure.
Error	IPC Firmware upgrade time-out	Firmware upgrade time-out on another controller.

**Table 6-9: HAC Events**

Level	Type	Description
Info	Controller inserted	Controller <number> is inserted into system.
Error	Controller removed	Controller <number> is removed from system.
Error	Controller time-out	Controller <number> gets no response.
Error	Controller lockdown	Controller <number> is locked down.
Error	Memory error	Memory size mismatch.
Error	Firmware mismatch	Firmware version mismatch.
Error	Low IPC down	Low speed inter link is down.
Error	High IPC down	High speed inter link is down.
Error	Backend connection lost	Disk connection loss is detected

This appendix describes how to download and install Overland Storage VSS software for your SnapSAN S1000 storage array. The software includes the following items:

- Multipath I/O (MPIO) driver  
To perform Multipath I/O operations in Fibre Channel or SAS environments, the MPIO driver must be installed on a network computer running Windows.
- Volume Shadow Copy Service (VSS) optional software  
To use VSS as an alternate way of creating snapshots in an iSCSI environment, install the Overland Storage VSS software.

## Theory of Operation

When setting up a system that makes use of the Snapshot feature, you must create two separate arrays. One of these arrays holds the logical drive that contains the user's data and is available as a standard volume within Windows. The second array is used to hold the snapshot data. Snapshot data is the data copied from the user volume at a specific point in the past.

When enabling the Snapshot feature on your SnapSAN S1000 logical drive holding the users data, you must choose the area of the second array. The second array holds the snapshot data and will be made into an internally available logical drive. A special area is created on that second array called the Overwrite Data Area (ODA). This area is not available for normal use by any hosts connected to the system – it is reserved purely for snapshot purposes.

When a snapshot is initiated using a Windows requester such as the Backup Utility, the following happens:

- I/O is temporarily frozen and cached data is written to the originating volume.
- VSS asks any registered providers if they support all of the parts of the selected volume. If a VSS provider responds in a positive way, then VSS commands the provider to start a snapshot.
- A command is then sent to the enclosure to tell it to perform the snapshot. All subsequent writes to the originating volume cause the data that is about to be overwritten to be copied to the snapshot area.
- After the snapshot has completed successfully, VSS waits for the Plug and Play device manager to recognize that a new device has arrived. This new device is the snapshot, itself. The snapshot is hidden, but you can expose and use it as a standard read-only volume at some future time. This allows you to see the volume as it was at the time of the snapshot and map it as a physical volume within the operating system.

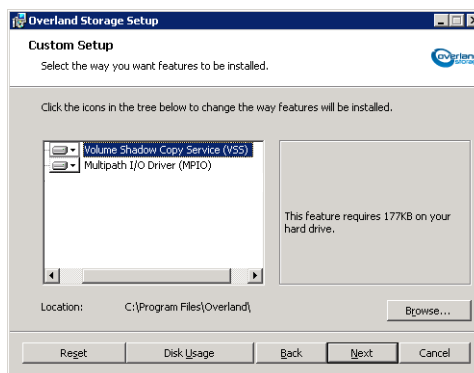
## Software Installation

**NOTE:** The software has 2 versions: One for a 32-bit OS (x86) and the other for a 64-bit OS (x64). It can only be installed on Microsoft Windows Servers 2003, 2003 R2, 2008, and 2008 R2.

1. Download the **VSS software**:
  - a. Go to the SnapSAN **web site**:  
(<http://support.overlandstorage.com/support/snapsan.htm>).
  - b. Follow the **link** to the software downloads.
  - c. Select and download the **VSS software**.  
The executable is called **Overland\_Storage\_Service\_Setup**. The name includes the latest version number and the bit version. The 32-bit version ends in **x86-en.msi** and the 64-bit version ends in **x64-en.msi**.
2. Double-click the installer **executable** to choose the components:
  - a. At the security alert, click **Run**.
  - b. At the Welcome screen, click **Next**.



- c. Read the **license** agreement, check the **Agreement** box to accept to the terms and conditions, and click **Next**.
- d. Customize your **setup**:
  - If desired, deselect **software** components to be installed (default = all).
  - Choose a destination **folder** for the application (or accept the default location).



- e. Click **Next** to go to the Start Installation screen.
3. Click **Install** to begin the installation.  
A **DOS window** opens and shows the progress.

4. At the MPIO security alert, click **Yes**.
5. When the installation finishes, click **Finish** to dismiss the installation window.
6. At the restart reminder screen, click **Yes** to reboot the server.

After rebooting, the Multipath Disk Device is displayed in the Computer Management screen. It becomes a disk under Disk Management. It is accessible through the normal program shortcuts.

## Using SnapSAN S1000 VSS

There are four applications that can communicate with VSS.

The following two applications are recommended for use with the hardware provider:

- The vshadow command (part of the Microsoft VSS Software Development Kit).
- A Microsoft VSS compliant backup application.

The following two applications do **not** use the hardware provider – they are configured to use an internal software provider:

- The vssadmin utility
- The Shadow Copy tabs in Windows Explorer's Properties window

### Creating a Snapshot

To issue a simple snapshot, type the following command:

```
vshadow -p <Drive Letter>
```

Where:

- p – Creates a persistent snapshot which can be viewed.
- <Drive Letter> – The Windows label for a drive located on the enclosure.

**NOTE:** If the -p is omitted, vshadow causes the snapshot to be deleted at completion of the command.

For example, to create a persistent snapshot on drive F, the command is:

```
vshadow -p F
```

### Listing Snapshots

To list all snapshots known to the system, type:

```
vshadow -q
```

### Exposing a Snapshot

To expose a snapshot as a drive, making its contents available as if it were any other drive, type:

```
vshadow -el=<Snapshot ID>,<Drive Letter>:
```

Where:

- <Snapshot ID> – The identifier for the snapshot, including the braces: {}. This can be determined using the “vshadow -q” command.

<**Drive Letter**> – The Windows label for accessing the snapshot data.

The data is only available to read; data cannot be written to this drive.

For example, to expose the snapshot with ID {6a1c4c9d-3fd7-48dc-adfa-a35d1064f9f9} as drive letter G:

```
vshadow -e1={6a1c4c9d-3fd7-48dc-adfa-a35d1064f9f9},G:
```

## Introduction

Replication is a new function on the SnapSAN S1000 redundant RAID subsystem. It helps users to replicate data easily through LAN or WAN from one S1000 to another. Users can learn from this document about how to configure Replication on the S1000 storage array, and how redundancy works on Replication when a controller fails on a source or target RAID subsystem.

## Network configuration

The following are the default address used but your own internal address can be used.

IP settings on **source** subsystem:

Controller 1, iSCSI port 1: 192.168.1.1/24  
iSCSI port 2: 192.168.1.2/24  
iSCSI port 3: 192.168.1.3/24  
iSCSI port 4: 192.168.1.4/24 (**Replication** port)

Controller 2, iSCSI port 1: 192.168.1.5/24  
iSCSI port 2: 192.168.1.6/24  
iSCSI port 3: 192.168.1.7/24  
iSCSI port 4: 192.168.1.8/24 (**Replication** port)

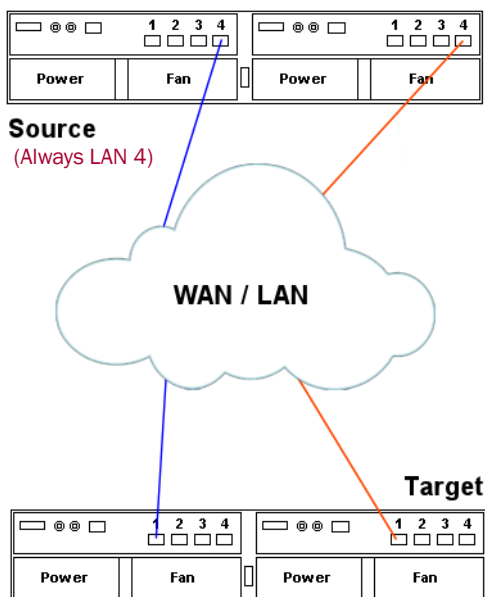
IP settings on **target** subsystem:

Controller 1, iSCSI port 1: 192.168.1.11/24  
iSCSI port 2: 192.168.1.12/24  
iSCSI port 3: 192.168.1.13/24  
iSCSI port 4: 192.168.1.14/24

Controller 2, iSCSI port 1: 192.168.1.15/24  
iSCSI port 2: 192.168.1.16/24  
iSCSI port 3: 192.168.1.17/24  
iSCSI port 4: 192.168.1.18/24

# Network Diagram

Below is the standard configuration of Replication which provides redundancy for controller or network failure.



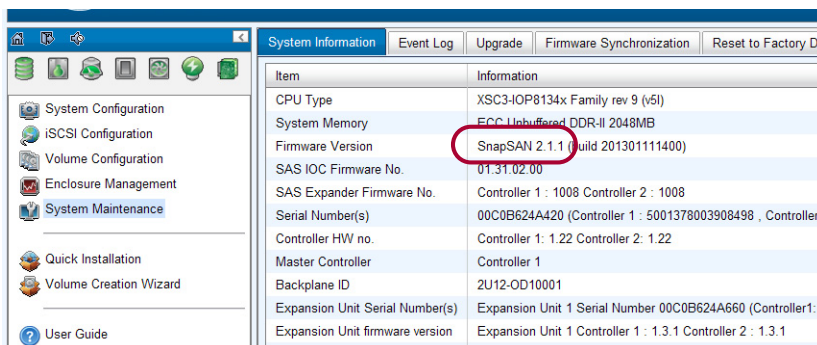
# Configure Replication

## Activate the RAID Subsystem License Key

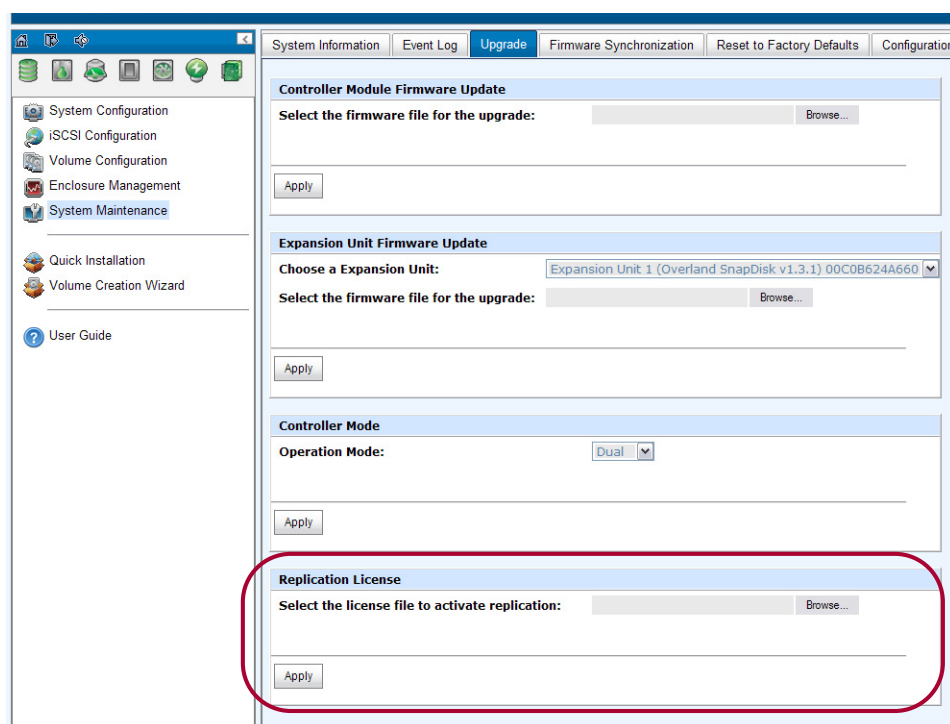
A unique license key must be installed onto each S1000 to activate the Replication function. The following steps show how to activate the license key:

**IMPORTANT:** The SnapSAN S1000 must be running firmware version 2.1.1 or higher to install the license to enable replication.

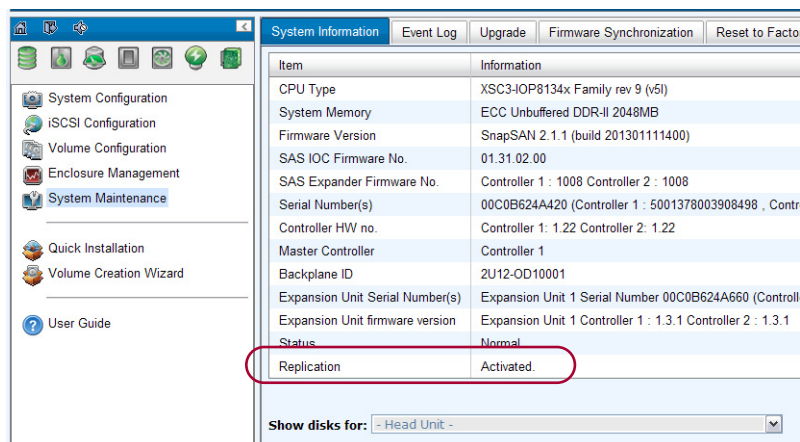
1. Log on as **Administrator**.
2. At the **System Maintenance > System Information** tab, verify the version.



- At the **System Maintenance > Upgrade** tab, locate the Replication License area.



- Click the **Browse** button, navigate to where you downloaded the license, and select it.
- Click **Apply**.  
After the license key is activated, a message is displayed requesting a reboot of the S1000 to have the license take effect.
- Click **Reboot**.  
After the reboot, the Replication license status is displayed as “Activated” on the **System Information** page.



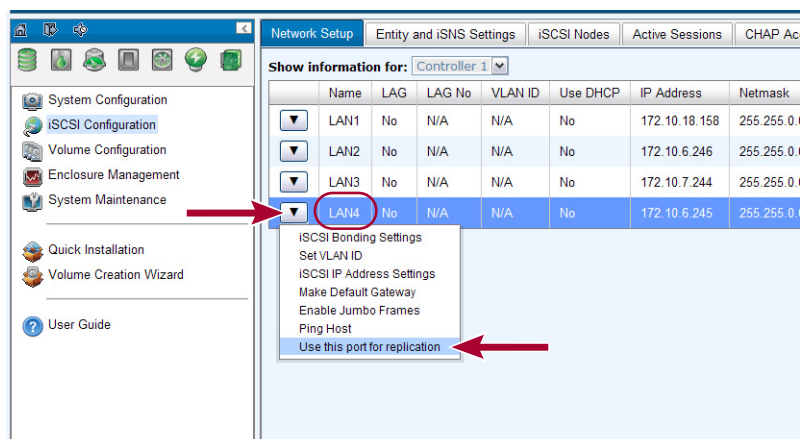
## Set Up the Replication Port On The Source

Replication uses the last iSCSI port (number 4) on the Source controllers to replicate the data. When Port 4 is configured as the replication port, it is no longer available as a host iSCSI port until it is reconfigured as the normal iSCSI port again.

- Go to **iSCSI configuration > Network Setup**.



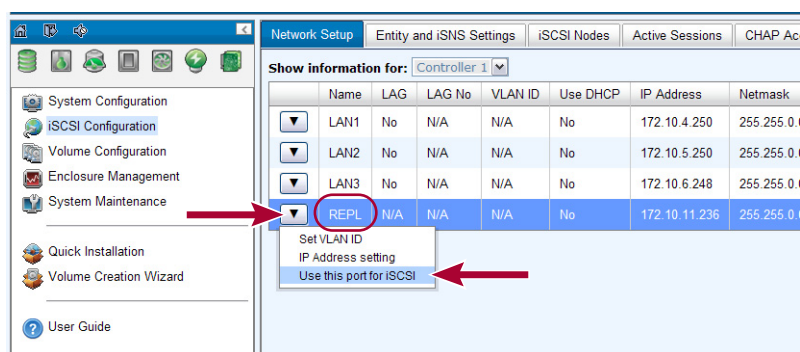
- Click the menu button (▼) next to the Port 4 name, and select **Enable Replication**.



NOTE: The Port 4 on Controller 2 will also be set as the Replication port automatically at the same time as Controller 1.

- At the confirmation message, click **OK**.

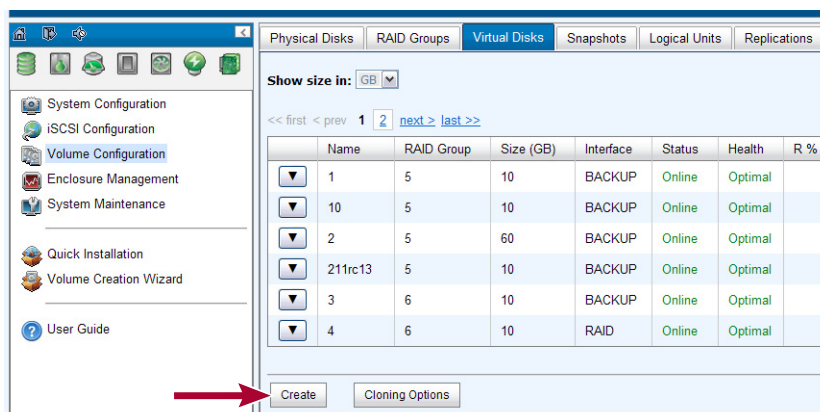
The setting can be reverted by **disabling** the Replication using the drop-down menu.



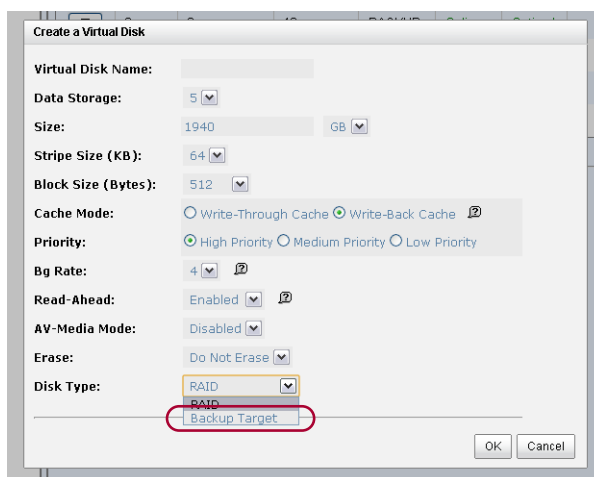
## Create A Backup Virtual Disk On The Target

Before creating the replication job on the Source subsystem, a virtual disk has to be created on the Target subsystem and the Type set to Backup.

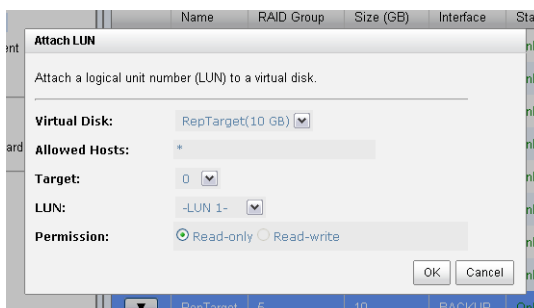
- On the Target subsystem, go to **Volume Configuration > Virtual Disks** and click **Create**.



- Enter the Virtual Disk Name, select the appropriate settings, and use the Disk Type drop-down menu to choose **Backup Target**. Click **OK**.



- Click the menu button (▼) next to the virtual disk name, and select **Attach LUN**. The backup virtual disk needs to be attached to a LUN ID before creating replication job. Also, a Backup virtual disk can only be attached with **Read-only** permissions. This is done to prevent it from being modified accidentally.

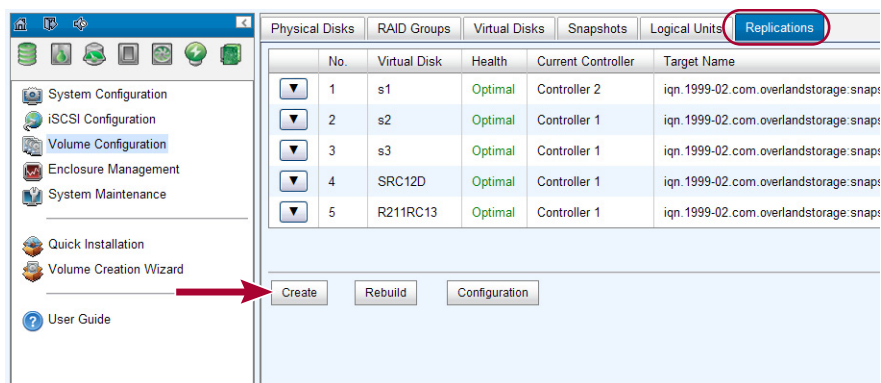


- Choose the LUN options and click **OK**.

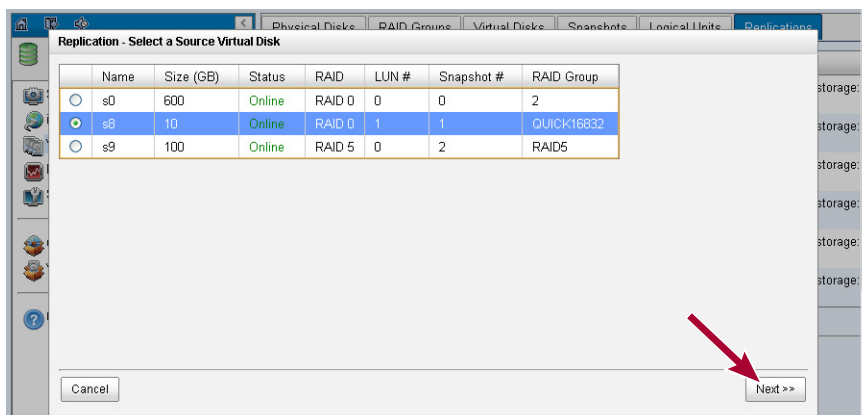
## Create Replication Job On The Source

When the license key is activated on the subsystem, a new **Replications** tab is added to the Web Management Interface. Use this new tab to create and maintain replication jobs.

- At the Replications tab on the Source array, click **Create**.

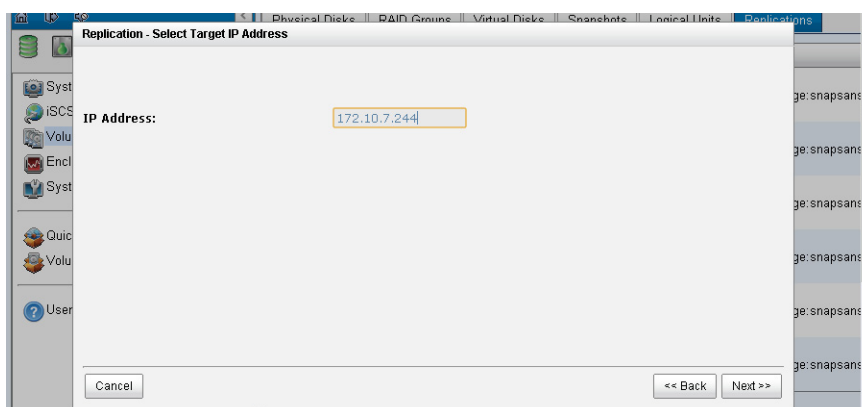


2. Select the **source virtual disk** which will be replicated to the Target subsystem, and click **Next**.



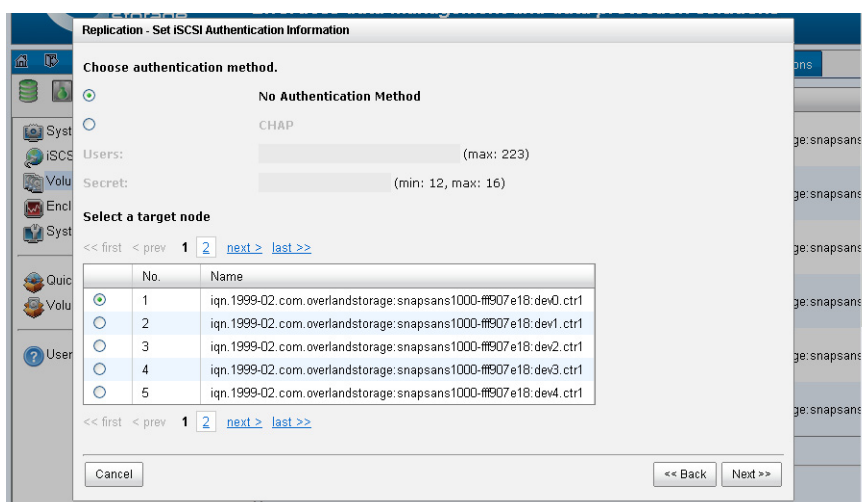
NOTE: If a message appears saying that there is not enough space to create a replication job, refer “Configure Snapshot Space” below.

3. Enter the **IP address** of an iSCSI port on Controller 1 of the Target subsystem. Click **Next** to continue.

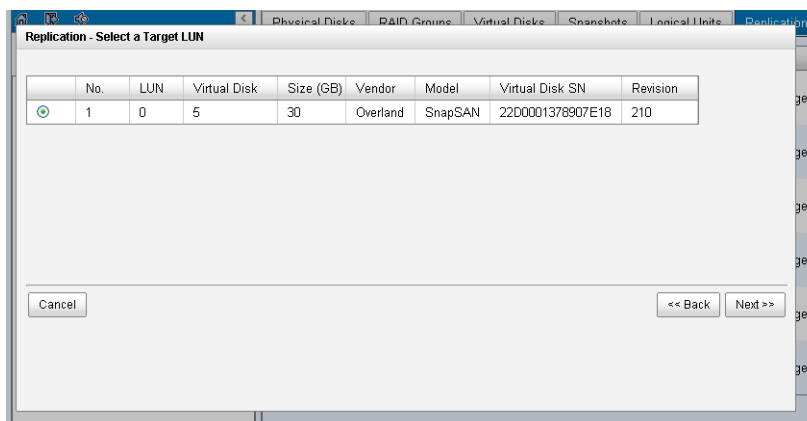


4. Set the **iSCSI authentication** information.

SnapSAN Replication uses standard iSCSI protocols for data replication. The user has to log on the iSCSI node to create the iSCSI connection for the data transmission. Choose the authentication method and select the target node that will be used.



- a. If authentication is desired, select the **CHAP** option and enter the required information.
  - b. Use the options above the Node table to show different Target **node lists** and then select a **node** from the list.
  - c. Click **Next** to continue.
5. Select a **Target LUN**, and click **Next**.



A new Replication job is created and listed on the Replication page.

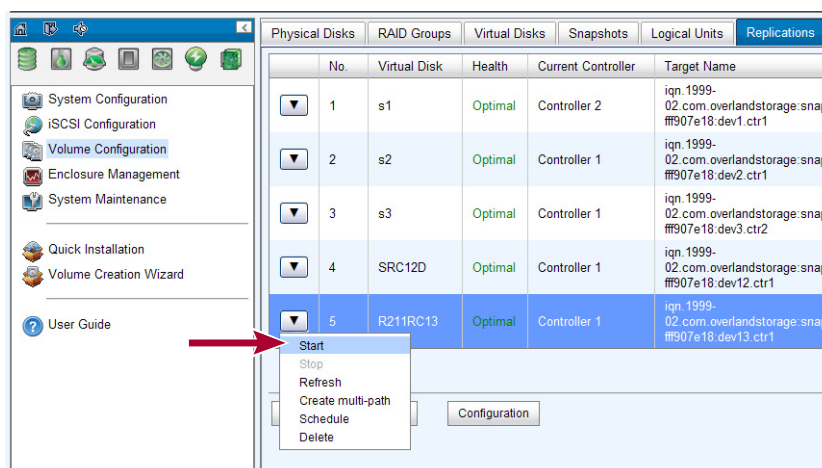
## Working with Replication Jobs

Use the Replications tab under Volume Configuration to work with replication jobs.

**NOTE:** Once a Replication job is created, do NOT reboot the Source array. If you reboot it, the virtual disk name information will be lost and Replication job can no longer be started. This issue could also be caused if the LUN is detached at the Target which causes the Replication job to no longer be linked.

### Run a Replication Job

1. At the Replications tab on the Source array, click the menu button (▼) next to the replication job number to open the operation menu.
2. Click **Start** to run the replication job.



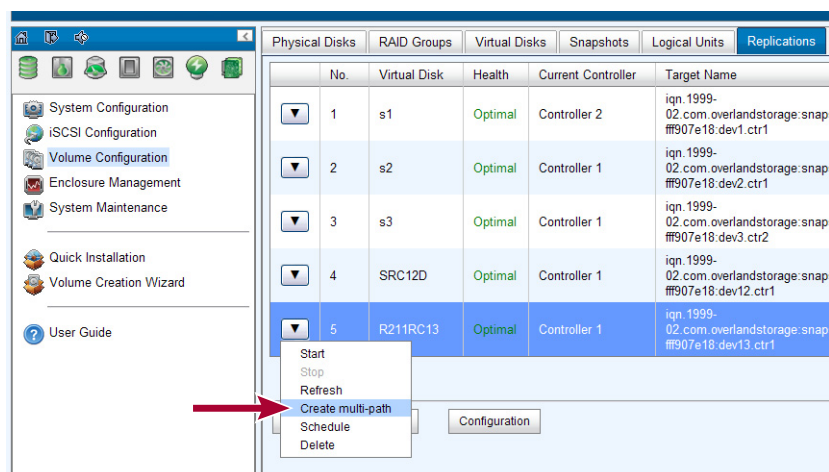
- At the Replication job confirmation message, click **Yes**.

The replication job can be monitored in the **Status** information column on the Replications tab. The progress is expressed by percentage in the Status column to the right.

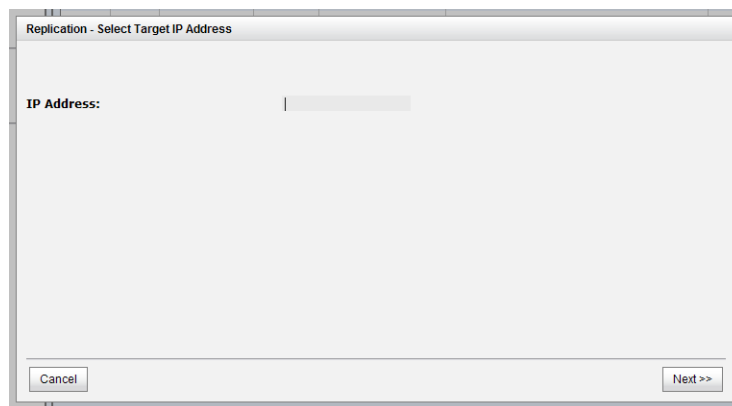
Source	Target IP	Target Virtual Disk Name	Size (MB)	Size (GB)	Status	Pct. Done	Sched
overlandstorage:snapsans1000-av1.ctr1	172.10.6.246	1	10240	10	Online		N/A
overlandstorage:snapsans1000-av2.ctr1	172.10.7.244	2	61440	60	Online		N/A
overlandstorage:snapsans1000-av3.ctr2	172.10.12.230	3	2410240	10	Online		N/A
overlandstorage:snapsans1000-av12.ctr1	172.10.18.158	TRC12D	102400	100	Online		
overlandstorage:snapsans1000-av13.ctr1	172.10.18.158	211rc13	10240	10	Replicating	24	N/A

## Create a Replication Job Multi-Path Setting

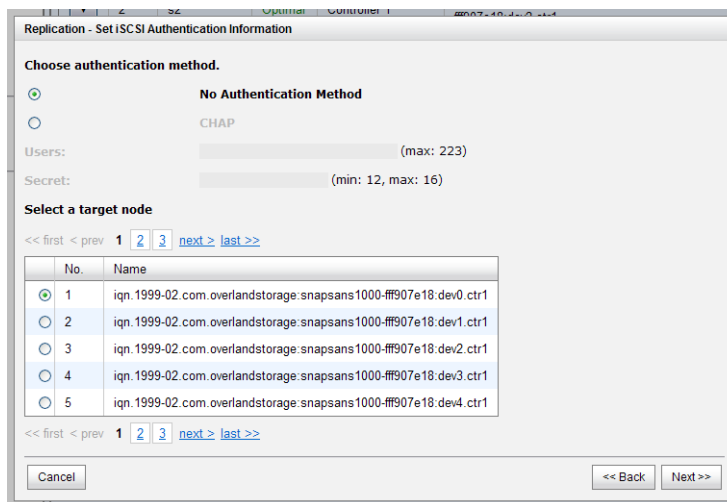
- At the Replications tab on the Source array, click the **menu button (▼)** and choose **Create multi-path**.



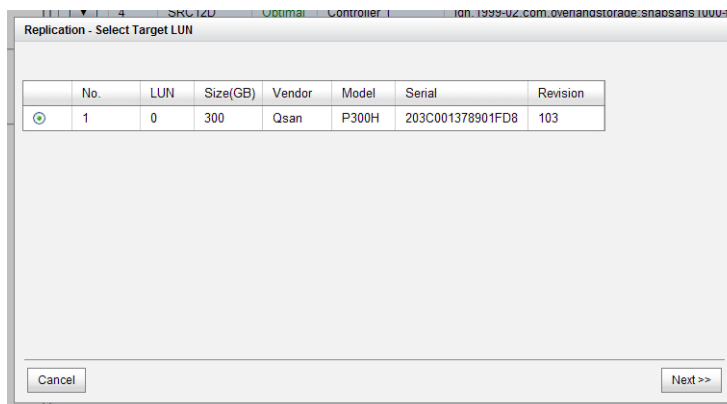
- Enter the **IP address** of iSCSI port on Controller 2 of the Target.



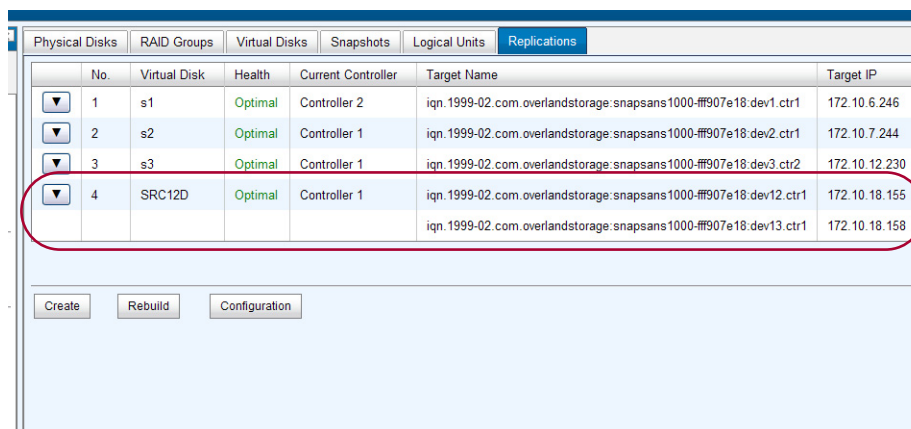
3. Select the **iSCSI node** used to log on, and click **Next**.



4. Choose the same Target virtual disk LUN and click **Next**.



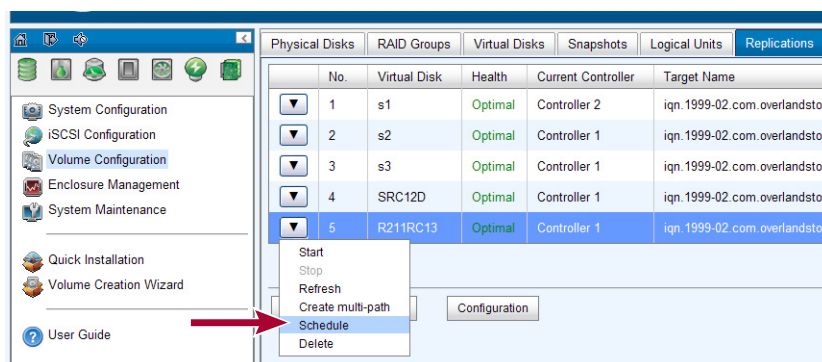
5. A **new target** is added to this replication job as a redundancy path.



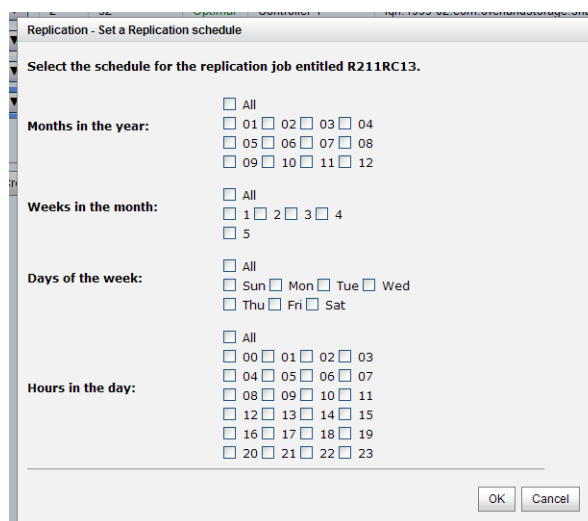
## Schedule a Replication Job

A replication job can be scheduled to run by hour, day, week, or month. The actual execution time can be configurable to meet a user's need. If a previous replication job is still running when the scheduled time of execution arrives, that scheduled execution is skipped.

1. At the Replications tab on the Source array, click the menu button (▼) and choose **Schedule**.



2. Select the specific time settings and click **OK**.

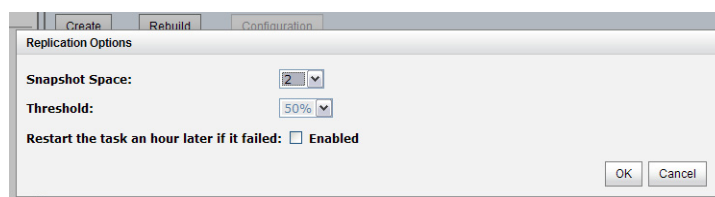


## Configure Snapshot Space

The Replication uses snapshots to replicate the data without stopping the access of the Source virtual disk. If snapshot space is not configured on the Source virtual disk in advance, the subsystem will allocate snapshot space automatically when the replication job is created. The default snapshot space allocated by the subsystem is two times the size of Source virtual disk. If the free space of the RAID group which the Source virtual disk resides in is less than double size of the Source virtual disk, the replication job will fail and an error message is shown.

To prevent this problem, make sure the RAID group has enough free space for the snapshot space. Otherwise, the user has to configure the snapshot space of the Source virtual disk manually before the replication job is created.

To configure the snapshot space settings of Replication, click **Configuration**.



There are three settings in the **Replication configuration** menu:

- **Snapshot space** – specifies the ratio of snapshot space allocated to the Source virtual disk automatically when the snapshot space is not configured in advance. The default ratio is 2 to 1 which means when the replication job is being created, the subsystem will automatically use the free space of RAID group to create a snapshot space which is double the size of the Source virtual disk.
- **Threshold** – monitors the utilization of snapshot space. When the used snapshot space reaches its threshold, the subsystem will automatically take a new snapshot and start the replication job. The purpose of the threshold is to prevent the incremental copy from immediately failing when it runs out of snapshot space.  
For example, the default threshold is set to 50%. When the snapshot space used goes over 50%, the subsystem automatically replicates data from the Source virtual disk to the Target virtual disk. After that, when the remaining unused snapshot space goes over 50% (for a total snapshot space used of 75%), the subsystem automatically starts the replication job again.
- **Restart the task an hour later if failed** – for use when running out of snapshot space and the replication job has stopped due to the lack of space. If checked, the subsystem will automatically clear older snapshots to release snapshot space, and the replication job will restart the task after another hour has past.



**IMPORTANT:** The settings Threshold and Restart the task an hour later if failed take effect only when the replication job is configured to run by schedule.



**CAUTION:** The default snapshot space allocated by the subsystem is normally two times the size of Source virtual disk. If the user sets the snapshot space manually and at a lower value than the default value, there is a risk that the snapshot space will not be large enough and replication job will fail.

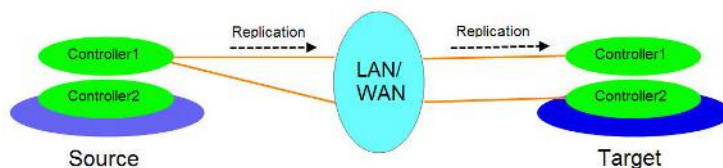
## How Replication Redundancy Works

**NOTE:** Replication job failover is not supported. As long as the controller that owns the replication job is functioning, the job is only available through it.

### Normal Operation

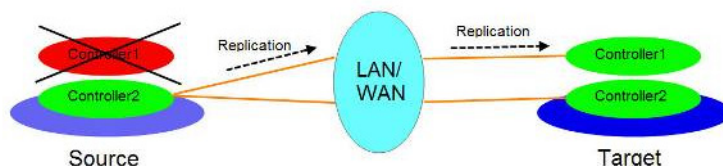
The replication job is running on the Controller 1 of Source subsystem. The data is replicated from the Controller 1 of Source subsystem to the Controller 1 of the Target subsystem. Replication only supports the MPIO policy for failover which means the data will be transmitted through one network path at a time.





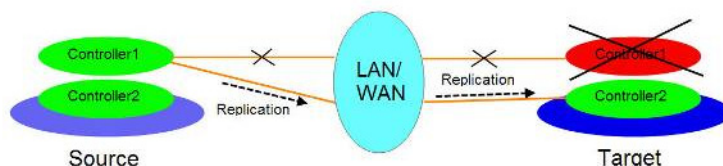
### Controller 1 Fails on Source

The network path will be failed over to the second path from the Controller 2 of Source subsystem to the Controller 1 of Target subsystem.



### Controller 1 Fails on Target

The network path will be failed over to the second path from the Controller 1 of Source subsystem to the Controller 2 of Target subsystem.



## Create Multiple Replication Jobs

To create multiple replication jobs on the Source subsystem, the user has to create two or more backup virtual disks on the Target subsystem and attach the backup virtual disks to the LUN IDs of different iSCSI nodes. For example, two replication jobs are created to replicate data from the Source virtual disks **S1** and **S2** to the Target virtual disks **T1** and **T2**. The virtual disk **T1** has to be attached to the LUN ID of iSCSI node 1 and the virtual disk **T2** has to be attached to the LUN ID of iSCSI node 2. This is because replication does not allow logging on to the same iSCSI node twice. If the target virtual disks **T1** and **T2** are attached to the LUN IDs of the same iSCSI node, the replication job will fail while logging on the second time.

**NOTE:** A maximum of eight (8) replication jobs can be running at one time.

## First Time Best Practices

When executing a full copy replication job for the first time over a LAN or WAN, it may take days or weeks to replicate all the data from the Source to the Target subsystem due to the limited network bandwidth. The SnapSAN S1000 provides two features to help the user shorten the execution time of a full copy.

- **Skip a full copy to a new, clean virtual disk.**

The term “clean” means that the virtual disk has never had data written to it since being created.

For a newly created virtual disk which has never been accessed, the subsystem recognizes that the disk is new and automatically skips the full-copy process when the replication job is created on this virtual disk for the first time.

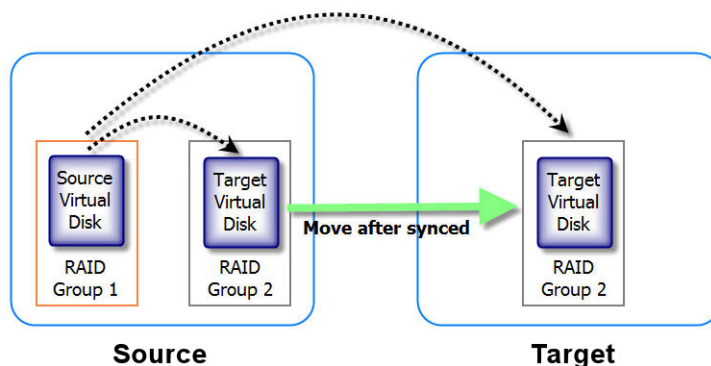
**NOTE:** Any IO access to the newly created virtual disk is marked as “not clean” by the subsystem, even when executing the Erase function when a virtual disk is created. The full copy process takes place in such a case.

- **Use Virtual Disk Clone.**

**NOTE:** It is recommended that both the array/RAID group and the Virtual Disk that will be used are both idle during a Virtual Disk Clone.

For a new replication job created on an existing virtual disk with stored data, a full copy is necessary to synchronize the volume image between the Source and Target virtual disks. It usually takes a long time to synchronize the data, especially when the replication job is running over WAN with limited bandwidth.

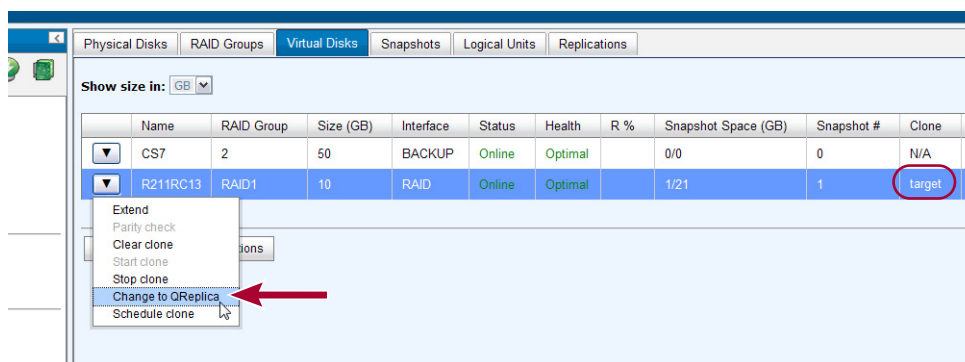
A Virtual Disk Clone provides a faster first-time full-copy replication by first copying the Source data between two virtual disks on two different physical disk drives. The Target drive is then moved to the Target S1000.



The followings are the **steps** to use Virtual Disk Clone:

1. Create a **cloning job** on an existing virtual disk with data already stored.
2. Verify that no host is connected to the Source virtual disk, and run **Virtual Disk Clone**.

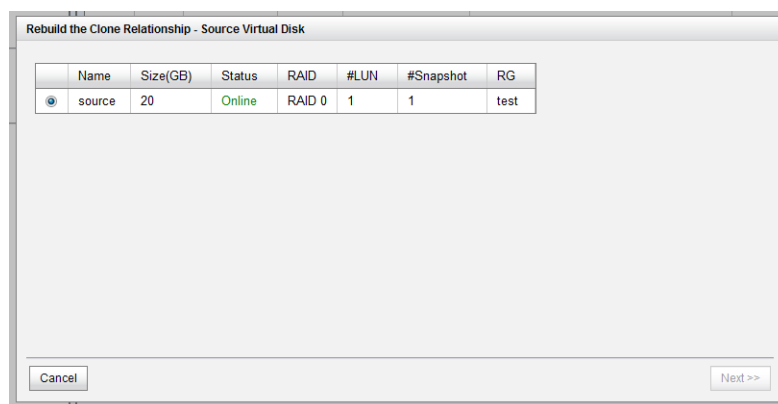
- After the data is synchronized, change the cloning job to a replication job by selecting **Change to Replication** from the drop-down menu of Source virtual disk.



The values at the **Clone** column changes from the target virtual disk name to **Rep.**

**CAUTION:** Changing a cloning job to a replication job is only available when the cloning job is complete. This change is irreversible.

- Deactivate the **RAID group** which the Target virtual disk resides in and move all physical disks of the RAID group to the Target subsystem.
- Activate the **RAID group** in the Target subsystem and attach the Target virtual disk to a LUN ID.
- Switch to **Replications** tab of the Source subsystem and click **Rebuild** to rebuild the replication job which was changed from a cloning job.
- Select the **replication job** to rebuild.



- Follow the **steps** for creating a new replication job.  
Refer to “[Configure Replication.](#)”

If a wrong target virtual disk is selected when rebuilding the replication job, a mismatched error message is displayed and the rebuilding stops.

# Overland Glossary & Acronym List

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**NOTE:** This is a general Overland Storage glossary and acronym list for all products. Not all items may be found in this document or be used by this product.

## **1000BASE-T**

1000BASE-T (also known as IEEE 802.3ab) is a standard for gigabit Ethernet over copper wiring. It requires, at a minimum, Category 5 cable (the same as 100BASE-TX), but Category 5e (Category 5 enhanced) and Category 6 cable may also be used and are often recommended. 1000BASE-T requires all four pairs to be present and is far less tolerant of poorly installed wiring than 100BASE-TX.

## **Address**

An address is a data structure or logical convention used to identify a unique entity, such as a particular process or network device.

## **ACL**

Short for *Access Control List*. A mechanism for restricting access. It is a list of initiator IQNs, along with type of access (read/write or read only) granted to each initiator together with any information required for authentication.

## **Array**

A group of disk drives that are combined together to create a single large storage area. Up to 64 arrays are supported, each containing up to 16 drives per array. There is no capacity limit for the arrays.

## **ATA**

Short for *Advanced Technology Attachment*. A standard interface for connecting storage devices to a PC.

## **Auto Balance**

A feature that automatically balances preferred paths evenly among all available host ports and controller ports. Auto balancing spreads I/O load by utilizing as many host ports and controller ports as possible.

## **Back-end**

Front-end and back-end are terms used to characterize program interfaces and services relative to the initial user, human or program, of these interfaces and services. A “front-end” application is one that application users interact with directly. A “back-end” application or program serves indirectly in support of the front-end services, usually by being closer to the required resource or having the capability to communicate with the required resource. The

back-end application may interact directly with the front-end or, perhaps more typically, is a program called from an intermediate program that mediates front-end and back-end activities.

### Back-off Percent

In order to allow drives from a different family or manufacturer to be used as a replacement for a drive in an array, it is recommended that a small percentage of the drive's capacity be reserved when creating the array. This is user selectable, from 0 to 10 percent. This is sometimes known as Reserved Capacity.

### Bridging

Devices that connect and pass packets between two network segments that use different communications protocol.

### Bus or Channel

A common physical path composed of wires or other media, across which signals are sent from one part of a computer to another. A channel is a means of transferring data between modules and adapters, or between an adapter and SCSI devices. A channel topology network consists of a single cable trunk that connects one workstation to the next in a daisy-chain configuration. All nodes share the same medium, and only one node can broadcast messages at a time.

### CA

Short for *Certificate Authority*. A trusted third-party in a network that issues and manages security credentials.

### Cache Flush Array

This is the array that is used to automatically flush cache data in a situation where power has failed to some of the drives.

### Cat 5 Cable

Short for *Category 5*, it is network cabling that consists of four twisted pairs of copper wire terminated by 8P8C modular connectors. CAT 5 cabling supports frequencies up to 100 MHz and speeds up to 100 Mbps. (CAT 5e cabling supports frequencies up to 1000 MHz and speeds up to 1000 Mbps.) It can be used for ATM, token ring, 1000BASE-T, 100BASE-T, and 10BASE-T networking.

Cat 5 is based on the EIA/TIA 568 Commercial Building Telecommunications Wiring Standard developed by the Electronics Industries Association as requested by the Computer Communications Industry Association in 1985.

### Cat 6 Cable

Short for *Category 6*, it is network cabling that consists of four twisted pairs of copper wire terminated by 8P8C modular connectors made to higher standards that help reduce noise caused by crosstalk and system noise. The ANSI/TIA-568-B.2-1 specification states the cable may be made with 22 to 24 AWG gauge wire, so long as the cable meets the specified testing standards.

It is designed for Gigabit Ethernet that is backward compatible with the Category 5/5e and Category 3 cable standards. Cat 6 features more stringent specifications for crosstalk and system noise. The cable standard provides performance of up to 250 MHz and is suitable for 10BASE-T / 100BASE-TX and 1000BASE-T (Gigabit Ethernet).

## CHAP

Short for *Challenge Handshake Authentication Protocol*. A scheme used to verify the identity of remote clients in a network.

If there are security concerns, it is possible to set up authentication of targets and initiators, using the CHAP authentication protocol. With CHAP authentication, an initiator can only connect to a target if it knows the target's password or secret. To set up CHAP, the same secret must be known by both the initiator and target.

It is also possible to use Mutual CHAP, where there is a second authentication phase. After the target has authenticated the initiator, the initiator will authenticate the target using an initiator secret. Put simply, with CHAP the target can ensure that the initiator connecting is who it claims to be; with mutual CHAP, the initiator can also ensure that the target is who it claims to be.

## Chunk Size

This is the amount of data that is written on a single drive before the controller moves to the next drive in the stripe.

## DHCP

Short for *Dynamic Host Configuration Protocol*. A mechanism for assigning unique IP addresses to network nodes.

## Discovery

Discovery is the process by which an initiator 'discovers' a target. Discovery uses a special type of session, called a Discovery Session, where an initiator connects to a RAID storage controller and asks it to send a list of the targets present on the controller. The target will respond with a list of all the targets to which the initiator has access.

## Disk Roaming

This is the process of removing a disk drive from a controller and putting it back later, either on the same controller, or a different one, and having it recognized as the same disk drive. The disks may be can be attached to different ports than they were originally attached to, without harm to the data. The disks may be attached to the same ports or different ports on the controller.

## DNS

Short for *Domain Name Service*. A network service that translates domain names into IP addresses.

## DSM

Short for *Device Specific Module*, it is a software module that allows RAID storage array hardware to use Microsoft's MPIO.

## Expansion Slot

Area in a computer that accepts additional input/output boards to increase the capability of the computer.

## F\_port

A *Fabric* port within a Fibre Channel switch that provides a point-to-point link attachment to a single N\_Port. F\_Ports are intermediate ports in virtual point-to-point links between end ports, for example N\_Port to F\_Port to F\_Port to N\_Port using a single Fibre Channel fabric switch.

## Failback

Failback occurs when a path with a higher priority than the currently active path is restored. In this case, I/O will “fail back” to the higher priority path once it is available again.

## Failover

The ability to automatically substitute a working system or path for one which has failed.

## Failover/Failback

A combination of Failover and Failback. When a preferred path becomes unavailable, another path is used to route I/O until the preferred path is restored. In this case I/O will “fail back” to the preferred path once it is available again.

## FC-AL

Short for *Fibre Channel Arbitrated Loop*. An FC-AL is a Fibre Channel network in which up to 126 systems and devices are connected in a loop topology, with each transmitter connecting to the receiver of the device on its logical right. The Fibre Channel Arbitrated Loop protocol used for transmission is different from Fibre Channel switched and point-to-point protocols. Multiple FC-AL loops can be connected via a fabric switch to extend the network.

## Fibre Channel

Fibre Channel (FC) is a gigabit-speed network technology which transports SCSI commands over Fibre Channel networks. Fibre Channel was primarily concerned with simplifying the connections and increasing distances, but later designers added the goals of connecting SCSI disk storage, providing higher speeds and far greater numbers of connected devices.

## Firmware

Software stored in read-only memory (ROM) or programmable ROM (PROM). Firmware is often responsible for the behavior of a system when it is first switched on.

## FL\_port

A *Fabric Loop* port within a Fibre Channel switch that is capable of Fibre Channel Arbitrated Loop operations and is connected to one or more NL\_Ports via a Fibre Channel Arbitrated Loop. An FL\_Port becomes a shared entry point for public NL\_Port devices to a Fibre Channel fabric. FL\_Ports are intermediate ports in virtual point-to-point links between end ports that do not reside on the same loop, for example NL\_Port to FL\_Port to F\_Port to N\_Port through a single Fibre Channel fabric switch.

## Front-end

See [Back-end](#).

## Gigabit Ethernet

Also known as GigE or GbE, this Ethernet standard uses a one Gigahertz (1000 Hz) clock rate to move data.

## HBA

Short for *Host Bus Adapter*. An HBA is an I/O adapter that sits between the host computer's bus and the Fibre Channel loop and manages the transfer of information between the two channels. In order to minimize the impact on host processor performance, the HBA performs many low-level interface functions automatically or with minimal processor involvement.

## Hot Spare

Used as a failover mechanism to provide reliability in system configurations. A hot spare is active and connected as part of a working system. When a key disk fails, the hot spare disk is switched into operation taking its place.

## Hot Swap

The action of components being removed and replaced while the unit is running, with power to either the component or a device still connected to the unit. Not all components are hot swappable. Please read installation and maintenance instructions carefully.

## IDE

Short for *Integrated Drive Electronics*. A standard interface for connecting storage devices to a PC

## Internet

A global network of networks used to exchange information using the TCP/IP protocol. It allows for electronic mail and the accessing and retrieval of information from remote sources.

## Initialization

RAID 5, 6, 50, and 60 disk arrays must have consistent parity before they can be used to protect data. Initialization writes a known pattern to all drives in the array. If you choose not to initialize an array, the array will be trusted. Any drive failure results in data corruption in a trusted array. (It is possible to later perform a parity rewrite that recalculates the parity based on the current data, thus ensuring the data and parity are consistent.)

## Initiator Device

A system component that originates an I/O command over an I/O bus or network. An initiator issues the commands; a *target* receives them.

An initiator normally runs on a host computer. It may be either a software driver or a hardware plug-in card, often called a Host Bus Adapter (HBA). A software initiator uses one of the computer's Ethernet ports for its physical connection, whereas the HBA will have its own dedicated port.

Software initiators are readily available for most host operating systems. Hardware initiators are not widely used, although they may be useful in very high performance applications or if 10 Gigabit Ethernet support is required.

## Internal Logical Drive

An internal logical drive is identical to a regular logical drive, except it is NOT made visible to a host adapter as a LUN. Instead, internal logical drives are used for setting up snapshot ODAs that are only accessed internally by the RAID controller.

## IP

Short for *Internet Protocol*. IP specifies the format of packets and the addressing scheme.

## IQN

Short for *iSCSI Qualified Name*. A name format used in the iSCSI protocol.



Initiators and targets have IP addresses, just like any other network entity. They are also identified using an iSCSI name, called the iSCSI Qualified Name (IQN). The IQN should be unique world-wide. It is made up of a number of components, specifying the date, identifying the vendor in reverse format, and then uniquely identifying the initiator or target. An example of an IQN is:

```
iqn.2001-04.com.example:storage:diskarray-sn-123456789
```

Since these IQNs are rather unwieldy, initiators and targets also use short, user friendly names (sometimes called alias names or just aliases).

## iSCSI

Short for *Internet SCSI*. iSCSI is an IP-based storage networking standard for linking data storage facilities, developed by the Internet Engineering Task Force (IETF). By carrying SCSI commands over IP networks, iSCSI is used to facilitate data transfers over intranets and to manage storage over long distances. The iSCSI protocol is among the key technologies expected to help bring about rapid development of the storage area network (SAN) market, by increasing the capabilities and performance of storage data transmission. Because of the ubiquity of IP networks, iSCSI can be used to transmit data over local area networks (LANs), wide area networks (WANs), or the Internet and can enable location-independent data storage and retrieval.

## iSNS Server

Short for *Internet Storage Name Service Server*. A protocol enabling the automatic discovery, configuration, and management of iSCSI devices on a TCP/IP network.

## LACP

*Link Aggregation Control Protocol* provides a method to control the bundling of several physical ports together to form a single logical channel. LACP allows a network device to negotiate an automatic bundling of links by sending LACP packets to the peer (directly connected device that also implements LACP).

## LAN

Short for *Local Area Network*. A network connecting computers in a relatively small area such as a building.

## LED

Short for *Light-Emitting Diode*. An LED is a type of diode that emits light when current passes through it. Visible LEDs are used as indicator lights on electronic devices.

## Logical Drive

A drive that is defined or created from regions of an array, a whole array, or a combination of regions of different arrays. The logical drive appears as a single disk to one or more host systems.

## Logical Drive Availability

To accommodate hosts with multiple ports and multiple host systems, it is possible to restrict a logical drive's availability to a particular HBA or controller port. Access can be enabled or disabled for each host port of each controller.

## LUN

Short for *Logical Unit Number*. A SCSI or Fibre Channel device identifier. LUN is a subdivision of a SCSI target.

**MAC Address**

Short for *Media Access Control address*, a hardware address that uniquely identifies each node of a network.

**Mapped LUN Number**

Each logical drive is presented to the host system with a unique LUN. In certain cases (such as after deleting another logical drive) it may be desirable to change the number that a logical drive is presented as. This can be done at any time, bearing in mind that any attached host systems may need to be rebooted or reconfigured to maintain access to the logical drive.

**Mapping table**

A table indexed by sequential LUN values, indicating the selected BUS:TARAID GroupET:LUN devices. Mapping tables are used by routers and bridges like the GEOi to perform Ethernet-to-SCSI pathing.

**MD5 Algorithm**

MD5 is a way to verify data integrity, and is much more reliable than checksum and many other commonly used methods.

**MPIO**

Short for *Multipath Input/Output*. A multipath solution built into Microsoft server-grade operating systems. It requires the DSM to work with RAID storage array hardware.

**MTU**

Short for *Maximum Transfer Unit*. It is the largest size packet or frame, specified in octets (eight-bit bytes), that can be sent in a packet- or frame-based network.

**N\_port**

A *Node* port connects via a point-to-point link to either a single N\_Port or a single F\_Port. N\_Ports handle creation, detection, and flow of message units to and from the connected systems. N\_Ports are end ports in virtual point-to-point links through a fabric, for example N\_Port to F\_Port to F\_Port to N\_Port using a single Fibre Channel fabric switch.

**NAS**

Short for *Network Attached Storage*. Data storage connected to a network that provides network clients access to data using file-level protocols.

**NAT**

Short for *Network Address Translation*. A technique for passing network traffic through a router whereby one set of IP addresses is used on one side of the router and another set of addresses is used on the other side. This is done to avoid address conflicts and to increase the address space of the internal network.

**Network Interface Card (NIC)**

A board that provides network communication capabilities to and from a computer.

**NDMP**

Short for *Network Data Management Protocol*. A protocol standard used by some Network Attached Storage systems to provide an industry standard means to do backup and restores of the NAS system without the need for 3rd party agents to be installed on the NAS device. Also see [NDMP.org](http://NDMP.org) for further details.

## NL\_port

A *Node Loop* port is capable of arbitrated loop functions and protocols. An NL\_Port connects via an arbitrated loop to other NL\_Port and at most a single FL\_Port. NL\_Ports handle creation, detection, and flow of message units to and from the connected systems. NL\_Ports are end ports in virtual point-to-point links through a fabric, for example NL\_Port to F\_Port to F\_Port to N\_Port using a single Fibre Channel fabric switch. In the absence of a fabric switch FL\_Port, NL\_Ports can communicate with other NL\_Ports in virtual point-to-point links through a FC-AL open loop circuit often through FC-AL (Arbitrated Loop) hub or loop switch devices.

## Node Name

This is an eight-byte, 16-character hexadecimal number, uniquely identifying a single fibre device. It incorporates the World Wide Name and two additional bytes that are used to specify the format. In a host system with multiple FC ports, all adapters typically use the same Node Name, but unique Port Names.

## NTFS

Short for *New Technology File System*. The standard file system used by Windows NT and later versions of the Windows operating system.

## NTP

Short for *Network Time Protocol*. A protocol for synchronizing the system clocks of computers over a packet-switched network.

## NVRAM

Abbreviation of *Non-Volatile Random Access Memory*, a type of memory that retains its contents when power is turned off.

## ODA

The *Overwrite Data Area* is an internal storage area on an array that is dedicated to storing data from a snapshot logical drive. The data stored on the ODA is the data from the logical drive that needed to be overwritten after a snapshot was initiated. The ODAs are mapped on top of internal logical drives. An ODA cannot be accessed externally through a host LUN; it is only accessed internally.

## ODA Stripe Size

The read/write block size that the system will use when copying data from the original logical drive to the ODA.

## Pool

A pool is a collection of RAID disks, grouped together by the RAID storage controller. iSCSI volumes are created from these pools. New volumes can be created and existing volumes can be extended, provided there is spare capacity in the pool from which the volume was created.

## Port Name

This is an eight-byte hexadecimal number, uniquely identifying a single host HBA port. It incorporates the World Wide Name and two additional bytes that are used to specify the format and indicate the port number.

## Portal

A target's IP address together with its TCP port number.

## Preferred Path

The preferred path is the default path. When the path selection policy is set to Failover/Failback, the preferred path is always used if it is available. If the preferred path fails, I/O switches to another path. If it is later restored, I/O switches back to the preferred path.

## PTP

Short for *Point-to-Point*. PTP is the common mode of attachment to a single host. PTP is sometimes used to attach to a Fibre Channel switch for SAN connectivity.

## RAID

Short for *Redundant Array of Independent Disks*. A data storage scheme where multiple disk drives are combined to form a single logical unit which is highly reliable and gives good performance. Reliability is achieved by mirroring (the copying of data to more than one disk), striping (the splitting of data across more than one disk) and error correction (redundant data is stored to enable faults to be detected and corrected).

RAID can be implemented either in software on the storage controller or using a dedicated, embedded hardware controller. A hardware controller provides a higher level of RAID functionality and better performance.

Different levels of RAID are available:

- **RAID 0 - fast storage**

RAID 0 is ideal for environments in which performance (read and write) is more important than fault tolerance, or you need the maximum amount of available drive capacity in one volume.

Data is striped across multiple disks so that it can be read and written in parallel. It provides higher performance than a single disk, especially when reading or writing large files, but it is vulnerable to a disk failure. If any disk in the pool fails, the entire pool is effectively lost. For this reason, RAID 0 pools should only be used in cases where the loss of the data is unimportant, for example because it can easily be recreated from another data source. The capacity of a RAID 0 pool is equal to the total capacity of all the disks making up the pool<sup>1</sup>. For example, a RAID 0 pool made up of 4 x 100 GB disks will have a capacity of 400 GB.

- **RAID 1 - mirrored storage**

RAID 1 is useful for building a fault-tolerant system or data volume, providing excellent availability without sacrificing performance. However, you lose 50 percent of the assigned disk capacity.

RAID 1 is also called disk mirroring: data is stored on two identical disks, so that if one disk fails, the other can still be used to access the data. Write operations are performed in parallel to both disks, so write performance is identical to that of a single disk; read operations can be done to either disk, so effectively read performance is doubled.

If one of the disks fails, it should be replaced. When it is replaced, the RAID pool will automatically be rebuilt by copying all the data from the surviving disk to the new disk. While the rebuild is occurring, there will be a degradation in performance.

Because disks are mirrored, the usable capacity of a pair of RAID 1 disks is only equal to the capacity of a single disk, so that a RAID 1 pool made of 2 x 100 GB disks will have a capacity of 100 GB.

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<sup>1</sup>Actually, capacity is usually very slightly less because a small but insignificant amount of space is reserved by the RAID controller to store internal metadata.

- **RAID 5 - highly available storage**

RAID 5 is similar to RAID 0 in that data is striped across multiple disks. However, one disk's worth of space is reserved to store parity data, which can be used to reconstruct the pool in the event of one of its disks failing. With RAID 5, the parity data is distributed across all the disks in the pool. If a single disk fails, each block of data stored on that disk can be reconstructed using the corresponding data block from all the other disks along with the parity block. This means that if a single disk fails, data can still be read, albeit at a rather slower rate (because it needs to be reconstructed, rather than read directly). For this reason, a RAID 5 pool with a disk failure is referred to as a degraded pool.

With a RAID 5 pool, because data is read from many disks in parallel, as for RAID 0, read performance is good. Write performance is slightly lower because, in addition to writing the data, parity data has to be calculated and written. If a hardware RAID controller is used, this will be done using dedicated hardware; if software RAID is used, the work will be done on the main processor of the storage controller.

The capacity of a RAID 5 pool is reduced by exactly one disk's worth of capacity, which is required to store the parity data. For example, a RAID 5 pool made up of 4 x 100 GB disks will have a capacity of 300 GB.

In principle, a RAID 5 pool could have a very large number of disks. However, the more disks there are, the greater the chance of a double disk failure. If a single disk fails, the data is no longer protected until the disk has been replaced and the pool has been rebuilt by reconstructing all the data from the failed disk and writing it to the new disk. If the disk capacities are very large, it may take many hours to rebuild the pool. If a second disk fails before the rebuild has completed, all the data in the pool will be lost. That is to say, large capacity disks increase the time taken to rebuild the pool, during which time the pool is vulnerable to a second disk failure. Moreover, the chance of a second disk failure increases as the number of disks in the pool increases.

- **RAID 6 - very highly available storage**

RAID 6 is similar to RAID 5 but instead of storing a single disk's worth of parity data, two disk's worth are stored, making the pool capable of withstanding the failure of two disks. However, there is an additional write overhead involved in calculating the double parity data. Since RAID 6 works best with dedicated hardware, RAID 6 is only offered on systems with a hardware RAID controller. Read performance is similar to that of RAID 0 or 5. Since two disks are used for storing parity data, the capacity of a RAID 6 pool made up of 8 x 100 GB disks will be 600 GB.

- **RAID Level 10**

RAID 10 is defined as mirrored stripe sets or also known as RAID 0+1. You can build RAID 10 either directly through the RAID controller (depending on the controller) or by combining software mirroring and controller striping, or vice versa (called RAID 01).

- **RAID Level 50**

A RAID 50 combines the straight block-level striping of RAID 0 with the distributed single parity of RAID 5. That is, a RAID 0 array striped across RAID 5 elements. It requires at least 6 disks. This can increase the performance by allowing the controller to more efficiently cluster commands together. Fault tolerance is also increased, as one drive can fail in each individual array.

- **RAID Level 60**

A RAID 60 combines the straight block-level striping of RAID 0 with the distributed double parity of RAID 6. That is, a RAID 0 array striped across RAID 6 elements. It requires at least 8 disks. This can increase the performance by allowing the controller to more efficiently cluster commands together. Fault tolerance is also increased, as two drives can fail in each individual array.

**RETMA**

Short for *Radio-Electronics-Television Manufacturers' Association*. It is the common name given for a 19-inch distribution frame rack for mounting components.

**Round Robin**

The Round Robin path selection policy causes all healthy paths to be used for I/O. Paths are used in a round-robin order.

**Router**

A router is a device that enables connectivity between Ethernet network segments.

**SAN**

Short for *Storage Area Network*. Data storage connected to a network that provides network clients access to data using block level protocols. To the clients, the data storage devices appear local rather than remote. An iSCSI SAN is sometimes referred to as an IP-SAN.

**SAS**

Short for *Serial Attached SCSI*. It is a point-to-point serial protocol that replaces parallel SCSI bus technology (multidrop) and uses the standard SCSI command set. It has no termination issues, supports up to 16,384 devices (using expanders), and eliminates clock skew. It consists of an Initiator that originates device service requests, a Target containing logical units that receives device service requests, and a Service Delivery Subsystem that transmits information between the Initiator and the Target.

**SCSI**

Short for *Small Computer System Interface*. SCSI is an industry standard for connecting peripheral devices and their controllers to an initiator. Storage devices are daisy-chained together and connected to a host adapter. The host adapter provides a shared bus that attached peripherals use to pass data to and from the host system. Examples of devices attached to the adapter include disk drives, CD-ROM discs, optical disks, and tape drives. In theory, any SCSI device can be plugged into any SCSI controller.

**SCSI addressing**

Each device supported by a SCSI adapter has its own unique SCSI address, which dictates the device's priority when arbitrating for access to the SCSI bus. A SCSI address of 7 has the highest priority. For a fast/wide SCSI adapter that supports up to 16 devices, the next highest priority address is 6, then 5, 4, 3, 2, 1, 0, 15, 14, 13, 12, 11, 10, 9, and 8. The narrow SCSI adapter supports up to eight devices, including itself. The SCSI address 7 has the highest priority, followed by 6, 5, 4, 3, 2, 1, and 0.

**SCSI bus**

A SCSI bus provides a means of transferring data between SCSI devices. A SCSI bus is either an 8- or 16-bit bus that supports up to 8 or 16 devices, including itself. The bus can consist of any mix of initiators and targets, with the requirement that at least one initiator and one target must be present.

**SCSI device**

A SCSI device is a single unit on a SCSI bus that originates or services SCSI commands. A SCSI device is identified by a unique SCSI address. SCSI devices can act as initiators or targets.

**SCSI port**

A SCSI port is an opening at the back of a router that provides connection between the SCSI adapter and SCSI bus.

**Session**

When an initiator wants to establish a connection with a target, it establishes what is known as an iSCSI session. A session consists of one or more TCP/IP connections between an initiator and a target. Sessions are normally established (or re-established) automatically when the host computer starts up, although they also can be established (and broken) manually.

**S.M.A.R.T.**

Short for *Self Monitoring, Analysis and Reporting Technology*. A standard mechanism for querying disk drives to monitor performance and reliability attributes, such as temperature, read error rates and seek times. S.M.A.R.T. systems are built into most modern disk drives.

**SMS**

Short for *Short Message Service*. Is a means of sending short text messages to a mobile phone.

**SMTP**

Short for *Simple Mail Transfer Protocol*. A TCP/IP protocol used for sending and receiving email.

**Snapback**

The process of restoring a logical drive from a selected snapshot. This process takes place internally in the RAID controller firmware and needs no support from any backup utility.

**Snapshot**

A method for producing a point-in-time image of a logical drive. In the process of initiating a snapshot, no data is actually copied from the snapshot logical drive. However as new writes are made to a snapshot logical drive, existing data blocks are copied to the [ODA](#) before the new data is written to the logical drive.

**Snapshot LUN**

A special LUN created from a combination of the snapshot logical drives' data and the data contained in the [ODA](#).

**Snapshot Number**

Identifier that references one of several snapshots of the same logical drive.

**SSL**

Short for *Secure Sockets Layer*. A protocol for managing the security of a message sent on the Internet.

**Storage Area Network**

See [SAN](#).

**Stripe**

The process of separating data for storage on more than one disk. For example, bit striping stores bits 0 and 4 of all bytes on disk 1, bits 1 and 5 on disk 2, etc.

**Stripe Size**

This is the number of data drives multiplied by the chunk size.

**Sub-array**

In RAID 50 applications, this is the name given to the individual RAID 5 arrays that are striped together. Each sub-array has one parity drive.

**Target**

A target is a device (peripheral) that responds to an operation requested by an initiator (host system). Although peripherals are generally targets, a peripheral may be required to act temporarily as an initiator for some commands (for example, SCSI COPY command).

Targets are embedded in iSCSI storage controllers. They are the software that makes the RAID storage available to host computers, making it appear just like any other sort of disk drive.

**TCP/IP**

Short for *Transmission Control Protocol/Internet Protocol*. The basic protocol used for data transmission over the Internet.

**Telco**

Short for *Telephone Company*. When used in reference to a rack, it refers to the two-posted, light-weight rack for center-mounted appliances.

**Telnet**

A terminal emulation program for TCP/IP networks such as the Internet. The Telnet program runs on a computer and connects it to a server on the network. You enter commands through the Telnet program and they will be executed as if you were entering them directly on the server console. This enables you to control the server and communicate with other servers on the network. To start a Telnet session, you must log in to a server by entering a valid user name and password. Telnet is a common way to remotely control Web servers.

**Terminator**

A terminator refers to the electrical connection at each end of a SCSI bus. The terminator is composed of a set of resistors, or possibly other components. The function of a terminator is to provide a pull-up for open collector drivers on the bus, and also impedance matching to prevent signal reflections at the ends of the cable. SCSI buses require that a terminator be placed on the SCSI connector on the last SCSI peripheral. Data errors may occur in a SCSI bus that is not terminated.

**TOE (TCP Offload Engine)**

Short for *TCP Offload Engine*. TOE is a technology used in network interface cards to offload processing of the entire TCP/IP stack to the network controller. It is primarily used with high-speed network interfaces, such as gigabit Ethernet and 10 gigabit Ethernet, where processing overhead of the network stack becomes significant.

**Topology**

Logical layout of the parts of a computer system or network and their interconnections. There are two types of topology: physical and logical. The physical topology of a network refers to the configuration of cables, computers, and other peripherals. Logical topology is the method used to pass the information between workstations.



## UDP

Short for *User Datagram Protocol*. A communications protocol for sending messages between computers in a network that uses the Internet Protocol (IP). UDP is an alternative to the Transmission Control Protocol but, unlike TCP, does not guarantee reliability or ordering of data packets.

## Unassigned Free Space

The controller keeps a map of all the space that is not assigned to any logical drive. This space is available for creation or expansion. Each unassigned region is individually listed.

## USB (Universal Serial Bus) Port

A hardware interface for low-speed peripherals such as the keyboard, mouse, joystick, scanner, printer, and telephony devices.

## VDS

Short for *Virtual Disk Service*. VDS is a feature of Microsoft Windows (from Windows Server 2003 onwards). It provides a consistent interface for managing storage devices and creating volumes. Each vendor of a storage solution can write their own hardware provider module that enables the standard set of VDS commands to be used with different enclosures. Thus, multiple storage systems by different vendors can be controlled using the same set of VDS commands.

## Virtual LUN

See [Snapshot LUN](#).

## VLAN

Short for *Virtual LAN*. It consists of a network of computers that behave as if they are connected to the same wire - even though they may actually be physically connected to different segments of a LAN.

## Volumes

Volumes (also referred to as iSCSI volumes) are created from storage pools, using unused capacity in a pool. They can be extended in size, so long as there is free capacity in the pool.

A volume appear to a host computer just like a regular, physical disk except that it is attached by means of iSCSI instead of traditional disk interconnects such as IDE, SCSI or SATA.

Each volume has an iSCSI target associated with it. The volume is mapped to Logical Unit Number (LUN) 0 of the iSCSI/SCSI target, just like a regular physical disk. Associated with the target is an Access Control List (ACL) that defines which host systems are allowed to access the volume.

When the iSCSI initiator on the host computer connects to the iSCSI target, the iSCSI volume becomes available for use.

## VSS

Short for *Volume Shadow Copy (or Snapshot) Service*. A low level communications interface that enables volumes to be backed up without having to halt all applications that are reading or writing the volumes.

**Write-Back Cache**

A caching method in which modifications to data in the cache aren't copied to the cache source until absolutely necessary. Write-back caching yields somewhat better performance than write-through caching because it reduces the number of write operations to main memory. With this performance improvement comes a slight risk that data may be lost if the system crashes.

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