Sun Storage Common Array Manager

Array Administration Guide, Version 6.8.0

Part No.: E20723-01
June 2011

Please
Recycle

Contents

Preface

This document describes how to configure and monitor Oracle's Sun Storage, StorageTek, and FlexLine arrays using the Sun Storage Common Array Manager software, version 6.8.0.

This preface contains the following topics:

Before You Read This Book

Before you begin to configure CAM, you must have already performed the following:

- Installed the array(s) as described in each array's installation guide.
- Reviewed the system requirements and basic steps of getting started with CAM, as provided in the *Sun Storage Common Array Manager Quick Start Guide*.
- Installed CAM, as instructed in the *Sun Storage Common Array Manager Installation and Setup Guide*.

See "Related Documentation" on page xv for a list of document titles.

Configuration Overview

The following table provides an overview of the initial steps to configuring CAM.

Task	Topic	Topic Location
Enter site and array information	Initial Array Set Up	*Installation and Setup Guide*
Register arrays	Registering Arrays	*Installation and Setup Guide*
Enable premium features for RAID arrays	Managing Licenses	"Managing Licenses" on page 43
Configure basic RAID storage	Configuring RAID Storage	*Installation and Setup Guide*
Set up profiles and storage pools	Configuring Storage Profiles Configuring Storage Pools	"Configuring Storage Profiles" on page 106 "Configuring Storage Pools" on page 117
Create volumes and virtual disks	Configuring Storage Volumes Configuring Virtual Disks	"Configuring Storage Volumes" on page 123 "Configuring Virtual Disks" on page 143
Create hosts/host groups	Configuring Host Groups and Hosts	"Configuring Host Groups and Hosts" on page 156
Map volumes to hosts/host groups	About Mapping Functions	"About Mapping Functions" on page 176
Set up monitoring	Setting Up Array Monitoring	*Installation and Setup Guide*
Add users and set up roles	Adding Users And Assigning Roles	*Installation and Setup Guide*
	Managing User Accounts	"Administering User Accounts" on page 18
Set up Access Configuration (zones) for JBOD arrays	SAS Domain Access Configuration	*Installation and Setup Guide*

Related Documentation

The following table provides a listing of document titles related to Sun Storage Common Array Manager.

Application	Title
Latest information	*Sun Storage Common Array Manager Software Release Notes*
	Release Notes for your array
Rack mounting instructions: 2500-M2 in universal rack	*Installing Adjustable Support Rails For 2U 6x90 and 2500-M2 Array Hardware*
Rack mounting instructions: Sun Rack II	*Sun Modular Storage Rail Kit Installation Guide*
Rack mounting instructions: Sun Rack	*Sun Rack Installation Guide*
Hardware installation	*Sun Storage 2500-M2 Arrays Hardware Installation Guide*
	Sun Storage 6180 Array Hardware Installation Guide
	Hardware Installation Guide for Sun Storage 6580 and 6780 Arrays
	Sun StorageTek 6540 Array Hardware Installation Guide
	Sun StorageTek 6140 Array Hardware Installation Guide
	Sun Storage F5100 Flash Array Installation Guide
	Sun Storage J4200/J4400 Array Hardware Installation Guide
	Sun Storage J4500 Array System Overview
	Sun Blade 6000 Disk Module Installation Guide
Software installation	*Sun Storage Common Array Manager Quick Start Guide* *Sun Storage Common Array Manager Installation and Setup Guide*
Administration, configuration, and monitoring	Online help integrated with the software.
Customer and field replacement procedures	Service Advisor integrated with the software.
Reference information for the CLI	*Sun Storage Common Array Manager CLI Guide* `sscs` man pages

Documentation, Support, and Training

- Documentation
  http://www.oracle.com/technetwork/indexes/documentation/index.html
- Support
  https://support.oracle.com
- Training
  https://education.oracle.com

CHAPTER 1

General Administrative Tasks

This chapter describes performing general administrative tasks applicable to all arrays. It contains the following subsections:

Using the Browser Interface

This section contains information about using the software's browser interface. It includes the following subsections:

About the Browser Interface

The browser interface provides a way to configure, manage, and monitor the system. Use the navigation tree to move among pages within an application. When you place your pointer over a button, tree object, link, icon, or column, a tooltip provides a brief description of the object. Click a link to get details about a selected item. Click a heading to sort and filter information displayed on a page.

About the Page Banner

Across the top of each page, the banner displays buttons, links, system information, alarm status, and the name of the application as shown in the following table.

TABLE 1-1 Contents of the Banner

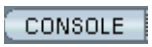
Button	Description
	Returns you to the Oracle Java Web Console page, where you can navigate between the configuration software and the diagnostic software.

TABLE 1-1 Contents of the Banner *(Continued)*

Button	Description
VERSION	Displays the software version and copyright information.
REFRESH	Refreshes the current page.
SEARCH	Enables you to quickly locate logical and physical elements defined in the system. You select a component and enter a name or World Wide Name (WWN) for the component you want to locate. An asterisk (*) searches for all instances of the selected component. For example, you can search for all initiators or only those initiators that match a specified name or WWN. For more information, see "Searching for System Elements" on page 9.
SERVICE ADVISOR	Launches Service Advisor.
LOG OUT	Logs you out of the Oracle Java Web Console and the current application.
HELP	Opens the online help in a separate window.
System Information and Status	
User: storage	Displays the name of the user logged into the current session.
Server: sp1	Displays the name of the system.
Current Logins: 1	Displays the number of users currently logged in to the system. Click the link to open the Active User Summary, which displays the user name, role, client type, and IP address for each logged-in user.
Last Update: Feb 2	Displays the latest date and time that data was retrieved from the server that you are administering. The latest data is collected and displayed each time you refresh the browser window or perform an action in the browser.
Current Alarms:	Displays the current number of each type of alarm. There are four alarm types:  Down,  Critical,  Major, and  Minor. To get more information about the alarms, click the Current Alarms link. The Alarms Summary page is displayed.

About the Navigation Tree

The navigation tree is displayed in the left-hand pane of the interface. Use the navigation tree to move among folders and pages.

The top level of the navigation pane displays the following links:

- Alarms

  Click the Alarms link to display the Alarms page. From here, you can view current alarms for all storage systems and gain access to alarm detail information.

- Storage Systems

  Click the Storage Systems link to display the Storage System Summary page. From here, you can select an array to manage.

- General Configuration

  Click the General Configuration link to display the Site Information page. From here, you can enter company, storage site, and contact information.

About the Page Content Area

The content section of each page displays storage or system information as a form or table. Click a link in the page to perform a task or to move among pages. To move among pages, click an object in the navigation tree.

Controlling the Table Display

TABLE 1-2 describes the objects you can use to control the display of data on a page.

TABLE 1-2 Table Objects

Control/Indicator	Description
	Enables you to display only the information that interests you. When filtering tables, follow these guidelines: • A filter must have at least one defined criterion. • A filter applies to the current server only. You cannot apply a filter to tables across multiple servers. To filter a table, choose the filter criterion you want from the table's Filter drop-down menu.
	Enable you to toggle between displaying all rows and displaying 15 or 25 rows one page at a time. When the top icon is displayed on a table, click the icon to page through all data in the table. When the bottom icon is displayed in a table, click the icon to page through 15 or 25 rows of data.
	Enable you to select or deselect all of the check boxes in the table. Use the icon on the left to select all of the check boxes on the current page. Use the icon on the right to clear all of the check boxes on the current page.
	Indicates that the column in the table is sorted in ascending order. The ascending sort order is by number (0-9), by uppercase letter (A-Z), and then by lowercase letter (a-z). Click this icon to change the sort order of the column to descending. A closed icon indicates the column by which the table is currently sorted.

TABLE 1-2 Table Objects *(Continued)*

Control/Indicator	Description
	Indicates that the column in the table is sorted in descending order. The descending sort order is by lowercase letter (z-a), by uppercase letter (Z-A), and then by number (9-0). Click this icon to change the sort order of the column to ascending. A closed icon indicates the column by which the table is currently sorted.
	Enables you to select the entries that you want to display. Click the button on the left to display the first 25 table entries. Click the button on the right to display the previous 25 table entries.
	Click the button on the left to display the next 15 or 25 table entries. Click the button on the right to display the last 15 or 25 table entries.
	Indicates how many pages are in the table, and displays the page you are currently viewing. To view a different page, type the page number in the Page field and click Go.

About the Status Icons

Icons are displayed to draw your attention to an object's status. TABLE 1-3 describes these status icons.

TABLE 1-3 Status Icons

Control/Indicator	Description
	Identifies a critical error. Immediate attention to the failed object is strongly recommended.
	Identifies a a minor error. The object is not working within normal operational parameters.

TABLE 1-3 Status Icons *(Continued)*

Control/Indicator	Description
	Identifies an unknown condition. A report on the status cannot be supplied at this time.

Using Forms

Forms have menus, buttons, links, and text fields that allow you to select available options and enter information on a page. TABLE 1-4 describes these elements.

TABLE 1-4 Form Controls

Control/Indicator	Description
*	Indicates that you must enter information in this field.
-- Actions --	Lists options from which you can make a selection.
	Displays the part of the form that is indicated by the text next to this icon.
	Returns you to the top of the form.
Save	Saves the selections and entries that you have made.
Reset	Sets all page elements to the original selections that were displayed when the page was first accessed.
Cancel	Cancels the current settings.

TABLE 1-4 Form Controls *(Continued)*

Control/Indicator	Description
	Causes the current settings to take effect.

Searching for System Elements

You can locate logical and physical elements of the system by using the search feature located in the banner of any page.

You can search for all elements of a selected type for particular elements that match a specified term. For example, you can search for all initiators or you can search for only the initiators that contain a specific World Wide Name (WWN).

1. Click Sun Storage Common Array Manager.
2. In the banner, click Search.

   The Search window is displayed.
3. Select the type of component you want to locate. You can search for arrays, disks, initiators, storage pools, storage profiles, trays, virtual disks, hosts, host groups, volumes, replication sets, snapshots, or all system elements.
4. If you want to narrow your search, enter a term in the text field.
   - All elements that contain the specified term in the name or description field will be located. For example, the term “primary” will locate elements with the name of primary, demoprimary, primarydemo, and firstprimarylast.
   - The search feature is not case-sensitive. For example, the term “primary” will locate elements that contain primary, Primary, PRIMARY, priMARY, and any other case combination.
   - Do not embed spaces or special characters in the search term.
   - Use the wildcard (*) only to search for all elements of a selected type. Do not use the wildcard with the search term. If you do, the system will search for the asterisk character.
5. Click Search.

   The result of your search is displayed.
6. Click Back to return to the previous page.

Using Help

To view additional information about the configuration software, click Help in the banner of the web browser. The help window consists of a navigation pane on the left and a topic pane on the right.

To display a help topic, use the Navigation pane's Contents, Index, and Search tabs. Click the Search tab and click Tips on Searching to learn about the search feature. TABLE 1-5 describes the help tabs.

TABLE 1-5 Help Tabs

Tab	Description
Contents	Click a folder icon to display subtopics. Click a page icon to display the help page for that topic in the Topic pane.
Index	Click an index entry to display the help page for that topic.
Search	Type the words for which you want to search and click Search. The Navigation pane displays a list of topics that match your search criteria in order of relevancy. Click a topic link to display the help page for that topic. Click the Tips on Searching link for information about how to improve your search results. To search for a particular word or phrase within a topic, click in the Topic pane, press Ctrl+F, type the word or phrase for which you are searching, and click Find.

TABLE 1-6 describes the meanings of the Help window icons.

TABLE 1-6 Help Icons

Control/Indicator	Description
	Click to go back to the previous help topic that you viewed in the current session.
	Click to go forward to the next help topic that you viewed in the current session.

TABLE 1-6 Help Icons

Control/Indicator	Description
	Click to print the current help topic.

Logging Out of the Management Software

To log out of the software, click Log Out in the window banner.

Administering Storage Arrays

This section contains general array administration information. It includes the following topics:

Displaying Array Information

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Choose Administration.

   The Administration page for the selected array is displayed.

About Array Registration

Using the Array Registration wizard, you can have the management software either auto-discover one or more arrays that are connected to the network and are not already registered, or you can choose to manually register an array.

The auto-discover process sends out a broadcast message across the local network to identify any unregistered arrays. The discovery process displays the percentage of completion while the array management software polls devices in the network to determine whether any new arrays are available. When complete, a list of discovered arrays is displayed. You can then select one or more arrays to register from the list.

Manual registration enables you to register an array by identifying the IP address of its controller. This option is typically used only to add a storage array that is outside of the local network.

The Array Registration wizard displays firmware information for each array and lists any action recommended to bring the array up to the current firmware baseline level. To modify the array firmware, select the array and click the Upgrade Firmware button on either the Storage System Summary page or the Administration page.

Registering an Array

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. Click Register.

   The management software launches the Register Array wizard.

3. Follow the instructions in the wizard.

Unregistering an Array

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. Select the check box to the left of the array you want to remove from the list of registered arrays.

   This enables the Remove button.

3. Click Remove.

Upgrading Array Firmware

As part of the installation of the management software, the script puts the array firmware files in a directory on the management host. When you upgrade the firmware, the software analyzes the firmware installed on the array. If the baseline firmware on the host is newer, and you choose to install, the software installs the baseline firmware on the array.

For optimal performance, the firmware on all arrays should be at the level of the current firmware baseline.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. Select the check box to the left of one of the displayed arrays.

   This enables the Install Firmware Baseline button.

3. Click Install Firmware Baseline.

   The management software launches the Analyze and Install Array Firmware Baseline wizard.

4. Follow the instructions in the wizard.

Note: You can also launch the Analyze and Install Array Firmware Baseline wizard from the Administration page.

Backing Out of Firmware Upgrades

If you have a need to back out of a firmware upgrade, contact Service.

Location of Firmware Files

Firmware file location information can be found in the *Sun Storage Common Array Manager Software Release Notes.*

Monitoring Array Health

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. Note the value in the Health field on the Storage System Summary page. The Health field indicates the state of the array. Possible values include:
   - **OK** - Indicates that every component of the storage array is in the desired working condition.
   - **Degraded** - Indicates that, although the management host can communicate with the storage array, a problem on the array requires intervention.
   - **Error** - Indicates that the management host cannot communicate with the controllers in the storage array over its network management connection. To view the alarms and the recovery options, go to the Alarms page for the array.

Viewing the Activity Log

The activity log lists user-initiated actions performed for all registered arrays, in chronological order. These actions may have been initiated through either the Sun Storage Common Array Manager or the command-line interface (CLI).

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand General Configuration.

3. Click Activity Log.

   The Activity Log Summary page is displayed.

Page and Field Descriptions

Browser interface pages and fields related to the "Administering Storage Arrays" section are described in the following subsections:

- "Activity Log Summary Page" on page 16
- "Storage System Summary Page" on page 16

Activity Log Summary Page

This page enables you to view all user-initiated activity that has occurred on the array.

TABLE 1-7 describes the fields on the Activity Log Summary page.

TABLE 1-7 Activity Log Summary Page

Field	Description
Time	The date and time when an operation occurred on the array.
Event	The type of operation that occurred, including the creation, deletion, or modification of an object type.
Details	Details about the operation performed, including the specific object affected and whether the operation was successful.

Storage System Summary Page

This page shows a summary of the arrays in the system. Click an array name to see the array details.

TABLE 1-8 describes the buttons and fields on the Storage System Summary page.

TABLE 1-8 Storage System Summary Page

Field	Description
Register	Click to launch the Register Array wizard to designate a new storage system to be managed by the Sun Storage Common Array Manager software.
Remove	Click to remove the selected array from the registry.
Install Firmware Baseline	Click to launch the Analyze and Install the Firmware Baseline wizard which analyzes the firmware on the selected Storage Systems and identifies the Storage Systems that are not at the current baseline.
Name	The name of the array.
Health	The current health status of the array; possible health status conditions include: • OK • Degraded • Error • Lost Communication

TABLE 1-8 Storage System Summary Page *(Continued)*

Field	Description
Type	The model number of the array.
Firmware Version	The current version of firmware that is loaded onto the array.
Total Capacity	The available storage capacity on all of the disks in the storage system.
Available Capacity	The capacity that is available for the array.
Network Address	The network address for controller A of the array. This field also identifies whether the array is managed in-band or out-of-band.

Administering User Accounts

This section describes managing user accounts. It contains the following topics:

About User Accounts

The management software provides user roles that define the privileges available to the user. TABLE 1-9 describes the user roles and their privileges.

TABLE 1-9 User Roles and Privileges

Role	Description of Role
`storage`	Users assigned the storage role can view and modify all attributes.
`guest`	Users assigned the guest role can view all attributes but not modify any of them.

After installing the array software on a server and logging in to the Sun Storage Common Array Manager software, you can assign one of the roles to valid Solaris user accounts that have access to the management host. The users can then log in to the Sun Storage Common Array Manager software using their Solaris user names and passwords. For information about creating user accounts for Solaris, Windows, and Linux refer to the system administration documentation for your operating system.

The role assigned to a user determines the degree of access that a user has to the array and its attributes. All users assigned the `guest` role can view information. To modify array attributes, a user must have `storage` privileges. Only users assigned the `storage` role can add users that have either the `guest` or `storage` account role.

If multiple users are logged in to the array and making changes as the `storage` administrator, there is a risk of one user's changes overwriting another user's previous changes. Therefore, `storage` administrators should develop procedures about who can make changes and when and about how to notify others.

Displaying User Information

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand General Configuration and choose User Management.

   The User Summary page is displayed.

Adding a New User

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand General Configuration and choose User Management.

   The User Summary page is displayed.

3. Click Add to add a new user.

   The Add New User page is displayed.

4. Enter the name of a valid Solaris account.

   Solaris user names should begin with a lowercase letter and can consist of 6 to 8 alphanumeric characters, underscores (_), and periods (.). For information about creating Solaris user accounts, refer to the Solaris system administration documentation.

5. Select a role for the Solaris account: `storage` or `guest`.

6. Click OK.

   The User Summary page lists the newly assigned user and role.

Removing a User

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand General Configuration and choose User Management.

   The User Summary page is displayed.

3. Click the check box to the left of the name of the user you want to remove.

   This enables the Remove button.

4. Click Remove.

Note: For information about removing user accounts from the server or NIS, consult the Solaris system administration documentation.

Page and Field Descriptions

Browser interface pages and fields related to the "Administering User Accounts" section are described in the following subsections:

- "Add New User Page" on page 20
- "User Summary Page" on page 21

Add New User Page

This page enables you to add new users.

TABLE 1-10 describes the fields on the Add New User page.

TABLE 1-10 Add New User Page

Field	Description
User Name	The user name for the new user.

TABLE 1-10 Add New User Page

Field	Description
User Role	The role of the user: • `storage` Users assigned the storage role can view all attributes and modify storage, jobs, and administrative settings. • `guest` Users assigned the guest role can view all attributes but cannot modify any of them.

User Summary Page

This page provides a summary of the array users and their roles, and enables you to add or remove users and assign user roles.

TABLE 1-11 describes the buttons and fields on the User Summary page.

TABLE 1-11 User Summary Page

Field	Description
New...	Click to add a user and assign a user role.
Delete	Click to remove a user.
User Name	The user name for the user.
User Role	The role of the user: • `storage` Users assigned the storage role can view all attributes and modify storage, jobs, and administrative settings. • `guest` Users assigned the guest role can view all attributes but cannot modify any of them.

CHAPTER 2

Overview and Administration of RAID Arrays

This chapter provides overview and administration information for Oracle's Sun Storage and StorageTek 6000 series, StorageTek 2500 series, and FlexLine arrays. It contains the following sections:

Software Overview for RAID Arrays

The software for Oracle's Sun Storage and StorageTek 6000 series, StorageTek 2500 series, and FlexLine arrays consists of:

Management Software

The web-based management software is the primary interface for configuring, managing, monitoring, and diagnosing the array. The management software consists of a suite of tools that you install on an external management host. For a list of supported platforms, see the *Sun Storage Common Array Manager Software Installation and Setup Guide*.

The management software enables the storage administrator to manage the array from any system with a web browser that is on the same network as the management host. For a list of supported browsers, see the release notes.

The management software provisions and maintains storage for data hosts using these storage components:

- **Storage pools** are collections of volumes that share a profile defining the common configuration of the volumes.
- **Storage profiles** define the characteristics of a storage pool. You can choose one from the set of preconfigured profiles or create a new one.
- **Volumes** are divisions of a storage pool, consisting of virtual disks, representing the storage space that is used by the data hosts in the environment.
- **Virtual disks**, also called redundant array of independent disks (RAID) sets, are collections of locations in the memory of more than one physical disk. The storage array handles a virtual disk as if it were an actual disk.
- **Host groups** are a collection of hosts that will share access to the same volumes.
- **Snapshots** are copies of the data in a volume. They offer a high-availability alternative to backups because you do not need to take the array offline to create the snapshot, and you can store the snapshots in less space than the original data.
- **Volume copies** are copies of the complete contents of one data volume that are located on another data volume on the same array.

- **Replication sets** are the association between primary and secondary volumes. The secondary volume contains a complete copy of the data on the primary volume. The data replication software continuously replicates the data between volumes in a replication set.

The management software enables monitoring and diagnostic tasks on the array. You can configure the software to monitor on a 24-hour basis, collecting information that enhances the reliability, availability, and serviceability (RAS) of the array.

The management software records alerts and notifications, which you can monitor by displaying the log file. It also automates the transmission of alerts, which can be sent to an email address, to a pager, or to diagnostic software running on a management host on the network.

Finally, the management software enables you to run diagnostic tests to troubleshoot problems and access Service Advisor for instruction on replacing field-replaceable units (FRUs).

Remote CLI Client

You can also manage and configure storage for the array using the remote command-line interface (CLI) client. The CLI provides the same control and monitoring capability as the web browser, and it is also scriptable for running frequently performed tasks.

The remote CLI client is available for the Solaris operating system (OS) and several other operating systems. See the release notes for a list of supported operating system platforms. For more information about the CLI commands, see the `sscs` man page.

Data Host Software

Array data host software enables data path connections and multipathing to various server operating systems. For a list of supported platforms, multipathing software information, and array settings specific to your server, see the *Sun Storage Common Array Manager Release Notes* and the hardware release notes for your array.

Note: Data host software is either bundled with the host operating system or available separately, either from the Oracle Download Center or another vendor (e.g. Symantec Veritas Volume Manager).

Optional Software

You can purchase additional software, including the following, for use on hosts with data paths or network connections to the array:

- VERITAS Volume Manager with Dynamic Multipathing (DMP) - for installation on a Solaris or third-party data host (DMP can coexist with StorageTek Traffic Manager multipathing software)
- Sun Storage Archive Manager and Sun QFS (SAM/QFS) - for automated policy-based hierarchical storage management and data archive. QFS is the shared file system for the client-side interface and SAM is the storage archive manager.
- Oracle Solaris Cluster or Microsoft clustering software - for clustered configurations

For a complete list of available software for use on hosts with connections to the array, see the release notes for your array.

Management-Related Service

You can manage the array using the Hypertext Transfer Protocol Secure (HTTPS) web interfaces for management and monitoring of storage. HTTPS is primarily for web browsers and is protected by passwords and data encryption. The remote command-line interface (CLI) client on a management host is also used for management and monitoring of storage.

Connection Tasks for RAID Arrays

This section contains information about setting up network connections and other administrative tasks for Oracle's Sun Storage and StorageTek 6000 series, StorageTek 2500 series, and FlexLine arrays. It includes the following subsections:

Managing Arrays

By default, the management host communicates with the arrays out-of-band over Ethernet. This enables you to manage the storage and monitor, diagnose, and fix problems in the array with a browser from any host that has a network connection to the management host. You can also configure in-band management for communication to travel over the data path between a data host and the array.

Managing From the Site LAN

When using out-of-band management, an Ethernet cable connects your management host in the site local area network (LAN) to the array. For more information on cable connections and setting Internet Protocol (IP) address, see your array documentation.

You have the following options in how you connect the array to the site LAN:

- Dynamic IP address. The array can get its IP addresses from your site's Dynamic Host Configuration Protocol (DHCP) server each time it logs in to the LAN.
- Static IP address. You can set a static IP addresses for the controllers.
- Default IP address. You can use default IP addresses for the controllers.
- The level of access that the array allows from the network.

You can also manage the array and monitor, diagnose, and fix problems manually with `sscs` commands or by means of scripts using a remote command-line interface (CLI) client.

About In-Band Management for RAID Arrays

The management host typically communicates with RAID arrays over the network. If the RAID array does not have access to a network, or if the network address of the RAID array is unknown, CAM can communicate with the RAID array by using an in-band RAID array proxy.

In-band management uses a proxy agent running on a data host which is directly connected to a RAID array (FC or SAS). Sun Storage Common Array Manager discovers the proxy agents on the subnet and then queries arrays registered with the software. The proxy agent receives the queries over the network and passes them on to the array over the data path between the data host and the array.

New arrays can be registered with the software using the CAM registration wizard. You can register the RAID array either by selecting auto discovery (if the data host is on the same subnet), or by providing the data host's IP address. Once an array is discovered and registered, management of that array is identical to any out-of-band managed RAID array. If the RAID array is managed in-band, the Network Address column on the CAM Storage System Summary page lists In-band after the address.

CAM typically manages a RAID array directly over the network (out-of-band). After CAM discovers and registers the RAID array via the in-band RAID array proxy data host, CAM checks if the RAID array can be directly contacted over the network based on the network configuration on the RAID array controllers. If CAM can directly communicate to the RAID array, CAM switches management to the out-of-band connection. If CAM cannot directly communicate to the RAID array over the network, it continues using the in-band RAID array proxy connection.

In-band management uses a special access LUN mapping to facilitate communications between the management software and the storage array. You can view all mappings on the array on the Mapping Summary Page in the Sun Storage Common Array Manager software. For in-band communication, an access volume is mapped to LUN 31. This special access LUN (also called the UTM LUN) is mapped to the default domain. (All arrays have a default domain for volumes not registered with a storage domain.)

With new arrays, the mapping of the access LUN to the default domain is installed at the factory. If you lose this mapping, before installing in-band, use out-of-band management and the Sun Storage Common Array Manager software to re-map the access LUN to the default domain. See the online help in the software for more information about mapping.

For information about how to configure in-band management, see the *Sun Storage Common Array Manager Installation and Setup Guide.*

Managing an Array Isolated From the LAN

Use the following procedure when your site's security requirements necessitate having the array isolated from any external local area network (LAN):

- Set up and configure the array using a management host.
- When you have finished configuring the array, disconnect the management host.

Whenever the array needs to be reconfigured, reconnect the management host.

Another way to secure the system is to install a firewall between the management host for the array and the external LAN.

Installing the Administrator Host (Remote) CLI Client

If you need to configure the array with the `sscs` commands from a host other than the management host, the installation software contains a remote command-line interface (CLI) that enables you to do all of the tasks supported by the browser interface. The commands can be used in scripts you create, or they can be entered directly in a terminal window's command line. The client can run on hosts, including:

- Windows 2000 Server and Advanced Server
- Windows Server 2003 Standard, Web, and Enterprise Editions
- Red Hat Linux
- SuSE Linux
- HP-UX
- IBM AIX
- Solaris 8 OS 4/01
- Solaris 9 (SPARC systems only)
- Solaris 10 (SPARC systems only)

- Solaris 10x86
- OpenSolaris

Note: Refer to *Sun Storage Common Array Manager Release Notes* for a complete list of supported hosts.

To install the Administrator Host CLI Client, follow the detailed procedure in the *Sun Storage Common Array Manager Software Installation and Setup Guide*.

The command for management services is `sscs`, used with a subcommand to direct the operation. For a list of commands, see the `sscs`(1M) man page or the *Sun Storage Common Array Manager CLI Guide*.

About Host Bus Adapters

A data host is any host that uses the array for storage. When a data host is connected to the array by a host bus adapter (HBA), the HBA is an initiator. The HBA is connected by a cable to a Fibre Channel (FC) port on the array.

After connecting a data host directly to the array with one or two HBAs, verify the firmware level of HBAs. Consult the HBA's operating system documentation to do this. For Solaris, use the `luxadm(1m)` command. If the firmware is not at the correct revision, download the latest revision from the web. To determine the HBA software to use, consult the release notes for the Sun Storage Common Array Manager. You can then configure the initiator and set up hosts and host groups.

About Multipathing

With multipathing, also called multipath failover, an array or network can detect when an adapter has failed and automatically switch access to an alternate adapter. Multipathing enables high-availability configuration because it ensures that the data path remains active. Multipathing also helps increase performance to multi-controller disk arrays by spreading I/O between multiple paths into the array.

Within the array, storage pools use multipathing by default. To complete the data path, data hosts also need the ability to multipath.

For more information about the appropriate multipathing software for your data host, refer to the release notes for the Sun Storage Common Array Manager.

Initial State of RAID Arrays

This section describes the initial state of Oracle's Sun Storage and StorageTek 6000 series, StorageTek 2500 series, and FlexLine arrays and factors to consider before you configure those arrays. It contains the following subsections:

About the Initial State of the Array

After you complete the basic configuration tasks described in the installation instructions for your array, all of the hardware and software is installed and at least one array is registered and named, and array passwords are set.

In addition, the following tasks will have been completed:

- The system time has been correctly set.
- At least one new user has been added and assigned the role of "storage."
- An initiator has been created.
- At least one host has been created and mapped to an initiator.
- At least one host group has been created.
- A storage pool has been created.
- A volume has been created and mapped to a host or host group.

About Provisioning Storage

In a simple storage configuration, all data hosts could share all available storage in one storage pool, and any host mapped to an initiator would have access to any storage in the pool. Your organization's needs determine whether you want a more complex storage configuration. For example, you might provision the storage for your organization by creating host groups and pools of virtual storage.

The array has a number of physical and logical storage elements that you can use to provision your storage:

- Physical storage elements: initiators, hosts, host groups, trays, and disks
- Logical storage elements: volumes, virtual disks, and pools

Before you can allocate storage appropriately, consider the following requirements for your site:

- **Security** – By creating host groups, you segregate initiators. For example, the hosts that handle financial data store their data in a different host group from the host group consisting of hosts that handle research data.
- **Input/output (I/O)** – Some storage profiles specify a general, balanced access to storage, but some parts of your organization might require one or more of the characteristics to be optimized at the expense of other attributes. The array management software includes a set of profiles to meet various needs. You can also create custom profiles.

About Physical Storage Elements

Consider the following physical storage elements before you decide how to distribute data across the available physical storage:

- Trays hold the disk drives and support their operation.
- Disk drives are nonvolatile, randomly addressable, rewriteable data storage devices.
- Initiators are Fibre Channel (FC) ports on host bus adapters (HBAs) that allow hosts to gain access to a storage array.
- Hosts, or data hosts, are servers that can store data on a storage array. Data hosts are mapped to initiators.
- A host group is a collection of one or more hosts on one storage array that share access to the same volumes.

About Logical Storage Elements

Consider the following logical storage elements before you decide how to distribute data across the available physical storage and map it to data hosts:

- Storage pools are collections of volumes that share a profile. The profiles defines the common configuration of the volumes.

- Virtual disks, also called redundant array of independent disks (RAID) sets, are a collection of locations in the memory of more than one physical disk. The storage array handles a virtual disk as if it were an actual disk. You create the virtual disks during volume creation.
- Volumes are divisions of a pool, consisting of virtual disks, and are accessed by hosts and host groups.
- Snapshots are copies of the data in a volume at a specific moment. Snapshots can be made without interruption of the normal operation of the system.

Working with Array Configurations

Sun Storage Common Array Manager provides the ability to export an array configuration and save it to an XML file that you can then import to one or more arrays. Using the array configuration file, you can provision several arrays and provide consistent configurations for your arrays.

Some common reasons to use to export and import array configurations include:

- Cloning a configuration for a remote backup site.
- Resetting an array to get it back to a known state for end of quarter processing, data warehousing, or data migration.
- Sending the exported array configuration to customer support for help in troubleshooting an issue with the array.

The ability to export or import array configurations is supported on the following arrays:

- Sun Storage 6180, 6580, 6780 arrays
- Sun Storage 2530-M2 and 2540-M2 arrays
- Sun StorEdge 6130 array
- StorageTek 6140 and 6540 arrays
- StorageTek 2510, 2530, and 2540 arrays
- StorageTek FlexLine 240, 280, and 380 arrays

Exporting an Array Configuration

Exporting an array configuration saves the entire array configuration including volume, pool, profile, virtual disk, snapshot, volume copy, storage domain, mappings, data replication configuration settings, etc. to a file that you save on your local machine. When the export process completes, Sun Storage Common Array Manager returns a success message.

To export an array configuration to a file:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array whose configuration you want to save to a file.

3. Expand Administration and choose Import/Export.

   The Import/Export Device Configuration page displays.

4. Under Export Device Configuration, either accept the configuration file name supplied by the software, or enter the name you'd like to assign to the configuration file.

5. Click Export and specify whether you'd like to open and view the configuration file or save the file to your local machine.

Importing an Array Configuration

Use the import function to reset all volume data and bring the array to a known state. You can import the array configuration file to one or more supported arrays. Since some arrays support features that others do not, when you import a configuration file to an array that has a more limited feature set, the import process discards unsupported configuration settings and returns an event that you can check later. Conversely, if you import an array configuration file to an array with a more extensive feature set, then those features will not be configured.

During the import process, a job is created. You can track the progress from the Historical Jobs Summary page. Import jobs started by the CLI will also display there.

Caution: Because the entire array configuration is exported to a file, you must change settings such as the IP address and array name for the target array, unless it serves as a replacement for the array configuration being exported. When cloning an array, ensure that both the old and new array are not on the network with the same IP address at the same time.

If the configuration file to be imported contains secure volumes, the array lock key for the array must be set before importing the configuration. The verification step of the import will fail if a secure volume is found but the array lock key has not been set. The import job will not be started and no settings on the target array will be changed.

Prerequisite: It is best practice to reset the array before performing the import procedure.

To import an array configuration to an array:

1. Click Sun Storage Common Array Manager.
2. From the navigation pane, expand the array to which you want to import the configuration file.
3. Expand Administration and choose Import/Export.
4. Under Import Device Configuration, click the Browse button to locate the configuration file stored on your local machine.
5. Click Import.

   The array name will be unlabeled after the import is complete.

Page and Field Descriptions

Browser interface pages and fields related to the "Initial State of RAID Arrays" section are described in the following subsections:

- "Import/Export Device Configuration Page" on page 36
- "Manage Array Lock Key Page" on page 36

Import/Export Device Configuration Page

This page saves an array configuration to an XML file or imports an array configuration to an array.

TABLE 2-1 describes the buttons and fields on the Import/Export Device Configuration Page.

TABLE 2-1 Import/Export Device Configuration Page

Field	Indicates
Device Type	The model name of this array.
Device Name	The name assigned to this array.
Export Device Configuration	
Enter Configuration File Name	The filename assigned to the configuration file. Sun Storage Common Array Manager provides a default filename with the format `fmsconfig-<array_name>`. Accept the default filename or supply a new one.
Export	Click to export the configuration to a file.
Import Device Configuration	
Select Configuration File	Identifies the configuration file to be imported into the array
Browse	Click the Browse button to populate the Select Configuration File field with the name of the configuration file to import into the array.
Import	Click to import the configuration file into the array.

Manage Array Lock Key Page

TABLE 2-2 describes the buttons and fields on the Manage Array Lock Key Page.

TABLE 2-2 Manage Array Lock Key Page

Field	Indicates
Array Lock Key Id	Enter a lock key identifier consisting of 189 (or fewer) alphanumeric or special characters except for hyphen(-) and underscore (_).This user-supplied identifier is combined as a prefix to the controller-generated identifier to make up the full drive security key. The array lock key is displayed on the Licensable Feature Details - Data Encryption Services page.

TABLE 2-2 Manage Array Lock Key Page

Field	Indicates
New Pass Phrase	Enter a pass phrase consisting of 8-32 alphanumeric or special characters.
Verify New Pass Phrase	Reenter the pass phrase to confirm your entry.
Create/Change	Click to create or change the lock key identifier. After the lock key is created, the Change button enables you to modify the identifier.
Export	Click to back up the lock key identifier.

Administration of RAID Arrays

This section describes performing administration tasks for Oracle's Sun Storage and StorageTek 6000 series, StorageTek 2500 series, and FlexLine arrays. It includes the following subsections:

Specifying General Settings

From the Administration page, you can manage passwords, view and specify array details, enable disk scrubbing on the array, and set the time on the array. To change settings, you must be logged in as a user with the storage role.

About the Array Password

An array password provides access to an array and is required for performance of notification operations. When you set the password, the management software stores an encrypted copy of the password in its array registration database. Thereafter, the management software can perform modification operations on the array without a password challenge.

Multiple management hosts can access a single array. Each management host has its own instance of management software, each of which has its own array registration database. For the management software to perform modification operations on an array, the password stored in the array registration database for that instance of the management software must match the password set on the array. Before another management host can perform modification operations on that array, the array registration database for that management host must also be updated with the new password.

You can change the array password at any time. When you change the password on one management host, only the array registration database used by that management host is updated with the changed password.

You may also need to update the password stored in the array registration database if the array was registered without a password or with an incorrectly typed password.

If the password stored in the array registration database does not match the array password, the following error message is displayed when you attempt a modification operation on the array: "The operation cannot complete because you did not provide a valid password."

Changing the Array Password

An array password provides access to an array and is required for performance of notification operations. When you set the password, the management software stores an encrypted copy of the password in its array registration database.

1. From the navigation pane, expand the array you want to work with.
2. Choose Administration.
3. From the Administration page, click Manage Passwords.
4. From the Manage Passwords page, select one of the following:
   - Change Array Password—Changing the password automatically updates the password stored in the array registration database.
   - Update Array Password In Array Registration Database—Do this if the array password was previously changed from another management host or, if the array was registered without a password or with an incorrectly typed password. This manually synchronizes the password stored in the array registration database with the password set on the array.
5. In the Old Password field (available only if you are changing the array password), enter the current password.
6. In the New Password field, enter the new password as an alphanumeric string of up to eight characters.
7. Enter the same new password in the Verify New Password field.
8. Click OK.

Note: For information about resetting the array password to its factory setting using the serial port, refer to the installation documentation for your array.

Setting Array Details

From the Administration page, you can set the array name, number of hot-spares, default host type, cache block size, minimum and maximum cache allocation percentages, disk scrubbing, and failover alert settings.

1. From the navigation pane, expand the array you want to work with.
2. Choose Administration and go to the Details section.
3. Specify the new settings you want to change.
4. Click OK.

Enabling Disk Scrubbing

Disk scrubbing is a background process performed by the array controllers to provide error detection on the drive media. Disk scrubbing detects errors and reports them to the event log.

Before disk scrubbing can run, you must enable it on the array. Disk scrubbing then runs on all volumes on the array. You can disable disk scrubbing on any volume that you do not want to have scrubbed. Later, you can re-enable disk scrubbing for any volume on which you disabled it.

The advantage of disk scrubbing is that the process can find media errors before they disrupt normal drive reads and writes. Disk scrubbing scans all volume data to verify that it can be accessed. If you enable a redundancy check, it also scans the volume redundancy data.

Enabling Disk Scrubbing on an Array

With disk scrubbing enabled, the array controllers detect disk drive errors and writes them to the event log.

1. From the navigation pane, expand the array for which you want to enable disk scrubbing.
2. Choose Administration.
3. Click the check box to the right of Disk Scrubbing Enabled, and specify the number of days you want as a scan duration (or period).
4. Click OK.

Disabling and Re-enabling Disk Scrubbing on a Volume

1. From the navigation pane, expand the array for which you want to disable or re-enable disk scrubbing for a specific volume.
2. Choose Volumes.
3. Click the volume on which you want to disable or re-enable disk scrubbing.
4. In the Volume Details page, select one of the following:
   - Disk Scrubbing Enabled field=False: Disable disk scrubbing.
   - Disk Scrubbing Enabled field=True: Re-enable disk scrubbing.
   - Disk Scrubbing With Redundancy field=True: Re-enable disk scrubbing so that it also scans the volume redundancy data.
5. Click OK.

Setting the Time

If the array does not use the network's time protocol server, you must manually set its clock.

1. From the navigation pane, expand the array for which you want to set the time and select Administration.
2. On the Administration page, go to the System Time section and do one of the following:
   - Synchronize the array time with the serve—click Synchronize With Server
   - Set the time manually:

     Set the hour and minute, using a 24-hour clock.

     Set the month, day, and year.
3. Click OK.

Setting the Array IP Address

In order for there to be an out-of-band Ethernet connection between the local management host and the array controller, the management host and the array controllers must have valid IP addresses. There are three methods for adding the IP address:

- Dynamic Host Control Protocol (DHCP)
- Via the serial port
- Using static IP addresses

For information about DHCP and using the serial port, refer to your array installation guide.

To substitute a static IP address for the default internal IP address, refer to the *Sun Storage Common Array Manager Software Installation and Setup Guide*.

Note: The web browser you use to manage the array relies on the array's IP address. If the address changes because either you changed it manually or the system was assigned a new one, the browser loses its connection to the array. You must reconnect to the array to continue monitoring and managing the array.

1. From the navigation pane, expand the array for which you want to set the IP address.
2. Expand Physical Devices and choose Controllers.
3. In the Ethernet Port 1 field, select Enable DHCP/BOOTP or Specify Network Configuration. If you select Specify Network Configuration, you must enter an IP address, gateway address, and netmask of the controller using Ethernet port 1.
4. (StorageTek 6140 array only) In the Ethernet Port 2 field, select Enable DHCP/BOOTP or Specify Network Configuration. If you select Specify Network Configuration, you must enter an IP address and netmask for the controller using Ethernet port 2.
5. Click OK.

Managing Licenses

This section describes managing licenses. It contains the following topics:

About Licensed Features

To use optional premium features, you must purchase licenses. When you order licenses, they will be sent to you with instructions on how to activate the features which include the following:

- Data Encryption Services
- Data Replication
- Snapshots
- Storage Domains
- Volume Copy

Displaying License Information

Proof-of-License certificates, issued when you purchase premium services, contain information about activating premium features your organization has purchased.

1. From the navigation pane, expand the array for which you want to display license information.
2. Expand Administration and choose Licensing.
3. On the Licensable Feature Summary page, click a feature for detailed information on licenses for that feature.

Adding a License

License certificates are issued when you purchase premium services and contain instructions for obtaining license information.

Note: Arrays should be named before licenses are added. Otherwise, when you select to reset storage configuration for an array, the name might not list on the License Summary page.

1. From the navigation pane, expand the array for which you want to display license information.
2. Expand Administration and choose Licensing.
3. On the Licensable Feature Summary page, click Add License.
4. On the Add License page, click Browse and select the license file for the premium feature you want to add.

   Note: The license file is sent to you by email. Navigate to the location of the saved file.
5. Click Enable.

Disabling a License

1. From the navigation pane, expand the array for which you want to display license information.
2. Expand Administration and choose Licensing.
3. Click the check box to the left of the license that you want to disable.
4. Click Disable.

Re-enabling a License

To re-enable a license, contact the License Center:

http://www.oracle.com/us/support/licensecodes/sun/fixline-dseries-premium-274781.html

Be prepared to provide the following information:

- Name of the product to be licensed
- Feature serial number, available from the license certificate

- Controller tray serial number, located on the back of the controller tray and on the Licensable Feature Summary page

Data Encryption Services

This section describes Data Encryption Services. It contains the following subtopics:

About Data Encryption Services

Sun Storage Data Encryption Services is a premium licensed feature that encrypts data stored on disk drives to protect against loss or theft. This feature is supported on all 6000 series arrays and the FLX380 array. The drive type must be security capable, that is, support full disk encryption (FDE).

How Data Encryption Services Works

The Data Encryption Services feature encrypts all of the data on security-capable disk drives. The encryption and decryption of the data is processed entirely by the drive and appears transparent to the array, and uses a separate encryption/decryption key. When the drive security is enabled and the drive is power cycled, it enters a "locked" state that prevents any read or write operations to the drive until the appropriate array lock key is passed to the drive by the array, at which point the drive will appear to operate as a normal disk drive.

The array lock key is maintained by the array controllers. Because both secure and non-secure virtual disks must be migrated between array controllers, this feature also includes a description of the method used to securely move the array lock key from one array to another.

About the Array Lock Key

An array lock key is stored on the array controllers. After the array lock key is created or imported, a security enabled drive can only be recognized if the lock key matches. If the lock key of a security enabled drive does not match the controllers' key, the drive will remain locked. The array lock key is used by both the drive and the array controllers to unlock a drive and make the drive available for I/O operations.

You can change the array lock key at any time provided all controllers are operational and secure volumes are in an optimal state. Security-sensitive users may want to change the array lock key at regular intervals.

About Security Capable Drives

A security capable drive is one that supports full disk encryption (FDE). You can enable or disable the security feature for a security-capable drive. With the security feature disabled, a drive functions exactly like a conventional, non-secure disk drive. When the security feature is enabled, a drive is in one of two states: locked or unlocked. Locked drives do not accept normal read or write operations. Unlocking a drive makes its data available to I/O operations.

Security enabled drives power up in the locked state and require unlocking before accepting I/O operations. To unlock a drive, the array controller presents an array lock key to the drive and performs an unlock operation. If the lock key of a security-enabled drive does not match the controllers' key, the drive will remain locked.

You cannot upgrade drive firmware of a security capable drive while the drive is locked.

If a secure virtual disk exists on the array and the premium license is disabled, an alarm will be generated. If you choose to delete the virtual disk to clear the alarm, security is still enabled on the drive. To access the secure drive, you need to re-enable the premium license or erase the secure drive.

Creating an Array Lock Key

Prerequisites:

- Install FDE disk drive and check firmware requirements
- Enable Data Encryption Services premium feature license

1. Select the array you want to use.
2. Select Administration > Array Lock Key.

3. Enter a name for the key.

   The Lock Key ID can consist of 1-189 alphanumeric characters including the hyphen (-) and underscore (_) characters, but no other special characters.

4. Enter a pass phrase.

   The pass phrase can consist of 8-32 alphanumeric or special characters.

5. Enter the same phrase to confirm your entry.

6. Click Create.

Creating a Secure Virtual Disk

Prerequisites:

- Install FDE disk drive and check firmware requirements
- Enable Data Encryption Services premium feature license
- Create an array lock key

To create a secure virtual disk:

1. Select the array you want to use.

2. Select Virtual Disks > New.

3. Specify a name for the new virtual disk.

4. Select a Typical or Custom configuration.
   - In a typical configuration, you specify the RAID level and the Sun Storage Common Array Manager provides a listing of possible virtual disk configurations that meet the requirements of that RAID level. The Security column displays the disk drive security status: none, Enabled, Disabled.
   - In a custom configuration, you specify all virtual disk settings including RAID level, segment size read-ahead setting, enable security for the disk, and then identify the disk drives that will be a part of the virtual disk

5. Complete the configuration wizard based on your selection, and click Finish to create the secure virtual disk.

Moving a Secure Drive to Another Array

You can move a security capable drive from one array to another using the Portable Virtual Disk feature. Moving a secure drive to another array requires moving the array lock key.

See Service Advisor instructions “Exporting A Portable Virtual Disk” and “Importing a Portable Virtual Disk” for instructions.

Changing the Array Lock Key Pass Phrase

1. Select the array you want to use.
2. Select Administration > Array Lock Key.
3. Change the pass phrase.

   consisting of 8-32 alphanumeric or special characters.
4. Enter the same phrase to confirm your entry.
5. Click Change.

Erasing a Secure Drive

1. Select the array that has the secure disk drive you want to erase.
2. Select Physical Devices > Disks.
3. Select the secure disk drive you want to erase.

Note: If the disk is part of a virtual disk, the Secure Erase button is disabled. You cannot erase a secure drive that is assigned to a virtual disk.

4. Click Secure Erase.
5. Click OK if you want to continue with the erase operation.

   A message reports when the erase operation is complete or if the operation failed for any reason.

About T10 Protection Information

T10 protection information (PI) feature provides end-to-end data integrity between host server and hard disk drive (HDD). Also known as T10 DIF (Data Integrity Field) and defined within the SCSI standard, this feature protects data during read/write transfer between host HBA, RAID controller, and physical disk.

Two types of errors that might occur during data transfer include:

- Data corruption—when one or more bits of data are changed as a result of a hardware or software failure.
- Data addressing—a type of silent data corruption that could occur when data is written to the wrong block, or a buffer is overwritten inside a controller.

The T10 standard verifies check points in the data path during data transfer. Error-checking protection information [cyclic redundancy check (CRC), application and logical block tag data] is stored with data as it is written to and read from disk.

The T10 PI feature, as implemented for CAM, requires specific hardware and firmware configuration including:

- Sun Storage 6180, 6580, or 6780 array
- RAID controller firmware revision level 07.77.xx.xx (minimum)
- Hard disk drive (HDD) formatted for PI to 520-byte user data block size
- HBA and revision level

Refer to the CAM Release Notes for currently supported hardware and firmware.

About PI Disk Drives

Support for T10 protection information requires a specific class of hard disk drive and format. To determine if any PI disk drives are installed in the array, refer to the Disk Summary Page and Disk Details Page. The PI column lists one of the following:

- Capable—the disk drive supports PI, which means it is formatted as a 520-byte user data block.
- None—the disk drive is not formatted for PI use.

Trays can be populated with combinations of PI drives, non-PI drives, and secure drives.

For information about installing and formatting PI disk drives, refer to Service Advisor procedures.

About Host and Host Port Protection Information

To determine which hosts have PI access to volumes, refer to the Host Summary page. Host Summary lists the hosts and host groups that can access PI volumes. A host listed as "Capable" confirms the host may access PI volumes through any array port. It is important to note that in order to realize the full benefit of the PI feature, the host must be using a PI-capable HBA.

The Port Summary page lists ports that are PI capable and ports that do not support PI. All 6x80 array FC ports are PI capable.

You can view host and port protection information status on the Host Details page and Port Details page.

Protected Virtual Disks

Click a link for information about protected virtual disks:

Creating a Protected Volume

1. Verify PI disk drives are installed in the array by checking the Disk Summary Page or Disk Details Page.
2. Verify controller firmware (07.77.xx.xx minimum) is installed.
3. Select an array and navigate to Storage Systems > *array name* > Volumes.
4. On the Volume Summary page for that array, click New to launch the Create New Volume wizard.
5. Select an existing storage pool that meets your storage requirements.
6. For Step 1.1, select one of the following:
   - An Existing Virtual Disk with Available Capacity

If you choose this option, Step 1.2 displays virtual disks that are PI capable or not capable (None). Select a PI-capable virtual disk.

- Currently Unassigned Disks (Create a New Virtual Disk)

  If you choose this option, the Step 1.2 displays available disk drives and PI status, capable or not capable (None). Select PI-capable disk drives to be used for the virtual disk

7. For Step 2, Configure Volume, enter the volume name and specifications. Be sure Enable Protection Information is checked.
8. Select whether you want to map the new volume to a new or existing host, or you can wait to map the volume at a later time.
9. When reviewing your selections, you will be notified if the array does not have an appropriate hot-spare drive. If this is the case, configure a hot-spare from either the General Settings or Disk Details page.
10. If the configuration is correct, click Finish to create the volume.

Creating a Protected Virtual Disk

1. Verify PI disk drives are installed in the array by checking the Disk Summary Page or Disk Details Page.
2. Verify controller firmware (07.77.xx.xx minimum) is installed.
3. Select an array and navigate to Storage Systems > *array name* > Virtual Disks.
4. On the Virtual Disk Summary page for that array, click New to launch the Create Virtual Disk wizard.
5. Enter a name for the protected virtual disk, select Typical or Custom, and click Next.

   For information about typical and custom configurations, click the Help tab.
6. Specify the configuration for the virtual disk, selecting only disks that are listed as PI capable.
7. Click Next to display the Configure Volume window.
8. Optionally, create one or more volumes, or defer volume creation until later.
9. Click Next to review your configuration selections.
10. If the configuration is correct, click Finish to create the virtual disk.

    You are notified if the array does not have a PI-capable hot spare available in the pool. If this is the case, assign a PI-capable drive as a hot spare.

Disabling Volume Protection

Before you disable volume protection, verify it is necessary to do so. When you disable PI, you cannot re-enable it for that volume.

Do not disable volume protection:

- if a volume is being reconfigured, such as changing the segment size or RAID type of the volume.
- on replication repositories, or on primary and secondary volumes that are in replication sets.
- on active snapshot volumes, and on base volumes or protected reserve volumes.

1. From the navigation pane, expand the array you want to work with.
2. Click Volumes.
3. On the Volume Summary page, click the name of the volume.
4. On the Volume Details page, click Disable Protection Information.
5. Click Save.

Expanding a Protected Virtual Disk

The rules for expanding virtual disks apply to protected virtual disks: RAID level requirements and drive types must be met.

1. From the navigation pane, expand the array you want to work with.
2. Click Virtual Disks.
3. On the Virtual Disk Summary page, click the virtual disk name.
4. On the Virtual Disk Details page, click Expand.
5. On the Expand Virtual Disk page, select the disks you want to include in the virtual disk expansion.

   Only PI drives are listed.
6. Click OK.

   The Virtual Disk Details page is refreshed, and a message confirms the virtual disk expansion.

Assigning Protected Hot-Spare Drives

1. From the navigation page, expand the array you want to work with.
2. Select Physical Devices > Disks.
3. On the Disk Summary page, click the name of the disk you want to assign as a hot-spare disk.

   The drive must be PI-capable, in addition to the standard disk drive requirements. This requires three things--the capacity must be equal to or greater than the capacity of the largest drive on the storage array, the disk type must be the same, and the disk role must be unassigned.
4. Click Assign Hot-Spare.

   If a drive fails for a PI-capable virtual disk and no PI-enabled volumes exist for that virtual disk, a non-PI drive will replace the failed drive, removing PI protection for the virtual disk.

Protected Snapshot, Remote, and Copy Volumes

Click a link below for information about using PI-enabled volumes with premium features:

- "Creating Protected Snapshot Volumes" on page 53
- "Creating Protected Data Replication Volumes" on page 54
- "Creating Protected Volume Copies" on page 55

Creating Protected Snapshot Volumes

When creating a snapshot of a protected volume, both the base volume and target volume must be PI-enabled.

1. From the navigation pane, expand the array you want to work with.
2. Click the volume for which you want to create a snapshot.
3. On the Volume Details page, check to be sure Protection Information is enabled.
4. Click Snapshot.

5. Follow the wizard prompts to specify information for the snapshot you want to create.
6. For Step 2, click the Enable Protection Information checkbox.
7. For Step 3, select disks that are listed as PI capable.
8. Continue to define the snapshot in the wizard.

Note: If a snapshot volume status is active, you cannot disable protection information on base volumes or on protected reserve volumes.

Creating Protected Data Replication Volumes

In order for a replication set to be created, a protected primary volume must be replicated to a protected secondary volume. If a protected volume is replicated, its associated repository volume should be a PI-enabled volume.

1. From the navigation pane, expand the array you want to work with.
2. Click the volume for which you want to replicate.
3. On the Volume Details page, check to be sure Protection Information is enabled.
4. Click Replicate.
5. Follow the wizard prompts to specify information for the replication set you want to create.
6. In Step 1, specify a new or existing virtual disk, and click the Enable Protection Information checkbox.
7. If you create a new virtual disk, select disks that are listed as PI capable.
8. Continue to follow the wizard to define the replication set.

Caution – Do not disable PI on replication repositories, primary volumes, or secondary volumes that are in replication sets.

Creating Protected Volume Copies

You can copy a protected source volume to a protected or unprotected target volume.

1. Before starting a copy operation, stop all I/O and unmount filesystems on the source and target volumes.
2. From the navigation pane, expand the array for which you want to copy volume information, and choose Volumes.
3. On the Volume Summary page, click the volume name you want to copy.
4. On the Volume Details page, click Copy.
5. On the Copy Volume page, select a copy priority.
6. Select a target volume that is listed as PI enabled, and click OK.

   If you choose to copy a protected volume to a PI-disabled target volume, you will be notified that protection will be removed from the target volume.

Note: You cannot disable protection on a PI-enabled volume if data is being copied from the source to the target volume.

Monitoring Array Performance

1. From the navigation pane, expand the array for which you want to see performance statistics.
2. Expand Administration and choose Performance Monitoring.

   is displayed.
3. On the Performance Monitoring page, check the Performance Monitoring Enabled check box.
4. Select the polling interval and retention period.
5. To view current statistics, go to the Performance Statistics section of the page.

Administering Jobs

Click a link below for information about jobs:

About Jobs

When you request an operation on one object, the management software processes that operation immediately. For example, if you select one volume to delete, the volume is deleted immediately. However, because operations on more than one object can affect performance, when you request an operation on several objects, the system creates a job that completes the operation while you make other selections. You can follow the progress of a job from the Job Summary page and view details about the processing job on the Job Details page.

The management software keeps track of jobs that have completed processing and lists them on the Historical Job Summary page. You can view details about a selected job that has already been processed on the Historical Job Details page.

The management software administers both array-based jobs and management host-based jobs. An array-based job runs on the array itself while a management host-based job runs on the management host. Examples of management host-based jobs include deleting volumes, deleting initiators, etc.

Management host-based jobs will only appear in the Current Job Summary page and the Historical Job Summary page when viewed from the management host from which the job was initiated. Array based jobs that are running will display on a management host's Current Job Summary page regardless of which management host initiated the job.

Array based jobs which have completed will be listed on a management host's Historical Job Summary page only if they had previously been seen on that management host's Current Job Summary page.

Displaying Current and Historical Job Information

1. From the navigation pane, expand the array for which you want to view job status.
2. Expand Jobs.
3. Click either Current Jobs or Historical Jobs.
4. For more information about a job, click on its Job identifier (ID).

Canceling Jobs

You can cancel the following types of jobs while they are in progress, or you can cancel them before they begin executing and remove them from the job queue:

- Volume copy jobs
- Delete volume jobs
- Delete initiator jobs

You can cancel the following types of jobs before they begin executing and remove them from the job queue. For these types:

- Expand virtual disk job
- Defragment virtual disk job
- Clear array configuration jobs
- Redistribute volume jobs

To cancel a job:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.
2. In the navigation pane, expand the array for which you want to display job information.

   The navigation tree is expanded for that array.
3. Choose Jobs.

   The Job Summary page is displayed.
4. Select the job you want to cancel, and click Cancel Job.

Note: All jobs can be cancelled and removed from the queue before they begin executing. However, if you select a job that is executing, the Cancel button will be active only for those jobs that can be canceled after they begin executing, including volume copy, delete volume, and delete initiator jobs. If you select any other type of job that is executing, including expand virtual disk, defragment virtual disk, clear array configuration, and redistribute volume jobs, the Cancel button will not be active because you can cancel those jobs from the queue only before they begin executing.

Monitoring Array Health

1. From the navigation pane, click Storage Systems.

   The Storage System Summary page lists the health for each array. Possible values include:

   - **OK**—Every component of the storage array is in the desired working condition.
   - **Degraded**—Although the management host can communicate with the storage array, a problem on the array requires intervention. For example, the array may have volumes that are not on the array's preferred I/O controller path.

     Typically, multipath drivers move volumes from their preferred owner controller when a problem occurs along the data path between the host and the storage array. Redistributing the volumes causes the volumes to revert back to their preferred controllers.

     Redistributing the volumes while an application is using the affected volumes causes I/O errors unless a multipath driver is installed on the data host. Therefore, before you redistribute volumes, verify either that the volumes are not in use or that there is a multipath driver installed on all hosts using the affected volumes.
   - **Error**—The management host cannot communicate with the controllers in the storage array over its network management connection.

2. If the Health column is Degraded or Error, expand the array and click Alarms to view the alarm details and recovery options.

Page and Field Descriptions

Browser interface pages and fields related to the "Administration of RAID Arrays" section are described in the following subsections:

Add License Page

This page enables you to obtain a license for premium features, including data replication, volume copies, snapshots, and storage domains.

TABLE 2-3 describes the fields on the Add License page.

TABLE 2-3 Add License Page

Field	Description
License File	The type of license to be added: Data Encryption Services, Replication Sets, Snapshots, Storage Domains, or Volume Copy Pairs.
Enable	Click Enable to add the selected premium license feature to the storage system.

Administration Page

Use the Details section of this page to view and define general array attributes.

TABLE 2-4 describes the buttons and fields on the Administration page.

TABLE 2-4 Administration Page

Field	Description
Manage Passwords	Click to update the array password stored in the array registration database or change the array password.
Redistribute Volumes	Click to move volumes back to their preferred controller owner. This button is not available if all volumes are currently owned by their preferred controllers, or if no volume exists on the storage array.
Reset Configuration	Click to reset the current array configuration.
Install Firmware Baseline	Click to launch the Analyze and Install the Firmware Baseline wizard which analyzes the firmware on the selected Storage Systems and identifies the Storage Systems that are not at the current baseline.
Details	
Name	Name of the array.
Type	Model number of the array.
Network Address	Network address of controller A of the array.
Device ID	Device ID of the array.
Serial Number	Serial number of the array.
Array WWN	World Wide Name of the array.
Node WWN	World Wide Name of the management host.
Array Hot-Spares	Designated disks serving as hot-spares to substitute for failed drives. PI indicates the disk supports protection information. In the Change to field, selecting a number larger than what is currently configured assigns additional hot-spares, while a smaller number unassigns hot-spares. The management software assigns or unassigns the specified number of hot-spares, balancing the selection among trays within the array.
Health	State of the array's health: OK or in an error condition.
Firmware Version	Version of the firmware installed on the array.
Default Host Type	Operating system of the host.
Cache Block Size	Size of the blocks used in the cache.

TABLE 2-4 Administration Page *(Continued)*

Field	Description
Cache Start %	Percentage of unwritten data in the cache that will trigger a cache flush. The value of Cache Start% must be greater than the value for Cache Stop%.
Cache Stop %	Percentage of unwritten data in the cache that will stop a cache flush that is currently in progress. The value of Cache Stop% must not be greater than the value for Cache Start%.
Disk Scrubbing Enabled	By default, this is not enabled. Select Enable Background Disk Scrubbing to check the disks on the array for media consistency. To specify the scan duration (or period), choose the number of days (from 1 to 30 days). Additional disk scrubbing options exist for individual volumes. See the Volume Details page for these options.
Failover Alert Delay (in minutes)	The number of minutes that the management software is to wait after an alert before enacting failover procedures.
Battery Next Learn Cycle	Allows you to control when the next battery learn cycle will occur. During a learn cycle, the battery is discharged and recharged so the controller can determine the current battery capacity. The default learn cycle interval for StorageTek 2500 series arrays is 13 weeks. The default learn cycle interval for Sun Storage 2500-M2 arrays, 6180, 6580, and 6780 arrays is 8 weeks. **Note**: A complete learn cycle (discharge and recharge) can take between 8-26 hours, depending on array model. During this time, write caching is disabled for 2500 series arrays. For 2500-M2 arrays, 6180, 6580, and 6780 arrays, write caching is not disabled, and the cache remains active during the learn cycle.
Total Capacity	Total capacity on the array.
Available Capacity	Unused capacity on the array.
System Time	
Synchronize with Server	Click to synchronize the time with the time set on the server.
System Time	Select the current hour and minute, using a 24-hour clock.
Month	Select the current month.
Day	Select the current day of the month.
Year	Select the current year.

Current Job Details Page

This page displays details about the selected job.

TABLE 2-5 describes the fields on the Job Details page.

TABLE 2-5 Current Job Details Page

Field	Indicates
Job ID	A unique job identifier that begins with the date when the job was started and ends with a unique set of characters.
Job Type	The type of job that is running. Possible job types are: • Volume Copy • Volume Formatting • Volume Initialization • Volume Copy From Standby • Volume Copy to Standby • Volume Capacity Expansion • Virtual Disk Capacity Expansion • Volume Segment Size Change • Virtual Disk Defragmentation • Volume RAID level change • Import Array • Remapping Due to Dynamic Volume Expansion • Dynamic Capacity Expansion/Dynamic RAID Reconfiguration • Replication Synchronization • Unknown
Location	Where the job was initiated: either on the management host or on the array.
Priority	Lowest, Low, Medium, High, Highest. The job priority applies to volume reconstruction jobs only; it does not apply to volume creation jobs.
Owning Job Element	The name of the object associated with the job.

TABLE 2-5 Current Job Details Page *(Continued)*

Field	Indicates
State	Current state of the job for each item: • Pending – The job is still in progress. • Complete – The job has finished. • Reason for error – The job started to run but could not be completed. • Running - The job has started. For the Virtual Disk Create job, the following additional states can be reported: • Dormant – The job is in a queue of jobs waiting for processing. • Error – The job started to run but could not be completed. The job reports status for each item. For example, in a mapping operation where a series of items is being assigned to another item, the job reports progress for each item as it gets mapped.
Start Time	Date and time when the job was initiated
Elapsed Time	Amount of time, in hours, minutes, and seconds, that has passed since the job was initiated
% Complete	Percentage of job completion displays numerically and graphically in a progress bar.
Estimated Time to Completion	Hours, minutes, and seconds remaining for job completion.
Status	The job ID followed by its current state: • Pending – The job is still in progress. • Complete – The job has finished. • Reason for error – The job started to run but could not be completed. • Running - The job has started. For the Virtual Disk Create job, the following states might also be reported: • Dormant – The job is in a queue of jobs waiting for processing. • Error – The job started to run but could not be completed. The job reports status for each item. For example, in a mapping operation where a series of items is being assigned to another item, the job reports progress for each item as it gets mapped.

Current Job Summary Page

This page displays information about all active jobs. Click an identifier in the Job ID field to view the details of the job.

TABLE 2-6 describes the buttons and fields on the Current Job Summary page.

TABLE 2-6 Current Job Summary page

Field	Indicates
Cancel Job	Click to cancel the selected job.
Job ID	Job identifier, based on the time stamp of the job's starting time.
Job Type	Code indicating the type of job.
Location	The location where the job was initiated: either on the management host or on the array.
Priority	Lowest, Low, Medium, High, Highest. The job priority applies to volume reconstruction jobs only; it does not apply to volume creation jobs.
Status	The current state of the job for each item: • Pending – The job is still in progress. • Complete – The job has finished. • Reason for error – The job started to run but could not be completed. • Running - The job has started. For the Virtual Disk Create job, the following additional states can be reported: • Dormant – The job is in a queue of jobs waiting for processing. • Error – The job started to run but could not be completed. The job reports status for each item. For example, in a mapping operation where a series of items is being assigned to another item, the job reports progress for each item as it gets mapped.
% (Percent) Complete	Percentage of completion is displayed numerically and graphically in the progress bar.
Estimated Time to Completion	Hours, minutes, and seconds (hh:mm:ss) remaining before the job is complete.

Historical Job Details Page

TABLE 2-7 lists the fields available on the Historical Job Details page.

TABLE 2-7 Historical Job Details Page

Field	Indicates
Job ID	Unique job identifier that begins with the date the job was started and ends with a unique set of characters.
Job Type	The type of job that is running. Possible job types are: • Volume Copy • Volume Formatting • Volume Initialization • Volume Copy From Standby • Volume Copy to Standby • Volume Capacity Expansion • Virtual Disk Capacity Expansion • Volume Segment Size Change • Virtual Disk Defragmentation • Volume RAID level change • Import Array • Remapping Due to Dynamic Volume Expansion • Dynamic Capacity Expansion/Dynamic RAID Reconfiguration • Replication Synchronization • Delete Job • Unknown
Location	Where the job was initiated: either on the management host or on the array.
Owning Job Element	The name of the object associated with the job.
State	The current state of the job for each item: • Pending – The job is still in progress. • Complete – The job has finished. • Reason for error – The job started to run but could not be completed. For the Virtual Disk Create job, the following additional states can be reported: • Dormant – The job is in a queue of jobs waiting for processing. • Error – The job started to run but could not be completed. The job reports status for each item. For example, in a mapping operation where a series of items is being assigned to another item, the job reports progress for each item as it gets mapped.
Start Time	Date and time when the job was initiated.

TABLE 2-7 Historical Job Details Page *(Continued)*

Field	Indicates
Finish Time	Date and time when the job finished executing.
Duration	Length of time, in hours, minutes, and seconds, that elapsed from the start time to the finish time, in the format HH:MM:SS.
Status	Hours, minutes, and seconds remaining for job completion.

Historical Job Summary Page

TABLE 2-8 describes the fields on the Historical Job Summary page.

TABLE 2-8 Historical Job Summary Page

Field	Indicates
Delete	Click to remove the selected job from the list of historical jobs.
Job ID	Unique alphanumeric string that identifies this job.
Job Type	The type of job. Possible job types are: • Volume Copy • Volume Formatting • Volume Initialization • Volume Copy From Standby • Volume Copy to Standby • Volume Capacity Expansion • Virtual Disk Capacity Expansion • Volume Segment Size Change • Virtual Disk Defragmentation • Volume RAID level change • Import Array • Remapping Due to Dynamic Volume Expansion • Dynamic Capacity Expansion/Dynamic RAID Reconfiguration • Replication Synchronization • Delete Job • Unknown
Finish Time	Date and time when the job completed.

TABLE 2-8 Historical Job Summary Page *(Continued)*

Field	Indicates
Status	The current state of the job for each item: • Pending – The job is still in progress. • Complete – The job has finished. • Reason for error – The job started to run but could not be completed. For the Virtual Disk Create job, the following additional states can be reported: • Dormant – The job is in a queue of jobs waiting for processing. • Error – The job started to run but could not be completed. The job reports status for each item. For example, in a mapping operation where a series of items is being assigned to another item, the job reports progress for each item as it gets mapped.

Licenseable Feature Details – Replication Sets Page

This page provides information about licensed replication sets.

TABLE 2-9 describes the fields on the Licenseable Feature Details – Replication Sets page.

TABLE 2-9 Licenseable Feature Details - Replication Sets Page

Field	Description
Activate/Deactivate	Click to launch the Activate License wizard, which enables you to activate or deactivate the Sun Storage Data Replicator software premium feature on this array only.
Details	
Enabled	Whether the cited premium feature is currently enabled: True or False.
Quantity Licensed	Number of licenses for this premium feature available for use.
Quantity Used	Number of licenses for this premium feature currently in use.
Repository Volume Summary	

TABLE 2-9 Licenseable Feature Details - Replication Sets Page *(Continued)*

Field	Description
Name	Name of the replication repository volume. Replication Repository #1 corresponds to controller A; Replication Repository #2 corresponds to controller B.
Virtual Disk	Name of the virtual disk where the replication repository volume resides.
Capacity	Configured capacity of the replication repository volume resides.
PI	Protection information status of this repository volume: • Disabled: protection information is not enabled. • Enabled: protection information is enabled

Licenseable Feature Details – Snapshots Page

This page provides information about licensed snapshots.

TABLE 2-10 describes the fields on the Licenseable Feature Details - Snapshots page.

TABLE 2-10 Licenseable Feature Details – Snapshots Page

Field	Description
Details	
Enabled	Whether the cited feature is currently enabled: True or False.
Quantity Licensed	Number of licenses for this feature that are available for use.
Quantity Used	Number of licenses for this feature that are currently in use.
Snapshot Summary	
Base Volume	Name of the volume of which the snapshot was taken.
Snapshot	Name of the snapshot.
Creation Date	Date the snapshot was created.

Licenseable Feature Details – Storage Domains Page

This page provides information about licensed storage domains.

TABLE 2-11 describes the fields on the Licenseable Feature Details - Storage Domains page.

TABLE 2-11 Licenseable Feature Details – Storage Domains Page

Field	Description
Details	
Enabled	Whether the cited feature is currently enabled: True or False.
Quantity Licensed	Number of licenses for this feature that are available for use.
Quantity Used	Number of licenses for this feature that are currently in use.
Storage Domains	
Host or Host Group Name	Name of a host or host group that participates in a storage domain.
Type	Type of the named host or host group that participates in a storage domain: host or host group.

Licenseable Feature Details – Volume Copy Pairs Page

This page provides information about licensed volume copies.

TABLE 2-12 describes the fields on the Licenseable Feature Details – Volume Copy Pairs page.

TABLE 2-12 Licenseable Feature Details – Volume Copy Pairs Page

Field	Description
Details	
Enabled	Whether the cited feature is currently enabled: True or False.
Quantity Licensed	Number of licenses for this feature that are available for use.
Quantity Used	Number of licenses for this feature that are currently in use.
Volume Copy Pairs	

TABLE 2-12 Licenseable Feature Details – Volume Copy Pairs Page

Field	Description
Source	Source volume for the volume copy.
Target	Target volume for the volume copy.
Status	Status of the volume copy.
Creation Date	Date the volume copy was created.

Licenseable Feature Details – Data Encryption Services

This page provides information about licensed Data Encryption Services.

TABLE 2-13 describes the buttons and fields on the Licenseable Feature Details – Data Encryption Services page.

TABLE 2-13 Licenseable Feature Details – Data Encryption Services

Field	Description
Details	
Enabled	Indicates whether the feature is currently enabled: True or False.
Array Lock Key Created	Indicates the key has been created: True or False.
Array Lock Key Id	Full drive security key.: includes the user-supplied array lock key identifier, storage array identifier, and controller-generated identifier. The full drive security key is stored on the management host at the following locations: • Solaris /var/opt/SUNWsefms/lockKeys/<devicekey>.alk • Linux /opt/sun/cam/private/fms/var/lockKeys/<devicekey>.alk • Windows <System drive>/Program Files/Sun/Common Array Manager/Component/fms/var/lockKeys<devicekey>.alk

Licensable Feature Summary Page

This page provides summary information for the licensed array features. Click the name of a feature to view details about that feature.

TABLE 2-14 describes the buttons and fields on the Licenseable Feature Summary page.

TABLE 2-14 Licensable Feature Summary Page

Field	Description
Details	
Array	Array name.
Array WWN	World Wide Name of the array.
Chassis Serial Number	Serial number for the controller tray of the array.
Feature Enabler Identification	Licensed feature's identification number.
Available Features	
Add License	Click to add a license for a licensed array feature.
Disable	Click to disable a licensed array feature.
Feature	Currently licensed feature(s) available to this array.
Enabled	Whether the listed feature is currently enabled: True or False.
Quantity Licensed	Number of licenses for this feature that are available for use.
Quantity In Use	Number of licenses for this feature that are currently in use.

Manage Passwords Page

This page enables you to update the array password stored in the array registration database or change the array password.

TABLE 2-15 describes the buttons and fields on the Manage Passwords page.

TABLE 2-15 Manage Passwords Page

Field	Description
Change Array Password	Select to change the array password.
Old Password	Specify the current array password to be changed.

TABLE 2-15 Manage Passwords Page *(Continued)*

Field	Description
New Password	Specify the new password.
Verify New Password	Re-enter the new password.
Update Array Password in Array Registration Database	Select to synchronize the value of the array password stored in the array registration database with the value set on the array.
New Password	Specify the new password.
Verify New Password	Re-enter the new password.

Performance Monitoring Page

This page enables you to set performance monitoring options and view performance statistics for the array.

Note: To refresh the contents of this page, click the Refresh button in the masthead.

TABLE 2-16 describes the buttons and fields on the Performance Monitoring page.

TABLE 2-16 Performance Monitoring Page

Field	Description
Set Baseline	Click to set the performance monitoring baseline for iSCSI statistics. Setting the baseline causes the logical statistical counters to reset to zero. Baseline statistics are derived as deltas from the time that you click the Set Baseline button.
Performance Settings	
Performance Monitoring Enabled	Select to turn on performance monitoring.
Polling Interval (in minutes)	Select the frequency with which you want the management software to poll the array for performance statistics. You can select a one, five, or fifteen minute interval.

TABLE 2-16 Performance Monitoring Page *(Continued)*

Field	Description
Data Retention Period	Length of time that the array retains the data. Valid options are: • 1 hour • 2 hours • 4 hours • 1 day • Forever
Performance Statistics	
Timestamp	Time when the displayed performance statistics were collected.
Total IOPS	Total inputs and outputs per second (IOPS).
Average IOPS	Average number of inputs and outputs per second (IOPS).
Read %	Percentage of incoming data read.
Write %	Percentage of outgoing data sent.
Total Data Transferred	Total amount of data that was processed, in kilobytes per second.
Read	Amount of incoming data that was read, in kilobytes per second.
Average Read	Average amount of incoming data that was read, in kilobytes per second.
Peak Read	Peak amount of incoming data that was read, in kilobytes per second.
Written	Amount of outgoing data that was sent, in kilobytes per second.
Average Written	Average amount of outgoing data that was sent, in kilobytes per second.
Peak Written	Peak amount of outgoing data that was sent, in kilobytes per second.
Average Read Size	Average amount of incoming data that was read, in bytes.
Average Write Size	Average amount of outgoing data that was sent, in bytes.
Cache Hit %	Percentage of cache affected by the performance statistics data.

Reset Configuration Page

From this page, you can select whether to reset an array configuration or reset a volume configuration for one array.

TABLE 2-17 describes the buttons and fields on the Storage System Summary page.

TABLE 2-17 Reset Configuration Page

Field	Description
Reset Array Configuration	Click to deletes the entire array configuration, remove all data from the array and refresh the settings to factory defaults.
Reset Volume Configuration	Click to delete all volumes and virtual disks from an array. Note that any related storage pools and storage profiles will also be deleted.

CHAPTER 3

Overview and Administration of JBOD Arrays

This chapter provides overview and administration information for Oracle's Sun Storage J4000, F5100, and B6000 array families. It contains the following subsections:

Software Overview for JBOD Arrays

Software for Oracle's J4000, F5100, and B6000 array families consists of the Sun Storage Common Array Manager software suite which provides management, monitoring, and service capabilities. The software has both a browser interface and a command-line interface (CLI).

Full Management Software

The full management software is installed on a management workstation. The management software communicates with the J4000, F5100, and B6000 arrays via a proxy agent that is installed on the data host. It provides:

- A browser interface
- Multiple array management

Remote Proxy

The remote proxy agent enables communication, equivalent to in-band management, from the full management host to the array over an out-of-band-band IP network.

If the proxy is enabled, the full install of the Sun Storage Common Array Manager can manage the J4000, F5100, and B6000 array families array directly. To remotely use the browser interface to manage the J4000, F5100, and B6000 array families, you sign into the IP address of the full management host, sign into the software from the Oracle Java Web Console, and select the array. The remote proxy must be enabled while running the installation wizard or script.

Command-Line Interface

The Sun Storage Common Array Manager software.s command-line interfaces provide the same control and monitoring capability as the Web browser and it is scriptable for running frequently performed tasks.

For more information about CLI commands, see the:

- sscs man page
- *Sun Storage Common Array Manager CLI Guide*

Connection Tasks for JBOD Arrays

This section contains information about setting up network connections and other administrative tasks for Oracle's J4000, F5100, and B6000 array families. It includes the following subsections:

Managing Arrays

The management software directly manages the Sun Storage J4000, F5100, and B6000 array families over the in-band network. For instruction on attaching a J4000, F5100, or B6000 array family array to the data and management host, refer to the hardware installation document for your array.

Managing an Array In-Band

In-band management uses a proxy agent running on a data host to communicate with a managed array. Sun Storage Common Array Manager software discovers the proxy agents on the subnet and then queries arrays registered with the software. The proxy agent receives the queries over Ethernet and passes them on to the array over the data path between the data host and the array.

New arrays can be registered with the software using the registration wizard. The wizard can auto-discover the arrays and all SAS domains via the proxies.

Managing an Array Isolated from the LAN

Use the following procedure when your site's security requirements necessitate having the array isolated from any external local area network (LAN):

- Set up and configure the array using a management host.

- When you have finished configuring the array, disconnect the management host.

Whenever the array needs to be reconfigured, reconnect the management host.

Another way to secure the system is to install a firewall between the management host for the array and the external LAN.

Installing the Administrator Host (Remote) CLI Client

If you need to configure the array with the `sscs` commands from a host other than the management host, the installation software contains a remote command-line interface (CLI) that enables you to do all of the tasks supported by the browser interface. The commands can be used in scripts you create, or they can be entered directly in a terminal window's command line. The client can run on hosts, including:

- Windows 2000 Server and Advanced Server
- Windows Server 2003 Standard, Web, and Enterprise Editions
- Red Hat Linux
- SuSE Linux
- HP-UX
- IBM AIX
- Solaris 8 OS 4/01
- Solaris 9 (SPARC systems only)
- Solaris 10 (SPARC systems only)
- Solaris 10x86
- OpenSolaris

Note: Refer to *Sun Storage Common Array Manager Release Notes* for a complete list of supported hosts.

To install the Administrator Host CLI Client, follow the detailed procedure in the *Sun Storage Common Array Manager Software Installation and Setup Guide*.

The command for management services is `sscs`, used with a subcommand to direct the operation. For a list of commands, see the `sscs`(1M) man page or the *Sun Storage Common Array Manager CLI Guide*.

Administration of JBOD Arrays

This section describes performing administration tasks for Oracle's J4000, F5100, and B6000 array families. It includes the following subsections:

Displaying Array Information

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Choose Administration.

   The Administration page for the selected array is displayed.

Changing the Array Name

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Choose Administration.

   The Administration page is displayed.

4. Go to the Details section.

5. Specify the new name for the array.

6. Click Save to apply your changes.

Page and Field Descriptions

Browser interface pages and fields related to the “Administration of JBOD Arrays” section are described below:

Administration Page

Use the Details section of this page to view and define general array attributes.

TABLE 3-1 describes the buttons and fields on the Administration page.

TABLE 3-1 Administration Page

Field	Description
Details	
Name	The name of the array.
Type	The model number of the array.
Network Address	The network address of the array.
Serial Number	The serial number for this array.
Firmware Version	The version of the firmware installed on the array.

Configuring SAS Domain Access

This section contains information about configuring SAS domain access. It includes the following subsections:

About SAS Domain Access Configuration

Serial attached SCSI (SAS) domain access configuration enables you to configure data hosts to access a specified group of storage devices. Sun Storage Common Array Manager SAS access configuration provides the traffic segregation, resource flexibility, controlled resource sharing, protection, and topology control functionality required to manage SAS-based systems.

Note: By default, access configuration is disabled; therefore, all hosts can access all disks. To work with access configuration features, you must click the Enable button from the Access Configuration Summary page.

SAS expanders have a boolean property to enable or disable access configuration. When access configuration is disabled, initiators can see all disks. When access configuration is enabled, the group assignments and permissions are in force and initiators can discover the specified disks.

Sun Storage Common Array Manager provides access configuration management for:

- Sun Storage J4200, J4400, and J4500 arrays
- Sun Storage F5100 Flash array
- Sun Blade 6000 Disk Module
- Sun Blade 6000 Multi-Fabric Network Express Modules

Before you configure SAS access configuration, become familiar with the concepts in TABLE 3-2:

TABLE 3-2 SAS Access Configuration Terms

Concept	Description
SAS Domain	A SAS domain is a group of SAS expander devices and end devices that are physically connected. When expanders are connected, they form one SAS domain. On the F5100 Flash Arrays, the expanders are not cabled together and each expander has its own domain. The expanders can be cabled together to form 1 to 3 larger domains.
Expander Devices	An expander is a physical device with ports to connect devices. SAS access configuration is implemented in expander devices in one or more arrays. Expander devices control which physical connections (PHYs) can be made between end devices. Expanders may be connected to each other via inter-expander links to form a cascade or daisy-chain.
End Devices	End devices are at ends relative to the expander. They are both initiating devices (host initiators on servers) and storage target devices such as disk or flash drives.
Ports and PHYs	A PHY is a single SAS physical connection. The supported arrays have x4 SAS ports requiring 4 PHYs. All PHYs in a port have the same PHY information.
Access Configuration	You divide the SAS domain into access configurations by connecting a port cabled to a group of initiators to a group of disks. By configuring the port, rather than the initiator, you can configure SAS in the management software before the initiating HBAs are cabled. Disks are wired internally to an expander PHY and have a changeable name and a set numbering scheme. You can configure an access configuration manually or use a wizard to configure with a template.

Configuring SAS Access Configuration

Using Access Configuration features, you can assign each host its own storage resources, optimizing efficiency through segregation and topology control. Access configuration is accomplished on a per host SAS port, per hard-disk level.

Important Notes

- It is best practice to configure servers one at a time.
- SAS Access Configuration features require a supported LSI-based HBA (SG-XPCIE8SAS-E-Z or SG-PCIE8SAS-EB-Z) with the minimum required firmware installed in the array management software's management or data host, directly connected to the J4x00 array. See Configuring SAS Domain Access for more information.
- Multipath connections to a J4x00 array using separate SAS fabrics will not cause SATA affiliation issues because each host uses a separate path to the disks.

Note: In a failover (multipath or clustered) configuration, granting multiple hosts access to the same disks through different controllers can lead to data loss. Use the Sun Storage Common Array Manager templates to help ensure your configurations are compatible.

Planning for SAS Access Configuration

1. Determine if your SAS storage will consist of one array or multiple arrays cascaded together.

   Note: Refer to the procedures in the *Sun Storage Common Array Manager Software Installation and Setup Guide* for information about configuring cascaded arrays.

2. Determine how many SAS domains you want on your storage system. If you want to form larger domains, cable SAS expanders together.
   - Each J4200/J4400 array has its expanders cabled together which form one domain.
   - The J4500 has two internal domains.
   - The F5100 Flash Array has a separate domain for each expander.
3. Note the available disks or FMods to be target devices.
4. Decide how to assign storage:
   a. Select a template and assign SAS ports to targets.

b. Manually map SAS ports to targets and determine which SAS ports will map to which targets.

c. If you want to group storage devices into target groups of shared storage, decide which SAS ports to link to which target groups.

5. After you complete Access Configuration for one host, connect remaining SAS ports to hosts per your plan.

- About SAS Domain Access Configuration

Registering the Array

Using the Register Array wizard, you can choose to have the software auto-discover the array, or you can choose to manually register an array. The Sun Storage Common Array Manager software discovers the array on the subnet through a proxy agent running on a data host.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. Click Register.

   The management software launches the Register Array wizard.

3. Follow the instructions in the wizard.

   After the array is registered, the SAS Domain Summary page displays the new array.

Viewing SAS Domains and Details

1. From the left navigation pane, select the desired SAS Domains page located under the Host or Array that you want to configure.

   The SAS Domain Summary page displays, showing the discovered domains.

2. Click a domain name in the SAS Domain Summary page.

   The SAS Domain Details page is displayed.

3. Expand a domain name in the navigation pane.

   The Access Configuration and Administration menu items are displayed.

4. Click one of the following links **in** TABLE 3-3:

TABLE 3-3 SAS Domain Links

Link	If you want to
Access Configuration	Set up access between SAS ports and specified targets (disks or FMods). You can configure access manually or import a predefined template.
Administration	Change the name of the selected domain, change the access configuration state for the selected domain, or manage the access configuration password.

Naming a SAS Domain

If you want to change a SAS domain's default name to a name that you can easily identify, do the following:

1. Select the SAS domain name to open the SAS Domain Details page.

From the SAS Domain Details page you can change the domain name. You can also view the:

- SAS domain ID
- Number of expanders associated with the SAS domain
- Number of initiators and associated SAS address
- Number of disks and details of each disk

2. Double-click the Name field and enter a unique, meaningful name for this SAS domain.
3. Click Save.

Manually Configuring SAS Port to Target Access

Caution: This step assumes you are configuring a new array. If data exists on the array, perform a full back up as a precautionary measure.

1. From the left navigation pane, click Access Configuration for the SAS domain you want to configure.

   The Access Configuration Summary displays showing any existing access configurations.

2. Click the Configure button to configure access between SAS ports and targets.

3. Select the SAS port you want to configure.
4. Select the targets you want the selected SAS port to access.
5. Click Add/Modify.

   The selected SAS port and target configuration is displayed.
6. To save this configuration, click Save.

   Sun Storage Common Array Manager saves the configuration to allow access control between the specified SAS ports and targets.
7. Click Export to save the configuration to a template (see Creating a SAS Access Configuration Template).

Importing Access Configuration

You can use the wizard to apply a predefined access configuration template.

1. From the left navigation pane, click Access Configuration for the SAS domain you want to configure.

   The Access Configuration Summary page displays showing any existing access configurations.
2. Click Configure.

   The Configure Access Between Ports and Targets page is displayed.
3. Click Import.

   The Import Access Configuration wizard is displayed.
4. Select the template that matches your configuration needs.

   The templates represent some common configurations. For example, Simple Zone Split will evenly divide all available targets across all SAS ports. You can also create a custom configuration and Export to a template (see Creating a SAS Access Configuration Template).
5. If you select a template that requires more information, the wizard displays a page similar to the following. Select the appropriate targets you want to configure from the drop down menu and click Next.
6. Review the selected configuration, and select one of the following:

- Click Finish to save the configuration
- Click Edit imported Access Configuration, to make additional modifications, and click Finish.

7. If you select Edit imported Access Configuration, the Configure Access Between Ports and Targets page is displayed. Make any additional modifications to the template and click Save.

Creating a SAS Access Configuration Template

The Export function allows you to create a custom configuration and save it as a template.

1. From the left navigation pane, click Access Configuration for the SAS domain you want to configure.

   The Access Configuration Summary displays any existing access configurations.

2. Click Configure.

   The Configure Access Between Ports and Targets page is displayed.

3. Select the SAS port and targets this initiator can access (see Manually Configuring SAS Port to Target Access for details).

   The selected SAS port and targets configuration is displayed.

4. Click Export.

   The Export SAS Domain page is displayed.

5. Enter a name, and optional description, for the new template and click Save.

   The template is now available as one of the templates in the Import Access Configuration wizard.

Managing SAS Domains

Discovering and Registering SAS Domains

SAS domains can be discovered and registered with Sun Storage Common Array Manager using the registration wizard. The wizard can auto-discover the array via the proxies or you can specify the IP address of the proxy agent.

When you select Scan the local network, the wizard displays the SAS address for each discovered SAS domain. Follow the wizard instructions to register all or selected SAS domains.

SAS domains are listed in the navigation pane, along with an Access Configuration and Administration selection associated for each SAS domain.

Displaying SAS Domain Summary Information

To display the SAS domains available as a result of the discovery and registration of arrays:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. From the left navigation pane, click SAS Domains.

   The SAS Domain Summary page is displayed.

Configuring SAS Access Using Templates

Access configurations can be configured using predefined templates or by creating a custom configuration using the Import and Export features.

To import an existing SAS configuration:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. From the left navigation pane, expand the array you want to work with.

   The navigation tree is expanded for that array.

3. Expand SAS Domains, then expand the SAS domain you want to work with.
4. Click Access Configuration, then click the Configure button.
5. Click Import to launch the Import Template wizard.
6. Select one of the predefined configurations, or a configuration you previously exported, and click Next.
7. Select the appropriate JBOD from the menu and click Next.
8. A summary of selections is displayed.
9. Review the configuration settings and click Finish.

To export a SAS configuration:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. From the left navigation pane, expand the array you want to work with.

   The navigation tree is expanded for that array.

3. Expand SAS Domains, then expand the SAS domain you want to work with.
4. Click Access Configuration, then click the Configure button.

5. Click Export to save the current configuration to a file.
6. Enter a name and optional description in the appropriate fields.

Modifying An Existing SAS Access Configuration

1. From the Access Configuration Summary page, click Configure.
2. From the Access Configuration table, select the configuration you want to modify.
3. Make the modifications and click Add/Modify.

   The modified configuration is displayed in the Access Configuration table.
4. Click Save to save the modified configuration.

Changing the SAS Access Configuration State

To temporarily disable domain-wide SAS access configuration:

1. From the left navigation pane, select Storage Systems > *array* > SAS Domains > *domain_ID* > Administration.
2. Click Disable.

   SAS domain access configuration is removed from all SAS ports, but leaves configurations intact.
3. To re-enable the access configuration state, click Enable from the Administration of SAS Domain *domain_ID* page.

To completely remove SAS access configuration:

1. From the left navigation pane, select Storage Systems > *array* > SAS Domains > *domain_ID* > Administration.
2. Click Reset to Default.

The existing access configuration is cleared and the state is disabled.

Changing the Name of the SAS Domain

The initial SAS domain name is the lowest SAS address in the SAS domain.

Note: When you add a new expander to a SAS domain, the SAS domain name is changed to the SAS address assigned to the previous expander.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. From the left navigation pane, under SAS Domain, expand the SAS domain that you want to work with.

   NOTE: You can change the SAS domain name from either the SAS Domain Details page or from the Administration of SAS Domain page.

   The navigation tree is expanded for that array.

3. In the name field, specify a unique, meaningful name for this SAS domain.

Displaying SAS Domain Detail Information

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. From the left navigation pane, expand the array you want to work with.

   The navigation tree is expanded for that array.

3. Expand SAS Domains, then click the SAS domain name for which you want details.

Managing the SAS Access Configuration Password

About the SAS Access Configuration Password

You can set a SAS access configuration password to prevent unauthorized changes to the SAS domain. The access configuration password is stored both in the software and on each JBOD SAS expander.

The SAS access configuration password set for the SAS expander must match the password in the Sun Storage Common Array Manager Array Registration database.

When you enter an access configuration password, it resides on the table in non-volatile memory on the expander. The table governs the flow of data from the source physical connector to destination physical connector. Access configuration membership stays with the physical connector on the expander. As a result, you can replace end device FRUs and retain access configuration membership.

Note: All access configurations in a SAS domain use the same password.

If a JBOD password is modified, the access configuration password must be modified in Sun Storage Common Array Manager.

Clearing the SAS Access Configuration Password

If the zone manager password for the JBOD SAS expander is reset, you must clear (or reset) the access configuration password in the Array Registration Database.

1. From the left navigation pane, click SAS Domains > *domain_ID* > Administration for the domain you want to manage.
2. Scroll down to Manage Access Configuration Password.
3. Click the Change Password checkbox.

4. Click Clear Password in Array Registration Database.

   Sun Storage Common Array Manager resets the password to the default setting, which is an empty string.

5. Click Save.

Changing the SAS Access Configuration Password

Use this option to change the password both on the JBOD SAS expander and in the Array Registration database.

1. From the left navigation pane, click SAS Domains > *domain_ID* > Administration for the domain you want to manage.
2. Scroll down to Manage Access Configuration Password.
3. Click the Change Password checkbox.
4. Click Change Password in Array Registration Database.
5. Enter the name of the password you want to change. If the password is set to the default, the Old password field will be filled in.
6. Enter the new password, up to 32 alphanumeric characters.
7. Confirm by reentering the new password.
8. Click Save.

Updating the Access Configuration Password

If the access configuration password is modified for a JBOD SAS expander, you must also update the access configuration password in the Array Registration database.

1. From the left navigation pane, click SAS Domains > *domain_ID* > Administration for the domain you want to manage.
2. Scroll down to Manage Access Configuration Password.
3. Click the Change Password checkbox.
4. Click Update Password in Array Registration Database.
5. Enter the new password, up to 32 alphanumeric characters.

6. Confirm by reentering the new password.

Page and Field Descriptions

Browser interface pages and fields related to the "Configuring SAS Domain Access" section are described in the following subsections:

Administration of SAS Domain Page

This page is displayed when you select Administration for a selected SAS domain.

TABLE 3-4 describes the buttons and fields on the Administration of SAS Domain Page.

TABLE 3-4 Administration of SAS Domain Page

Field	Description
Details	
Name	The name of the SAS domain you want to modify.
ID	The unique identifier for this SAS domain.
Change Access Configuration State	
Reset to Default	Click to clear the access configuration to the default settings for the selected SAS domain. **CAUTION**: Resetting to default disables access configuration and opens access between all initiators and all disks within the domain if access configuration is enabled without reconfiguration.
Enable	Click to change the access configuration state to Enabled for current access configurations.

TABLE 3-4 Administration of SAS Domain Page *(Continued)*

Field	Description
Disable	Click to change the access configuration state to Disabled and disable access configuration without clearing the current access configurations. Use this option to temporarily disable access when adding a new JBOD, for example.
Access Configuration State	The current access configuration state: Enabled, Disabled, or Unknown.
Cascade Storage	
Prepare Storage	Click to clear any previous access configurations on the SAS domain for the selected array. **Note**: Refer to the procedures in the *Sun Storage Common Array Manager Software Installation and Setup Guide* for information about configuring cascaded arrays.
Synchronize Cascade	Click to synchronize the merged SAS domain. This action synchronizes the zoning permissions and initializes the connections between the arrays.
First Expander Attached to Host	The SAS address of the expander attached to the host.
Manage Access Configuration Password	
Change Password:	
Clear Password in Array Registration Database	Select to clear the access configuration password. You must clear this password when the physical presence switch password on the storage device is reset.
Change Password in Array Registration Database	Select to change the password in the array registration database and the JBOD SAS expander. Note: Change Password in Array Registration Database doesn't work until the password is updated. As a preventive measure, Sun Storage Common Array Manager checks the old password against the password in the registration database--not the password in the expander.
Old Password	Specify the current password to be changed.
New Password	Specify the new password.
Re-type new Password	Type the new password again.
Update Password in Array Registration Database	Select this option to update the password in the array registration database. If the primary JBOD had a zoning password set before you cascade the arrays, you must update the password in the Array Registration Database for the aggregated SAS domain.
New Password	Type the new password.
Re-type new Password	Type the new password again.

- Updating the Access Configuration Password
- Changing the SAS Access Configuration State

Configure Access Between Ports and Targets Page

Use the fields on this page to configure access between host ports and targets. When you begin to modify the configuration, Edit Mode... is displayed at the bottom of the page until you click Save or Cancel.

TABLE 3-5 describes the buttons and fields on the Configure Access Between Ports and Targets Page.

TABLE 3-5

Field	Description
Reset to Default	Click to clear the access configuration to the default settings for the selected SAS domain. CAUTION: Resetting to default disables access configuration and opens access between all initiators and all disks within the domain if access configuration is enabled without reconfiguration.
Export	Click to export the current configuration to a file on the management host. You are prompted to enter a template name and optional description.
Import	Click to launch the Import Access Configuration wizard. The wizard provides pre-configured templates to simplify the configuration process.
Current Access Configuration State	The current access configuration state: Enabled, Disabled, or Unknown.
Change Access Configuration State	Click to change the access configuration state for current access configurations. Click Disable to disable access configuration without clearing the current access configurations. Use this option to temporarily disable access when adding a new JBOD, for example. Click Enable to re-enable the access configuration state.
Ports (X)	
Port Name	Select the ports you want to map to selected disks.
Connected To	The host to which the port is connected.
SAS Address	The SAS address of the HBA port on the host listed under "Connected To".
Disks (X)	
Name	Select one or more disks that the selected initiators can access.

TABLE 3-5 *(Continued)*

Field	Description
Storage System Name	The name of the storage device (JBOD) associated with the listed disks.
Storage System Type	Type of array such as J4200 or J4400.
Capacity	Capacity of a specified disk.
Access Configuration (X)	Lists port name and target selections from the storage system viewpoint.
Port Name	The name of the port that is mapped to the specified disks.
Targets	The name of the disks that are mapped to the specified port.
Add/Modify >>	After making port and disk selections, click this button to add the configuration to the Access Configuration list. To modify an existing configuration, click the configuration in the list, make your changes, then click this button to update the configuration.
<< Remove	Click to remove a configuration from the Access Configuration list.

Access Configuration Summary for SAS Domain Page

This page displays the access configuration settings between ports and targets for the selected SAS domain.

TABLE 3-6 describes the buttons and fields on the Access Configuration Summary for SAS Domain Page.

TABLE 3-6 Access Configuration Summary for SAS Domain Page

Field	Description
Configure	Click to configure access between ports and disks.
Reset to Default	Click to clear the access configuration to the default settings for the selected SAS domain. **CAUTION**: Resetting to default disables access configuration and opens access between all initiators and all disks within the domain if access configuration is enabled without reconfiguration.
Enable	Click to enable disk access configuration.
Disable	Click to disable disk access configuration.
Port Name	The port that has access to a named disk.
Connected To	The host to which the JBOD port is connected.

TABLE 3-6 Access Configuration Summary for SAS Domain Page

Field	Description
Targets	The targets (disks or FMods) for which each port can access.

Note: SAS expanders have a boolean property to enable or disable access configuration. When access configuration is disabled, initiators can see all disks. When access configuration is enabled, the group assignments and permissions are in force and initiators can discover the specified disks.

Host Details Page

This page provides a listing of all registered arrays, SAS domains, and HBAs.

TABLE 3-7 describes the buttons and fields on the Host Details Page.

TABLE 3-7 Host Details Page

Field	Description
Details	
Name	The name of the data host on which the proxy agent is running.
IP Address	The IP address of the data host.
ID	An identification number unique to the data host.
OS Type	The type of operating system running on the data host.
OS Version	The version of the operating system running on the data host.
CAM Version	The version of the Sun Storage Common Array Manager software.
Registered Storage Systems	
Name	Name of the array: either the WWN default name or the name with which you replaced it.
Health	The current status of the storage system, such as OK or Degraded.
Type	Type of array such as J4200 or J4400.
Firmware Version	The version of the firmware running on the storage system.
Total Capacity	The total capacity of the storage system.
Available Capacity	The remaining unused capacity of the storage system.
SAS Domains (X)	

TABLE 3-7 Host Details Page *(Continued)*

Field	Description
Name	The name associated with the SAS domain, which is the lowest SAS address in the initial SAS domain discovery. The SAS domain name can be changed to a string of alphanumeric characters from the SAS Domain Details page. Note: As you add each new expander, the SAS domain name changes to the previous expander's SAS address.
SAS Domain ID	By default, the SAS domain name and ID are initially the same. However, if a new lowest SAS address is added to the domain when a new array is added, the domain ID will change accordingly but the SAS domain name will not change. The new SAS domain ID will display when the SAS Domain Details page refreshes.
Number of Expanders	The number of expanders associated with the SAS domain.
Number of End Devices	The number of end devices, including initiators and disks, associated with the SAS domain.
HBA Ports in Use (X)	
HBA	The name of the HBA associated with this SAS domain.
Port Number	The HBA port number associated with this SAS domain.
Port SAS Address	The SAS address associated with this HBA port number.
Attached SAS Domain	The name associated with the SAS domain.
Disks (X)	
Name	The name of the disk.
Storage System	The name of the registered storage system containing the disk.
Path	The location (path) of the disk.
Total Capacity	The total storage capacity of the disk.

Host Summary Page

This page lists all registered proxy agents.

TABLE 3-8 describes the buttons and fields on the Host Summary Page.

TABLE 3-8 Host Summary Page

Field	Description
Name	Name of the data host on which the proxy agent is running.
OS Type	The type of operating system running on the data host.
OS Version	The version of the operating system running on the data host.
CAM Version	The version of the Sun Storage Common Array Manager software.

Modify Access Between Ports and Targets Page

This page lets you modify access between host initiators and disks. When you begin to modify the configuration, Edit Mode... is displayed until you click Save or Cancel.

TABLE 3-9 describes the buttons and fields on the Modify Access Between Ports and Targets Page.

TABLE 3-9 Modify Access Between Ports and Targets Page

Field	Description
Export	Click to export the SAS domain configuration to a file.
Import	Click to launch the SAS Domain configuration wizard, which imports a SAS domain configuration template.
Ports (X)	
Port Name	Name of the SAS port, for example: F5100_P2_MB[Chassis.Expander.00.Port 2]
Connected To	Name of the host to which the array is connected.
SAS Address	SAS address of the host.
Disks (X)	
Name	Name of the physical disk drive.
Storage System Name	Name of the array.
Storage System Type	Type of array such as J4200 or J4400.

TABLE 3-9 Modify Access Between Ports and Targets Page

Field	Description
Capacity	Current capacity of the disk.
Add/Modify	Modify the selected configuration.
Remove	Remove the selected configuration.
Access Configuration (X)	
Port Name	Name of the SAS port.
Targets	Name of the FMods or disks the port can access.

SAS Domain Details Page

This page provides details for the selected SAS domain.

TABLE 3-10 describes the buttons and fields on the SAS Domain Details Page.

TABLE 3-10 SAS Domain Details Page

Field	Description
Details	
Name	Enter a unique name to identify the SAS domain. Initially, the domain name is SAS address of the expander. Note: As you add each new expander, the SAS domain name changes to the previous expander's SAS address.
ID	The lowest SAS address in the selected domain. When a new JBOD is discovered, a lower domain ID is assigned. The new SAS domain ID will display when the SAS Domain Details page refreshes.
Number of Expanders	The number of expanders associated with this SAS domain.
Number of End Devices	The total number of initiators and disks associated with this SAS domain.
Expanders	
SAS Address	The SAS address associated with each expander.
End Devices - Initiators	
SAS Address	The SAS address associated with each initiator.
End Devices - Disks	
Name	The name of each disk in the array.

TABLE 3-10 SAS Domain Details Page

Field	Description
Storage System Name	The name of the array associated with the SAS domain.
Storage System Type	The array model number. For example, J4400 or J4500.
Capacity	The disk capacity.
SAS Address	The SAS address associated with each disk.

SAS Domain Summary Page

This page provides information about currently registered SAS domains.

TABLE 3-11 describes the buttons and fields on the SAS Domain Summary Page.

TABLE 3-11 SAS Domain Summary Page

Field	Description
Name	The domain name of the selected SAS domain. Click the name link to view details of the selected domain and change the domain name.
ID	The domain ID of the selected domain. A new domain ID is assigned when you register a new JBOD. Note: To ensure a new JBOD is successfully registered, be sure to supply the required password at the time of registering.
Storage System Name	The name of the array associated with the SAS domain.
Number of Expanders	The number of expanders associated with the SAS domain.
Number of End Devices	The number of end devices, including initiators and disks, associated with the SAS domain.

CHAPTER 4

Configuration Tasks for RAID Arrays

This chapter provides information about storage configuration tasks for Oracle's Sun Storage and StorageTek 6000 series, StorageTek 2500 series, and FlexLine arrays. It contains the following sections:

Configuring Storage Profiles

This section describes configuring storage profiles. It contains the following topics:

About Storage Profiles

A storage profile is a set of attributes that you apply to a storage pool to allocate storage, instead of having to set each attribute individually. The system has a predefined set of storage profiles. The array comes with a number of preconfigured storage profiles to meet different requirements. You can choose a profile suitable for the application that is using the storage, or you can create a custom profile.

The array has a default storage profile with RAID-5 storage characteristics that is suitable for many storage applications. The default pool uses the default profile.

Note: For more information concerning RAID levels, see "RAID Levels" on page 143.

Each storage profile has the attributes described in TABLE 4-1.

TABLE 4-1 Storage Profile Settings

Parameter	Value or Variable Type	Description
Name	Up to 32 characters including A-Z, a-z, 0-9, - (dash), and _ (underscore). Spaces are not allowed.	Unique identifier for the storage profile.

TABLE 4-1 Storage Profile Settings *(Continued)*

Parameter	Value or Variable Type	Description
RAID Level	0, 1, 3, 5, 6	RAID level configured across all disks within a virtual disk. **Note**: RAID-6 is available for the Sun Storage 2530-M2, 2540-M2, 6180, 6580, and 6780, and StorageTek 6140, 2510, 2530, and 2540 arrays.
Segment Size	16 KB, 32 KB, 64 KB, 128 KB, 256 KB, 512 KB	Segment size for this profile.
Readahead	Enabled or Disabled	Read-ahead mode of the array. Read-ahead enables the controller to copy additional data blocks into cache while the controller reads and copies host requested data blocks from disk into cache.
Disk Type	ANY, FC, SATA, SAS, or SSD.	Disk type.
No. of Disks	• Variable for all RAID levels • 1 to 30 for RAID 3, 5 or 6 • 1 to 224 for RAID 0 or 1 • 1 to 448 if the license for 448 Drive support is enabled (available on Sun Storage 6580 and 6780 arrays only).	The number of disks to be grouped together in a virtual disk. For example, if you create a storage pool with a profile that has the number of disks parameter set to a number, all virtual disks that are part of that storage pool must have the same number of disks. If the number of disks parameter is set to the Variable value you are prompted for the number of disks when storage is added to the pool.

Standard Storage Profiles

The array includes the storage profiles described in TABLE 4-2.

Note: There are no standard storage profiles specific to the SSD drive type. For SSD drives, you can either select an existing profile with the "Any" Disk Type, or create a new profile using the "SSD" Disk Type.

TABLE 4-2 Standard Storage Profiles

Name	RAID Level	Segment Size	Read-Ahead Mode	Disk Type	No. of Disks
Default	RAID-5	512 KB	Enabled	Any	Variable
High_Capacity_Computing	RAID-5	512 KB	Enabled	SATA	Variable
High_Performance_Computing	RAID-5	512 KB	Enabled	FC	Variable
Mail_Spooling	RAID-1	512 KB	Enabled	FC	Variable
Microsoft_Exchange	RAID-5	32 KB	Enabled	FC	4
Microsoft_NTFS	RAID-5	64 KB	Enabled	Any	4
Microsoft_NTFS_HA	RAID-1	64 KB	Enabled	FC	Variable
NFS_Mirroring	RAID-1	512 KB	Enabled	FC	Variable
NFS_Striping	RAID-5	512 KB	Enabled	FC	Variable
Oracle_10_ASM_XvFS_HA	RAID-5	256 KB	Enabled	FC	5
Oracle_8_VxFS	RAID-5	128 KB	Enabled	FC	4
Oracle_9_VxFS	RAID-5	128 KB	Enabled	FC	4
Oracle_9_VxFS_HA	RAID-1	128 KB	Enabled	FC	Variable
Oracle_DSS	RAID-5	512 KB	Enabled	FC	Variable
Oracle_OLTP	RAID-5	512 KB	Enabled	FC	Variable
Oracle_OLTP_HA	RAID-1	512 KB	Enabled	FC	Variable
Random_1	RAID-1	512 KB	Enabled	FC	Variable
Sequential	RAID-5	512 KB	Enabled	FC	Variable
Sun_SAM-FS **Note**: This profile is for Sun Storage Archive Manager and Sun QFS (SAM/QFS).	RAID-5	128 KB	Enabled	Any	4

TABLE 4-2 Standard Storage Profiles *(Continued)*

Name	RAID Level	Segment Size	Read-Ahead Mode	Disk Type	No. of Disks
Sun_ZFS	RAID-5	128 KB	Enabled	Any	4
Sybase_DSS	RAID-5	512 KB	Enabled	FC	Variable
Sybase_OLTP	RAID-5	512 KB	Enabled	FC	Variable
Sybase_OLTP_HA	RAID-1	512 KB	Enabled	FC	Variable
VxFS	RAID-5	128 KB	Enabled	Any	4

Displaying Profile Information

You can display summary and detail information on existing storage profiles. You can also display summary information about pools and volumes associated with each storage profile.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Profiles.

   The Storage Profile Summary page is displayed.

3. Click a profile name for detailed information on that profile.

   The Storage Profile Details page for that profile is displayed.

4. Go to Related Information and click an item for more information associated with the selected profile.

   The Summary page for the selected item is displayed.

Creating a Storage Profile

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Profiles.

   The Storage Profile Summary page is displayed.

3. Click New.

   The New Storage Profile page is displayed.

4. Specify a name for the new profile, using a maximum of 32 characters including A-Z, a-z, 0-9, - (dash), and _ (underscore). Spaces are not allowed.

5. Specify a description for the new profile, using a maximum of 256 characters.

6. Specify the remaining profile attributes.

7. Review the specified information for the new storage profile. If you are satisfied, click OK.

Modifying a Storage Profile

You cannot modify the default factory profiles. If a profile's state is In Use, then you can change the profile name and description only. A profile is in the In Use state when it is associated with a storage pool.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. Expand the array you want to work with, and choose Profiles.

   The Storage Profile Summary page is displayed.

3. Click the storage profile that you want to modify.

   The Storage Profile Details page for the selected profile is displayed.

4. Make the appropriate modifications, and click OK.

Copying a Storage Profile

You can copy a profile to another array or other arrays.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Profiles.

   The Storage Profile Summary page is displayed.

3. Select the check box to the left of the storage profile that you want to copy.

   The Copy button is enabled.

4. Click Copy.

   The Copy Storage Profile page is displayed.

5. Select the array or arrays to which you want to copy the profile, and click OK.

Deleting a Storage Profile

You cannot delete the default factory profiles, nor can you delete a profile that is in the In Use state (associated with a storage pool).

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Profiles.

   The Storage Profile Summary page is displayed.

3. Select the check box to the left of the storage profile that you want to delete.

   This enables the Delete button.

4. Click Delete.

   The selected storage profile is removed from the Storage Profiles table.

Page and Field Descriptions

Browser interface pages and fields related to the "Configuring Storage Profiles" section are described in the following subsections:

Copy Storage Profiles Page

This page enables you to copy a profile or profiles to selected storage arrays.

TABLE 4-3 describes the fields on the Copy Storage Profiles page.

TABLE 4-3 Copy Storage Profiles Page

Field	Indicates
Name	The names of available storage arrays to which you can copy this profile.

Create New Storage Profile Page

This page enables you to create a new storage profile.

TABLE 4-4 describes the fields on the Create New Storage Profile page.

TABLE 4-4 Create New Storage Profile Page

Field	Indicates
Name	The profile name, which can consist of up to 32 characters including A-Z, a-z, 0-9, - (dash), and _ (underscore). Spaces are not allowed.
Description	A description for the new profile.

TABLE 4-4 Create New Storage Profile Page *(Continued)*

Field	Indicates
RAID Level	The redundant array of independent disks (RAID) level of the virtual disk: RAID-0 RAID-1 RAID-3 RAID-5 RAID-6 **Note:** RAID-6 is available for the Sun Storage 2530-M2, 2540-M2, 6180, 6580, and 6780, and StorageTek 6140, 2510, 2530, and 2540 arrays.
Segment Size	The associated segment size in kilobytes: 16 KB, 32 KB, 64 KB, 128 KB, 256 KB, or 512 KB. The segment size attribute can be set differently for each volume on an array.
Readahead Enabled	Whether the read-ahead attribute is enabled or disabled. The read-ahead attribute can be set differently for each volume on an array.
No. of Disks	The number of disks associated with this profile. This is the number of disk drives that are used to construct the virtual disk in a pool using this profile. The number of disks available varies, depending on the RAID level selected: • For RAID 0 and 1, you can specify 1 to 224 disks. If the license for 448 Drive support is enabled (available on Sun Storage 6580 and 6780 arrays only), then you can specify 1 to 448 drives. • For RAID 3, 5, and 6, you can specify 1 to 30 disks. • For all RAID levels, you can select Variable.
Disk Type	Specifies the disk type: ANY, FC, SATA, SAS, or SSD.

Storage Profile Details Page

This page displays detailed information about the selected profile, including the specific characteristics that the profile assigns to storage.

TABLE 4-5 describes the fields on the Storage Profile Details page.

TABLE 4-5 Storage Profile Details Page

Field	Indicates
Details	
Name	The profile name.

TABLE 4-5 Storage Profile Details Page *(Continued)*

Field	Indicates
Description	The profile description.
State	The profile state: • In Use - A pool exists that uses this profile. • Not In Use - No pools exist that use this profile. You cannot modify or delete profiles that are in use.
Type	The profile type: • User - The profile was created by a user. • Factory - The profile was provided as part of the system software.
RAID Level	The redundant array of independent disks (RAID) level of the virtual disk: RAID-0 RAID-1 RAID-3 RAID-5 RAID-6 **Note:** RAID-6 is available for the Sun Storage 2530-M2, 2540-M2, 6180, 6580, and 6780, and StorageTek 6140, 2510, 2530, and 2540 arrays. **Note:** When you assign RAID-1 to a virtual disk having more than two drives on arrays with two or more physical disks, the firmware automatically assigns RAID-1+0 to the virtual disk.
Segment Size	The associated segment size, in kilobytes: 16 KB, 32 KB, 64 KB, 128 KB, 256 KB, or 512 KB. The segment size attribute can be set differently for each volume on an array.
Readahead Enabled	Whether the read-ahead attribute is enabled or disabled. The read-ahead attribute can be set differently for each volume on an array.
No. of Disks	The number of disks associated with this profile. This is the number of disk drives that is used to construct the virtual disk in a pool using this profile. The number of disks available varies, depending on the RAID level selected: • For RAID 0 and 1, you can specify 1 to 224 disks. If the license for 448 Drive support is enabled (available on Sun Storage 6580 and 6780 arrays only), then you can specify 1 to 448 drives. • For RAID 3, 5, and 6, you can specify 1 to 30 disks. • For all RAID levels, you can select Variable.
Disk Type	The disk type: ANY, FC, SATA, SAS, or SSD.
Related Information	

TABLE 4-5 Storage Profile Details Page *(Continued)*

Field	Indicates
Storage Pools	The number of storage pools for which the profile is used.
Volumes	The number of volumes for which the profile is used.

Storage Profile Summary Page

This page displays information about all existing profiles. Click a profile name to see the profile details.

TABLE 4-6 describes the buttons and fields on the Storage Profile Summary page.

TABLE 4-6 Storage Profile Summary Page

Field	Indicates
New	Click to create a new storage profile.
Delete	Click to delete a selected storage profile. You cannot delete a factory-supplied profile.
Copy	Click to copy a storage profile. You cannot copy a factory-supplied profile.
Name	The profile name.
State	The profile state: • In Use - A pool exists that uses this profile. • Not In Use - No pools exist that use this profile. You cannot modify or delete profiles that are in use.
RAID Level	The redundant array of independent disks (RAID) level of the virtual disk: RAID-0 RAID-1 RAID-3 RAID-5 RAID-6 **Note:** RAID-6 is available for the Sun Storage 2530-M2, 2540-M2, 6180, 6580, and 6780, and StorageTek 6140, 2510, 2530, and 2540 arrays. **Note:** When you assign RAID-1 to a virtual disk having more than two disk drives on arrays with two or more physical disks, the firmware automatically assigns RAID-1+0 to the virtual disk.

TABLE 4-6 Storage Profile Summary Page *(Continued)*

Field	Indicates
Segment Size	The associated segment size, in kilobytes: 16 KB, 32 KB, 64 KB, 128 KB, 256 KB, or 512 KB. The segment size attribute can be set differently for each volume on an array.
Readahead	Whether the read-ahead attribute is enabled or disabled. The read-ahead attribute can be set differently for each volume on an array.
Disk Type	The disk type: ANY, FC, SATA, SAS, or SSD.
No. of Disks	The number of disks associated with this profile. This is the number of disk drives that is used to construct the virtual disk in a pool using this profile. The number of disks available varies, depending on the RAID level selected: • For RAID 0 and 1, you can specify 1 to 224 disks. If the license for 448 Drive support is enabled, then you can specify 1 to 448 drives. • For RAID 3, 5, and 6, you can specify 1 to 30 disks. • For all RAID levels, you can select Variable.

Configuring Storage Pools

This section describes configuring storage pools. It contains the following subsections:

About Storage Pools

A storage environment can be divided into storage pools. Each pool is associated with a profile that allows the storage pool to meet specific I/O requirements. Each array has a default pool that uses the default profile which implements RAID-5 storage characteristics.

The default pool satisfies most common storage requirements. The array also provides a set of storage profiles that satisfy certain I/O requirements which are optimal for the type of application to which they refer. If none of the factory profiles are suitable for your site's needs, you can create a custom storage profile. When you create a new storage pool, you assign a specific profile to it.

To see the current storage pools, go to the Storage Pool Summary page, as described in "Displaying Pool Information" on page 118.

Note: Removing a storage pool destroys all stored data in the pool and removes all volumes that are members of the pool. The data can be restored from backup after new storage pools are added, but it is far easier to avoid the data restoration in the first place. You cannot, however, remove the default storage pool.

Displaying Pool Information

You can display summary and detail information on existing storage pools. You can also display summary information about the virtual disks and volumes that are associated with each pool.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Pools.

   The Storage Pool Summary page is displayed.

3. Click a pool name for detailed information on that pool.

   The Storage Pool Details page for the selected pool is displayed.

4. Go to Related Information and click any item for more information associated with the selected pool.

   The Summary page for the selected item is displayed.

Creating a Storage Pool

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Pools.

   The Pool Summary page is displayed.

3. Click New.

   The Create New Storage Pool page is displayed.

4. Specify a name for the new pool, using a maximum of 32 characters including A-Z, a-z, 0-9, - (dash), and _ (underscore). Spaces are not allowed.

5. Enter a description of the new storage pool.

6. Select a storage profile for this pool, and click OK.

Modifying a Storage Pool

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Pools.

   The Storage Pool Summary page is displayed.

3. Click the storage pool that you want to modify.

   The Storage Pool Details page for that pool is displayed.

4. Make the appropriate modifications, and click OK.

Deleting a Storage Pool

You cannot delete the factory default storage pool. If a storage pool is in use, deleting that storage pool will also delete all volumes associated with the pool.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Pools.

3. Click the check box for the storage pool that you want to delete.

   This enables the Delete button.

4. Click Delete.

   The selected storage pool is no longer displayed in the Storage Pools table.

Page and Field Descriptions

Browser interface pages and fields related to the "Configuring Storage Pools" section are described in the following subsections:

Create New Storage Pool Page

This page enables you to create a new storage pool.

TABLE 4-7 describes the fields on the Create New Storage Pool page.

TABLE 4-7 Create New Storage Pool Page

Field	Description
Name	The storage pool name, which can consist of up to 32 characters including A-Z, a-z, 0-9, - (dash), and _ (underscore). Spaces are not allowed.
Description	A description of storage pool.
Storage Profile	The storage profile associated with this pool.

Storage Pool Details Page

This page displays storage details for the selected pool.

TABLE 4-8 describes the fields on the Storage Pool Details page.

TABLE 4-8 Storage Pool Details Page

Field	Description
Storage Pool Utilization	A graphical representation (pie chart) of the configured and available capacity of the storage pool
Volumes in Storage Pool	A graphical representation (bar chart) the volumes in the storage pool. Each colored stripe in the bar chart represents an individual volume in the storage pool.

TABLE 4-8 Storage Pool Details Page

Field	Description
Details	
Name	The storage pool name.
Description	A description of the storage pool.
Storage Profile	The storage profile associated with this pool.
State	The current state of the storage pool.
Total Capacity	The total capacity of all existing virtual disks which meet the settings of the pool.
Configured Capacity	The storage capacity of all volumes in this pool.
Available Capacity	The free capacity of all existing virtual disks that meet the settings of the pool, plus the total capacity of what the system believes the next new virtual disk candidate will be based on the pool's settings. This value is specific to the point in time that the Storage Pool Details page is requested and may fluctuate as volumes and virtual disks are created. This value is presented to provide the user with an idea of exactly how much storage would be available for volume creation if the wizard were to be invoked at that time, given the restriction that only one new virtual disk can be created when creating a new volume.
Related Information	
Volumes	The number of volumes in this pool.

Storage Pool Summary Page

This page displays information about one of the following, depending on how you navigated to it:

- If you chose Pools, in the navigation pane, it shows information about all pools configured on the array and enables you to create or delete pools.
- If you clicked Storage Pools in the Related Information section of the Storage Profile Details page, it lists the storage pools that are associated with the selected storage profile.

Click a pool name to view the details and related information for that pool.

TABLE 4-9 describes the buttons and fields on the Storage Pool Summary page.

TABLE 4-9 Storage Pool Summary Page

Field	Indicates
New	Click to create a new storage pool.
Delete	Click to remove a selected storage pool.
Name	The storage pool name.
Storage Profile	The storage profile associated with this pool.
State	The current state of the storage pool.
Used Percent	The percentage of the total capacity that is currently configured, represented as both a bar chart and a corresponding numeric value.
Total Capacity	The total capacity of all existing virtual disks which meet the settings of the pool.
Configured Capacity	The storage capacity of all volumes in this pool.
Available Capacity	The free capacity of all existing virtual disks that meet the settings of the pool, plus the total capacity of what the system believes the next new virtual disk candidate will be based on the pool's settings. This value is specific to the point in time that the Storage Pool Details page is requested and may fluctuate as volumes and virtual disks are created. This value is presented to provide the user with an idea of exactly how much storage would be available for volume creation if the wizard were to be invoked at that time, given the restriction that only one new virtual disk can be created when creating a new volume.

Configuring Storage Volumes

This section describes configuring storage volumes. It contains the following subsections:

About Volumes

Physical disks are managed as a pool of storage space for creating volumes. Volumes are containers into which applications, databases, and file systems can place data. Volumes are created from virtual disks based on the characteristics of the storage pool associated with them. Depending on your specifications, the array automatically allocates storage on a virtual disk.

For detailed information concerning the kinds of volumes that can be created, see "Volume Types" on page 123.

Volume Types

- **Standard volume** – The typical volumes users will access from data hosts, standard volumes are logical structures initially created on a storage array for data storage. During or after standard volume creation, you can map a host or host group to the volume to give the host or host group read/write privileges to the volume. Each host, including any host that is a member of a host group, must be assigned one or more initiators before the host or host group can be mapped to the volume.
- **Source volume** – A standard volume becomes a source volume when it becomes the source of data copied to a target volume. The source and target volumes maintain their association through a copy pair. When the copy pair is removed, the source volume reverts back to a standard volume.
- **Target volume** – A standard volume becomes a target volume when it becomes the recipient of data copied from a source volume. The source and target volumes maintain their association through a copy pair. When the copy pair is removed, the target volume reverts back to a standard volume.

- **Replicated volume** – A volume that participates in a replication set. A replication set consists of two volumes, each located on a separate array. After a replication set is created, the software ensures that the replicated volumes contain the same data on an ongoing basis.
- **Snapshot volume** – A point-in-time image of a standard volume, created with the snapshot feature. The standard volume on which a snapshot is based is also known as the base or primary volume.
- **Reserve volume** – Automatically created when you create a snapshot, the reserve volume stores information about the data that has changed since the snapshot was created. When you delete a snapshot, its associated reserve volume is also deleted.
- **Access volume** – This volume is used in a SAN environment for communication between in-band management software and the storage array. Automatically created, it uses LUN 31 (except for the Sun StorEdge 6130 array) and consumes 20 MB of storage space not available for application data storage. Access volumes are listed on the Mapping Summary page.

Volume Tasks

Once a volume has been created, the following tasks can be performed based on volume type, as shown in TABLE 4-10.

TABLE 4-10 Volume Tasks

	Volume Type				
	Standard	**Source**	**Target**	**Reserve**	**Access**
Map a volume to a host or host group	x	x	x	-	x
Unmap a volume from a host or host group	x	x	x	-	x
Create a volume snapshot	x	x	-	-	
Recopy a volume copy	-	-	x	-	
Copy a volume	x	x	x	-	
Remove a copy pair	-	-	x	-	
View performance statistics	x	x	x	-	
Delete the volume	x	x	x	-	

Planning Volumes

You can create up to 256 volumes on each virtual disk. Creating a volume involves a number of tasks and decisions about a variety of elements in your storage configuration. Therefore, before running the New Volume wizard to create a new volume, you should plan your storage configuration.

Required Information for Volumes

When you create a volume, be prepared to provide the following information:

- Volume name

  Provide a unique name that identifies the volume.

- Volume capacity

  Identify the capacity of the volume in megabytes, gigabytes, or terabytes.

- The storage pool for this volume

  By default, the management software supplies a default storage pool. This pool uses the default storage profile which implements RAID-5 storage characteristics that can be used in the most common storage environment. Other pools may have also been configured. Before you run the New Volume wizard, check the list of configured pools to see whether one of the pools has the storage characteristics you want. If a suitable pool does not exist, create a new pool using an existing or a new storage profile before you run the New Volume wizard.

- The way a virtual disk is selected

  A volume can be created on a virtual disk as long as the RAID level, the number of disks, and the disk type (FC, SATA, or SAS, depending on the array model) of the virtual disk match the storage profile associated with the volume's pool. The virtual disk must also have enough capacity for the volume. You must choose the method of determining which virtual disk will be used to create the volume. The following options are available:

  - **Automatic** – The management software automatically searches for and selects a virtual disk that matches the necessary criteria. If none are available, it creates a new virtual disk if enough space is available.
  - **Create Volume on an Existing Virtual Disk** – You manually select the virtual disks on which to create the volume from the list of all available virtual disks. Be sure that disks you select have enough capacity for the volume.

- **Create a New Virtual Disk** – You create a new virtual disk on which to create the volume. Be sure that the number of disks you select have enough capacity for the volume.

- Whether you want to map the volume now or later.

  You can add the volume to an existing storage domain, including the default storage domain, or create a new one by mapping the volume to a host or host group. A storage domain is a logical entity used to partition storage that allows a host or host group to have read/write access to the volume. The default storage domain contains all hosts and host groups without explicit mappings and enables them to share access to all volumes that are not explicitly mapped. If you choose to map the volume later, the management software automatically includes it in the default storage domain.

Managing Volumes

This section describes managing volumes. It contains the following subsections:

Displaying Volume Information

Summary and detailed information about existing storage volumes can be displayed, as well as information about mapped hosts, mapped host groups, and snapshots associated with each volume.

1. In the navigation pane, expand an array and choose Volumes.
2. In the Volume Summary page, click a volume name for detailed information.

3. In the Volume Details page, go to Related Information and click any item for more information associated with the selected volume.

   The Summary page for the selected item is displayed.

Displaying Volume Performance Statistics

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array for which you want to display volume performance statistics, and choose Volumes.

   The Volume Summary page for that array is displayed.

3. Click View Performance Statistics.

   The Performance Statistics Summary - Volumes page is displayed.

Creating a Volume

Before creating a volume, see "Planning Volumes" on page 125 to review the factors and decisions involved in volume creation.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array for which you want to create a volume and choose Volumes.

   The Volume Summary page for that array is displayed.

3. Click New.

   The New Volume wizard is displayed.

4. Follow the steps in the wizard. Click the Help tab in the wizard for more information.

Modifying a Volume

1. From the Storage Systems Summary page, expand an array and choose Volumes.
2. From the Volume Summary page, select a volume.
3. From the Volume Details page, modify the volume.
4. Click Save to save your changes or Cancel to reinstate all previously saved settings.

Copying Volume Information

You can copy an existing volume to a another existing standard volume.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.
2. In the navigation pane, expand the array for which you want to copy volume information, and choose Volumes.

   The Volume Summary page for that array is displayed.
3. Click a volume name for detailed information on that volume.

   The Volume Details page for the selected volume is displayed.
4. Click the Copy button.

   The Copy Volume page is displayed.
5. Select a copy priority.
6. Select a target volume for the copy, and click OK.

Mapping a Volume to a Host or Host Group

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.
2. In the navigation pane, expand the array you want to work with, and choose Volumes.

   The Volume Summary page for that array is displayed.

3. Click the check box to the left of the volume to which you want to map a host or host group.

   This enables the Map button.

4. Click Map.

   The Map Volume page displays a list of available hosts and host groups. Use the filter to display only hosts or host groups.

5. Select the host or host group to which you want to map this volume, and click OK.

   A message specifies that the selected volume was successfully mapped.

Expanding Volume Capacity

You can expand the capacity of a base volume that has snapshots associated with it.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Volumes.

   The Volume Summary page for that array is displayed.

3. Click the volume whose capacity you want to expand.

   The Volume Details page is displayed.

4. Click Expand.

   A message box displays information about volume expansion.

5. Click OK.

   The Expand Volume page displays the current capacity.

6. Specify the additional capacity you want, and click OK.

   A message specifies that dynamic volume expansion is in progress.

Unmapping a Volume From a Host or Host Group

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Volumes.

   The Volume Summary page for that array is displayed.

3. Click the volume that you want to unmap.

   The Volume Details page is displayed.

4. Click Delete.

   Upon completion of the unmapping process, a confirmation message is displayed.

Changing Controller Ownership of a Volume

It is possible to change a volume's controller ownership. Before doing so, review the following sections.

Automatic Volume Ownership Changes

The preferred controller owner for a volume is initially selected by the controller when a volume is created. Under certain circumstances, ownership of a volume is automatically shifted so that the alternate controller becomes the current owner. For example, if the controller tray that is the preferred controller owner is being replaced or undergoing a firmware download, ownership of the volumes is automatically shifted to the other controller tray, and that controller becomes the current owner of the volumes. There can also be a forced failover from the preferred controller to the other controller because of I/O path errors.

Manual Volume Ownership Changes

Additionally, you can manually change the current owner of a volume to improve performance. For example, you might want to change the controller ownership of one or more volumes if you notice a disparity in the total input/output per second (IOPS) of the controllers, such that the workload of one controller is heavy or is increasing over time while that of the other controller is lighter or more stable.

Note: You can change the controller ownership of a standard volume or a snapshot reserve volume. You cannot manually change the controller ownership of a snapshot volume because it inherits the controller owner of its associated base volume.

Redistributing Volumes

Use the Redistribute Volumes button to cause all volumes to return to their preferred controller owners.

How to Change Volume Controller Ownership

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Volumes.

   The Volume Summary page for that array is displayed.

3. Click the volume for which you want to change controller ownership.

   The Volume Details page is displayed.

4. In the Owning Controller field, select either A or B.

5. Click Save.

Deleting a Volume

Volumes can be easily deleted. Before deleting a volume, however, carefully read the following sections.

Associated Actions of Volume Deletion

- Deleting a volume that is mapped to a host or host group also causes the mappings to be deleted.
- Deleting a volume with snapshots also causes the snapshots to be deleted.
- Deleting a volume that is part of a replication set also causes the replication set to be deleted. The remote volume remains intact, however.
- If you are deleting the last volume in a virtual disk, the virtual disk is retained and you will be reminded to manually delete the virtual disk. If there are other volumes in the virtual disk, the storage space used by the deleted volume is converted to a free extent for future volume creation.

How to Delete a Volume

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Volumes.

   The Volume Summary page for that array is displayed.

3. Select the check box for the volume that you want to delete.

   This enables the Delete button.

4. Click Delete.

   The volume is removed from the Volume Summary table.

Page and Field Descriptions

Browser interface pages and fields related to the "Configuring Storage Volumes" section are described in the following subsections:

Copy Volume Page

This page enables you to copy an existing volume to a target volume and assign a copy priority to it.

TABLE 4-11 describes the buttons and fields on the Copy Volume page.

TABLE 4-11 Copy Volume Page

Field	Indicates
Select Copy Priority	The priority for this volume copy: Highest, High, Medium, Low, Lowest. The higher the priority, the more resources will be allocated at the expense of the storage array's performance.
Target Volume Candidates	
Name	The name of this volume.
State	The current state of the volume: Mapped or Free.
Condition	Whether the volume is in an optimal state or in an error condition.
Type	The volume type. Possible types that can serve as target volumes are: • Standard - A standard volume. • Replicated - A primary volume in a replication set.
Pool	The storage pool associated with this volume.
Security	The security status of this volume: • None: disk does not support data encryption services. • Enabled: security is enabled for this volume. • Disabled: security is not enabled for this volume.
PI	The protection information status of this volume: • Enabled: protection information is enabled. • Disabled: protection information is not enabled.
Capacity	The storage capacity that is currently allocated to this volume. The capacity is the usable size of the volume for data.

Expand Volume Page

This page enables you to expand the capacity of a volume.

TABLE 4-12 describes the fields on the Expand Volume page.

TABLE 4-12 Expand Volume Page

Field	Indicates
Modify Volume Capacity	
Current Capacity	The storage capacity that is currently allocated to this volume. The capacity is the usable size of the volume for data. You might need additional capacity for a snapshot reserve volume.
Capacity to Add	The additional storage capacity to allocate to this volume: % Base Volume, KB (default), MB, GB, TB, blocks.
Virtual Disk	
Name	The name of this virtual disk.
Available Capacity	The available storage capacity for this virtual disk.
Configured Capacity	The currently configured storage capacity for this virtual disk.
Total Capacity	The total storage capacity allocated to this virtual disk.
State	The current state of the volume: Initializing, Optimal.
RAID Level	0, 1, 3, 5, or 6 **Note:** RAID-6 is available for the Sun Storage 2530-M2, 2540-M2, 6180, 6580, and 6780, and StorageTek 6140, 2510, 2530, and 2540 arrays.
Disk Type	The type of disks in this volume: ANY, Fibre Channel, Serial Attached Technology Attachment (SATA), Serial Attached SCSI (SAS).

Mapped Initiators Page

This page shows the mappings between the volume and the members of the storage domain, down to the level of the individual initiator.

TABLE 4-13 describes the fields on the Mapped Initiators page.

TABLE 4-13 Mapped Initiators Page

Field	Indicates
Initiator	The name of the mapped initiator.
Initiator WWN	The World Wide Name of the initiator.
Host	The host to which this volume is mapped.
Host Group	The collection of hosts to which this volume is mapped.

Map Volumes Page

This page enables you to map a volume to a host or host group. Select the host or host group that you want to map to this volume.

TABLE 4-14 describes the fields on the Map Volumes page.

TABLE 4-14 Map Volumes Page

Field	Indicates
Name	The name of the host or host group that you want to map to this volume.
Type	The type of this named host or host group: Host, Host Group, Default Storage Domain.
LUN	The logical unit number (LUN) assigned to this mapping.

Performance Statistics - Volume Details Page

This page enables you to view performance statistics for the selected volume. In addition to a timestamp indicating the time at which the displayed performance statistics were collected, it displays the following statistics.

TABLE 4-15 describes the fields on the Performance Statistics - Volume Details page.

TABLE 4-15 Performance Statistics - Volume Details Page
Performance Statistics Summary - Volumes Page
Performance Statistics - Controller Details Page
Performance Statistics Summary - Controllers Page

Field	Description
Total IOPS	The total inputs and outputs per second (IOPS).
Average IOPS	The average number of inputs and outputs per second (IOPS).
Read %	The percentage of incoming data read.
Write %	The percentage of outgoing data sent.
Total Data Transferred	The total amount of data that was processed, in kilobytes per second.
Read	The amount of incoming data that was read, in kilobytes per second.
Average Read	The average amount of incoming data that was read, in kilobytes per second.
Peak Read	The peak amount of incoming data that was read, in kilobytes per second.
Written	The amount of outgoing data that was sent, in kilobytes per second.
Average Written	The average amount of outgoing data that was sent, in kilobytes per second.
Peak Written	The peak amount of outgoing data that was sent, in kilobytes per second.
Average Read Size	The average amount of incoming data that was read, in bytes.
Average Write Size	The average amount of outgoing data that was sent, in bytes.
Cache Hit %	The percentage of cache that is affected by the performance statistics data.

Performance Statistics Summary - Volumes Page

This page enables you to view performance statistics for all volumes. Next to each volume name, it displays the following statistics.

TABLE 4-16 describes the fields on the Performance Statistics Summary - Volumes page.

TABLE 4-16 Performance Statistics - Volume Details Page
Performance Statistics Summary - Volumes Page
Performance Statistics - Controller Details Page
Performance Statistics Summary - Controllers Page

Field	Description
Total IOPS	The total inputs and outputs per second (IOPS).
Average IOPS	The average number of inputs and outputs per second (IOPS).
Read %	The percentage of incoming data read.
Write %	The percentage of outgoing data sent.
Total Data Transferred	The total amount of data that was processed, in kilobytes per second.
Read	The amount of incoming data that was read, in kilobytes per second.
Average Read	The average amount of incoming data that was read, in kilobytes per second.
Peak Read	The peak amount of incoming data that was read, in kilobytes per second.
Written	The amount of outgoing data that was sent, in kilobytes per second.
Average Written	The average amount of outgoing data that was sent, in kilobytes per second.
Peak Written	The peak amount of outgoing data that was sent, in kilobytes per second.
Average Read Size	The average amount of incoming data that was read, in bytes.
Average Write Size	The average amount of outgoing data that was sent, in bytes.
Cache Hit %	The percentage of cache that is affected by the performance statistics data.

Volume Details Page

This page displays details about the selected volume.

TABLE 4-17 describes the fields on the Volume Details page.

TABLE 4-17 Volume Details Page

Field	Indicates
Replicate	Click to create a replication set that includes the selected volume. **Note**: This button is available only if the Data Replication premium feature is supported for your array type.
Map/Unmap	Click to map/unmap the volume to/from a host or host group.
Snapshot	Click to create a snapshot of the volume. **Note**: This button is not displayed for target volumes.
Copy	Click to create a volume copy. **Note**: This button is available only if the Volume Copy premium feature is supported for your array type.
Recopy	Click to recopy a volume copy. **Note**: This button is available only if the selected volume is a target volume in a volume copy pair. This button is available only if the Volume Copy premium feature is supported for your array type.
Expand	Click to expand the size of the volume.
View Performance Statistics	Click to view volume performance statistics.
Remove Copy Pair	Removes the association between the source volume and target volume. For more information, see Configuring Volume Copies. **Note**: This button is available only if the selected volume is a target volume in a volume copy pair.
Delete	Click to delete the volume.
Details	
Name	The name of this volume.
World Wide Name	The World Wide Name for this volume.
Source Name	For a target volume, the name of the associated source volume. **Note**: This field is available only if the Volume Copy premium feature is supported for your array type.
Type	The volume type: Standard, Source, Target, Snapshot, Reserve.
Capacity	The storage capacity that is allocated to this volume: KB, MB, GB (default), TB, blocks. The capacity is the usable size of the volume for data. You might need additional capacity for a snapshot reserve volume.

TABLE 4-17 Volume Details Page *(Continued)*

Field	Indicates
Virtual Disk	The number of virtual disks for this volume.
Pool	The storage pool associated with this volume.
RAID Level	The RAID level of the volume: 0, 1, 3, 5, or 6. **Note:** RAID-6 is available for the Sun Storage 2530-M2, 2540-M2, 6180, 6580, and 6780, and StorageTek 6140, 2510, 2530, and 2540 arrays.
Segment Size	The amount of data (in kilobytes) that the controller writes on a single physical disk in a volume before writing data on the next physical disk.
Read Ahead Enabled	Whether the read cache is enabled: True or False.
Write Cache Enabled	Whether the write cache is enabled: True or False.
Write Cache With Replication Enabled	Whether the write cache is enabled to be mirrored between controllers.
Write Cache Without Batteries Enabled	Whether the write cache is enabled without batteries.
Write Cache Active	Specifies whether the write cache is active.
Flush Cache After	The maximum amount of time that dirty data (data that has been cached, but not yet written to physical storage for the volume) can be maintained in cache before being flushed to physical storage.
Disk Scrubbing Enabled	By default, the disk scrubbing check for media consistency is enabled for this volume. However, disk scrubbing for the array must be enabled on the Administration page before this takes effect. In the navigation pane, expand Storage Systems Summary and choose an array to enable or disable disk scrubbing for the array. For details about disk scrubbing, see Enabling Disk Scrubbing.
Disk Scrubbing With Redundancy Enabled	Enable disk scrubbing with redundancy for this volume to check for media consistency. Disk scrubbing for the array must be enabled on the Administration page before this takes effect. In the navigation pane, expand Storage Systems Summary and choose an array to enable or disable disk scrubbing for the array. For details about disk scrubbing, see Enabling Disk Scrubbing.
State	The current state of the volume: Initializing, Ready.
Condition	Whether the volume is optimal or in an error condition.
Status	Whether the volume is online or offline.
Action	Whether or not the volume is ready.

TABLE 4-17 Volume Details Page *(Continued)*

Field	Indicates
Preferred Controller	For a standard volume, the controller of choice when both controllers are operational.
Owning Controller	The controller for this array: A or B.
Modification Priority	The priority according to which volume is to be modified, at the expense of I/O activity: Highest, High, Medium, Low, or Lowest.
Read Only	Specifies whether the target volume is read only. For more information, see Configuring Volume Copies. **Note**: This option is available only if the selected volume is a target volume in a volume copy pair.
Copy Priority	Specifies the copy priority for the volume copy. The highest priority rate supports the volume copy at the expense of I/O activity. The lowest priority rate supports I/O activity at the expense of volume copy speed. For more information, see Configuring Volume Copies. **Note**: This option is available only if the selected volume is a target volume in a volume copy pair.
Security	The security status of this volume: • None: volume is on a non-FDE drive. • Enabled: security is enabled for this volume. • Disabled: security is not enabled for this volume.
Disable Protection Information	Click the checkbox to disable protection information for this volume. A volume is PI enabled if the virtual disk or all disks support protection information. Once you disable protection information for a volume, the volume is not protected and you cannot re-enable for that volume.
Application Tag Ownership	The component that provides the contents of the application tag field. Values are Host, Controller, N/A.
Related Information	
Mapped Initiators	The number of mapped initiators for this volume.
Replication Sets	The number of replication sets for this volume.
Snapshots	The number of snapshots for this volume.
Targets	The number of targets associated with the volume.

Volume Summary Page

This page displays information about one of the following, depending on how you navigated to it:

- If you chose Volumes in the navigation pane, it displays information about all storage volumes.
- If you clicked Volumes in the Related Information section of a component Details page, it lists the volumes associated with that component.

From the Volume Summary page, you can:

- Create a new volume
- Map a volume to a host or host group
- Delete a volume
- View performance statistics for each volume on the array

Click an individual volume name to see volume details.

You can also filter the volume listings by pool, thereby showing only those volumes that are associated with that pool.

TABLE 4-18 describes the buttons and fields on the Volume Summary page.

TABLE 4-18 Volume Summary Page

Field	Indicates
New	Click to launch the Create Volume wizard.
Map	Click to map the selected volume to a host or host group.
Delete	Click to delete the selected volume.
View Performance Statistics	Click to view volume performance statistics for each volume on the array.
Name	The volume name.
State	The current state of the volume: Mapped or Free. If the state of the volume is mapped, view the mappings from Volume Details > Related Information. Click one of the links to view mapped initiators, snapshots, replication sets, or targets.
Condition	Whether the volume is in an optimal state or in an error condition.

TABLE 4-18 Volume Summary Page

Field	Indicates
Type	The volume type. Possible types are: • Standard - A standard volume. • Source - A source volume in a copy pair. • Target - A target volume in a copy pair. • Source,Target - A volume that is a source volume in one copy pair, and a target volume in another copy pair. • Replicated - A volume that participates in a replication set.
Security	The security status of this volume: • Enabled: security is enabled for this volume. • Disabled: security is not enabled for this volume.
PI	The protection information status of this volume. Enabled: protection information is enabled for this volume. Disabled: protection information is not enabled for this volume.
Virtual Disk	The virtual disk that is associated with this volume.
Pool	The storage pool associated with this volume.
Capacity	The storage capacity that is allocated to this volume. The capacity is the usable size of the volume for data. You might need additional capacity for the snapshot reserve volume.
WWN	The World Wide Name associated with the volume.

Configuring Virtual Disks

This section describes configuring virtual disks. It contains the following topics:

About Virtual Disks

A virtual disk is a group of logical disks defined by a particular redundant array of independent disks (RAID) level. While they can be created and removed directly, they are typically indirectly created or removed through the process of creating or deleting volumes or snapshots, subject to a volume's storage profile.

Note: Disk drives participating in the virtual disk must all be the same type, either Serial Advanced Technology Attachment (SATA), Fibre Channel (FC), Serial Attached SCSI (SAS), or Solid State Drive (SSD).

RAID Levels

Redundant array of independent disks (RAID) systems make the data on many disks available as a single array to file servers, hosts, or the network, and use two or more drives in combination for fault tolerance and performance. Disk drives within an array tray are grouped together into RAID sets (virtual disks) according to RAID level. RAID level affects data throughput and availability by determining how data is stored.

TABLE 4-19 provides details on all supported RAID levels.

TABLE 4-19 RAID Level Descriptions

RAID Level	What It Does	Advantages or Disadvantages
RAID-0	Stripes data across multiple disks but without redundancy.	Improves performance but does not deliver fault tolerance.
RAID-1	Mirrors a disk so that all data is copied to a separate disk.	Provides high levels of redundancy but not high performance.
RAID-1+0	Combines disk mirroring (RAID-1) with disk striping (RAID-0). **Note**: Configuring RAID-1 with four or more drives will automatically create a RAID-1+0 virtual disk. Sun Storage Common Array Manager reports a RAID-1+0 virtual disk as RAID-1.	Combines high performance and high levels of redundancy.
RAID-3	Stripes data at the byte level across multiple disks while writing the stripe parity to a parity disk. Parity is checked when data is read.	Provides high throughput for a single streamed file.
RAID-5	Stripes data at the block level and provides stripe error correction (parity checking) information. Parity checking specifies that redundant information (parity bits) is written across multiple disks. **Note**: The minimum number of drives is three.	Provides excellent performance and good fault tolerance. If a disk fails, lost information is recreated with parity bits. Because parity information is spread across multiple disks, efficiency of available storage space is improved.
RAID-6	Stripes data at the block level and provides stripe error correction (parity checking) information, but with an additional parity block. Two parity blocks are distributed across all member disks. **Note**: The minimum number of drives is five.	Provides improved reliability over RAID-5 but with a slight impact on performance.

Secure Virtual Disks

The Sun Storage Data Encryption Services feature provides for the creation of secure virtual disks, which are composed entirely of encrypted drives. Encryption of the data is performed by the drive controller. An array lock key must be set before you can create a secure virtual disk.

All of the drives in a security capable virtual disk are security capable, but security is not enabled. This attribute of the virtual disk is used to define drive candidates for creation of drives groups and spare drives for use in a virtual disk that you would like to make secure at some later time through secure virtual disk conversion.

Displaying Virtual Disk Information

You can display summary, virtual disk utilization, and detail information on existing virtual disks. You can also display summary information about the disk drives and volumes associated with each virtual disk.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array for which you want to display virtual disk information, and choose Virtual Disks.

   The Virtual Disk Summary page is displayed.

3. Click a virtual disk name for detailed information on that virtual disk.

   The Virtual Disk Details page for the selected virtual disk is displayed.

4. Go to Related Information and click any item for more information associated with the selected virtual disk.

   The Summary page for the selected item is displayed.

Rules for Expanding Virtual Disks

- **RAID-0**—Up to 30 disk drives with 06 level firmware and 224 disk drives with 07 level firmware. A minimum of one disk drive is required for virtual disk expansion.
- **RAID-1**—Up to 30 disk drives with 06 level firmware and 224 disk drives with 07 level firmware. A minimum of two disk drives are required for virtual disk expansion.
- **RAID-3, RAID-5, and RAID-6**—Up to 30 disks. A minimum of one disk drive is required for virtual disk expansion.
- **All RAID levels**—Maximum of two disk drives can be used for virtual disk expansion at a time.

When you expand a virtual disk, its disk drives must be of the same size. Similarly, the disk drives must be of the same type. The different types of disk drives are:

- Serial Advanced Technology Attachment (SATA)
- Fibre Channel (FC)
- Serial Attached SCSI (SAS)
- Solid State Drive (SSD)

Expanding a Virtual Disk

You can expand the size of a virtual disk if there are sufficient unassigned disks and the virtual disk is online and ready.

1. From the Storage Systems Summary page, expand an array and choose Virtual Disks.
2. From the Virtual Disk Summary page, select a virtual disk.
3. From the Virtual Disk Details page, click Expand to see the disks available for virtual disk expansion.
4. From the Expand Virtual Disk page, select the disks you want to include in the virtual disk expansion.
5. Click OK.

   The Virtual Disk Details page is refreshed, and a message confirms the virtual disk expansion.

Defragmenting a Virtual Disk

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Virtual Disks.

   The Virtual Disk Summary page is displayed.

3. Click the name of the virtual disk that you want to defragment.

   The Virtual Disk Details page for that virtual disk is displayed.

4. Click Defragment.

The Virtual Disk Details page is refreshed, and a message confirms that the defragmentation process has successfully started.

Moving a Virtual Disk Between Arrays

For the Sun Storage 6180, 6580, 6780 arrays and StorageTek 6140, 6540, FLX380 arrays only, Sun Storage Common Array Manager provides the ability for a storage administrator to move a virtual disk between storage arrays by performing the following tasks:

1. Logically export a virtual disk from the source storage array.
2. Physically remove the disk drives that comprise the virtual disk from the source storage array and insert them into the destination storage array.
3. Logically import the virtual disk into the destination storage array.

The virtual disk should be exported before the disk drives that comprise the virtual disk are moved and the virtual disk is imported into the destination array. Failure to follow this recommended sequence of events may leave the virtual disk and its constituent volumes inaccessible.

For detailed instructions about how to port a virtual disk from one array to another, refer to Service Advisor.

Deleting a Virtual Disk

1. In the navigation pane, expand an array and choose Virtual Disks.
2. In the Virtual Disk Summary page, place a check mark in the box next to the names of the virtual disks that you want to delete and click Delete.

Page and Field Descriptions

Browser interface pages and fields related to the "Configuring Virtual Disks" section are described in the following subsections:

- "Disk List Page" on page 148
- "Expand Virtual Disk Page" on page 150
- "Virtual Disk Details Page" on page 151
- "Virtual Disk Summary Page" on page 153

Disk List Page

This page displays a summary of the disk drives in this virtual disk.

TABLE 4-20 describes the fields on the Disk List page.

TABLE 4-20 Disk List Page
Expand Virtual Disk Page

Field	Indicates
Name	The name of the disk.
Tray	The tray associated with this disk.
Role	The role of the disk: • Array Spare • Data Disk • Unassigned
Virtual Disk	The virtual disk associated with this disk.

TABLE 4-20 Disk List Page
Expand Virtual Disk Page *(Continued)*

Field	Indicates
State	The state of the disk: • Not in Use • In Use
Status	The status of the disk: • Unknown • Other • OK • Degraded • Offline • Online • Uninitialized
Security	The security status of this virtual disk: • None: virtual disk does not support data encryption services. • Enabled: security is enabled for this virutal disk. • Disabled: security is not enabled for this virtual disk. • Locked: disk is locked and requires a pass phrase to unlock.
PI	• Capable: virtual disk supports protection information. • None: virtual disk does not support protection information. If the virtual disk you are expanding is protected, only PI capable disks are displayed.
Capacity	The total capacity of this disk.
Type	The type of disk this is: All, SCSI, Fibre Channel, SATA, or SSD.
Firmware	Firmware version of this disk drive.

Expand Virtual Disk Page

This page displays a summary of the disks available for the expansion of this virtual disk.

TABLE 4-21describes the fields on the Expand Virtual Disk page.

TABLE 4-21 Disk List Page
Expand Virtual Disk Page

Field	Indicates
Name	The name of the disk.
Tray	The tray associated with this disk.
Role	The role of the disk: • Array Spare • Data Disk • Unassigned
Virtual Disk	The virtual disk associated with this disk.
State	The state of the disk: • Not in Use • In Use
Status	The status of the disk: • Unknown • Other • OK • Degraded • Offline • Online • Uninitialized
Security	The security status of this virtual disk: • None: virtual disk does not support data encryption services. • Enabled: security is enabled for this virutal disk. • Disabled: security is not enabled for this virtual disk. • Locked: disk is locked and requires a pass phrase to unlock.
PI	• Capable: virtual disk supports protection information. • None: virtual disk does not support protection information. If the virtual disk you are expanding is protected, only PI capable disks are displayed.
Capacity	The total capacity of this disk.
Type	The type of disk this is: All, SCSI, Fibre Channel, SATA, or SSD.

TABLE 4-21 Disk List Page
Expand Virtual Disk Page *(Continued)*

Field	Indicates
Firmware	Firmware version of this disk drive.

Virtual Disk Details Page

This page displays details about the selected virtual disk.

TABLE 4-22 describes the buttons and fields on the Virtual Disk Details page.

TABLE 4-22 Virtual Disk Details Page

Field	Indicates
Expand	Click to expand the capacity of this virtual disk.
Defragment	Click to defragment this virtual disk.
Revive	Revives the virtual disk. If one or more disk drives in a virtual disk are in the failed state, you can recover from this failure by reviving the virtual disk. Reviving a virtual disk automatically revives the failed disk drives included in the virtual disk. **Caution**: Contact My Oracle Support (https://support.oracle.com/) before you attempt a revive procedure. This is a volatile operation and should be performed under the direct supervision of a Support representative. **Note**: Arrays using firmware version 7.x do not have the Revive option.
Offline	Places the virtual disk offline. Placing a virtual disk offline disables the virtual disk. **Note**: Arrays using firmware version 7.x do not have the Offline option.
Delete	Click to delete this virtual disk.
Virtual Disk Utilization	A graphical representation (pie chart) of the used and available virtual disk capacity displayed.
Volumes on Virtual Disk	A graphical representation (bar chart) of the names and capacities of the volumes configured on the virtual disk.
Details	
Name	The name assigned to this virtual disk.

TABLE 4-22 Virtual Disk Details Page *(Continued)*

Field	Indicates
Status	The virtual disk status. Possible values vary by firmware version. For arrays running firmware prior to version 07.xx.xx.xx, possible values are: • Failed • Impaired • Online • Degraded • Uninitialized • Optimal • Offline For arrays running firmware version 07.xx.xx.xx and beyond, possible values are: • Optimal • Degraded • Exported • Forced • Failed • Missing
State	Whether the device is ready.
Disk Type	The disk type: FC, SATA, SAS, or SSD.
Security State	The security status of this virtual disk: • None: virtual disk does not support data encryption services. • Enabled: security is enabled for this virtual disk. • Disabled: security is not enabled for this virtual disk.
Security Enabled	Click this checkbox to enable security for this virtual disk and click the Save button.
Protection Information	The Protection Information status of this virtual disk. • Capable: virtual disk consists of all disks that support protection information. • None: virtual disk does not consist of all or any protection information supported disks.
Hot Spare Coverage	• Yes: a suitable hot-spare disk exists for the failed disk. • No: the hot spare pool does not have a suitable disk to be used as a substitute for the failed disk. See the array's Administration Details page to determine disk types that are designated as array hot spares.

TABLE 4-22 Virtual Disk Details Page *(Continued)*

Field	Indicates
RAID Level	The redundant array of independent disks (RAID) level of the virtual disk: • RAID-0 • RAID-1 • RAID-3 • RAID-5 • RAID-6 **Note:** RAID-6 is available for the Sun Storage 2530-M2, 2540-M2, 6180, 6580, and 6780 arrays, and StorageTek 6140, 2510, 2530, and 2540 arrays. **Note**: Sun Storage Common Array Manager reports a RAID-1+0 virtual disk as RAID-1. For more information, see "RAID Levels" on page 143.
Total Capacity	The total capacity for the virtual disk.
Configured Capacity	The total configured capacity for the virtual disk.
Available Capacity	The total remaining available capacity for the virtual disk.
Maximum Volume Size	The maximum size of a volume that can be created from this virtual disk.
Related Information	
Disks	The number of disk drives in this virtual disk.
Volumes	The number of volumes on this virtual disk.
Snapshot Reserve Volumes	The number of snapshot reserve volumes on this virtual disk.

Virtual Disk Summary Page

This page displays information about the current virtual disks. Click a name to view details for that virtual disk.

TABLE 4-23 describes the buttons and fields on the Virtual Disk Summary page.

TABLE 4-23 Virtual Disk Summary Page

Field	Indicates
New	Click to create a new virtual disk.
Delete	Click to delete selected virtual disks.
Name	The name of the virtual disk.

TABLE 4-23 Virtual Disk Summary Page *(Continued)*

Field	Indicates
Status	The virtual disk status. Possible values vary by firmware version. For arrays running firmware prior to version 07.xx.xx.xx, possible values are: • Failed • Impaired • Online • Degraded • Uninitialized • Optimal • Offline For arrays running firmware version 07.xx.xx.xx and beyond, possible values are: • Optimal • Degraded • Exported • Forced • Failed • Missing
State	The state of the virtual disk: • Hot spare copyback is in progress • Initializing • Reconstructing data • Dynamic capacity expansion is in progress • Dynamic RAID migration is in progress • Dynamic RAID migration and capacity expansion is in progress • Dynamic segment sizing is in progress • Dynamic volume expansion is in progress • Dynamic volume capacity expansion is in progress • An internal move due to capacity expansion is in progress • Defragmentation is in progress • Formatting • The volume is synchronizing • Ready
Disk Type	The disk type: FC, SATA, SAS, or SSD.

TABLE 4-23 Virtual Disk Summary Page *(Continued)*

Field	Indicates
RAID Level	The redundant array of independent disks (RAID) level of the virtual disk: • RAID-0 • RAID-1 • RAID-3 • RAID-5 • RAID-6 **Note:** RAID-6 is available for the Sun Storage 2530-M2, 2540-M2, 6180, 6580, and 6780, and StorageTek 6140, 2510, 2530, and 2540 arrays. **Note**: Sun Storage Common Array Manager reports a RAID-1+0 virtual disk as RAID-1. For more information, see "RAID Levels" on page 143.
Used Percent	The graphical representation (bar chart) of the configured capacity of the virtual disk, displayed as a percentage of the virtual disk's total capacity.
Total Capacity	The total available capacity for the virtual disk.
Configured Capacity	The total configured capacity for the virtual disk.
Maximum Volume Size	The maximum size of a volume that can be created from this virtual disk.
Security	The security status of this virtual disk: • None: virtual disk does not support data encryption services. • Enabled: security is enabled for this virtual disk. • Disabled: security is not enabled for this virtual disk.
PI	The protection information status of the drives included in this virtual disk. • Capable: virtual disk consists of all disks that support protection information. • None: virtual disk does not consist of all PI supported disks.
Hot Spare Coverage	• Yes: a suitable spare exists for the failed disk. • No: the hot spare pool does not have a suitable disk to be used as a substitute for the failed disk. See the array's Administration Details page to determine disk types that are designated as array hot spares.

Configuring Host Groups and Hosts

This section describes configuring host groups and hosts. It contains the following topics:

About Host Groups

A host group is a collection of one or more data hosts. The hosts in a host group access a storage array volume when the host group and the specified volume are included in a storage domain, which is a logical entity used to partition storage.

When you create a host group, the management software automatically includes it in the default storage domain. The default storage domain contains all hosts and host groups without explicit mappings and enables them to share access to volumes assigned a default logical unit number (LUN) mapping during volume creation.

When you explicitly map a host group to a specific volume and LUN, the host group and volume are removed from the default storage domain and create a separate storage domain, which enables only the hosts in the group to share access to the specified volume.

A host group can be mapped to up to 256 volumes or snapshots.

A host can be a member of a host group. As a member of the group, the host has access to all volumes that are mapped to the host group, in addition to any volumes that are mapped directly to the host. For example, suppose that Host 1 is mapped to volume1, volume2, and volume3 and Host Group A is mapped to volume4 and volume5. If we add Host 1 to Host Group A, Host 1 now has access to volume1, volume2, volume3, volume4, and volume5.

Server clusters must use host groups so that all the servers can share access to the same volumes. But, servers in a host group do not necessarily need to run clustering software. Keep in mind, however, that without file sharing or clustering software, all servers in a host group can access the same volumes, which can lead to data

integrity issues, multi-pathing issues, and array instability. Oracle recommends the use of file sharing or clustering software on all servers in a host group that can access the same volumes.

Managing Host Groups

The following topics describe management of host groups:

Displaying Host Group Information

You can display summary and detail information on existing host groups. You can also display summary information about the hosts and volumes that are associated with each host group.

To display information on host groups:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Expand Physical Devices and choose Host Groups.

   The Host Group Summary page is displayed.

4. Click a host group name for detailed information on that host group.

   The Host Group Details page for the selected host group is displayed.

5. Go to Related Information and click any item for more information associated with the selected host group.

   The Summary page for the selected item is displayed.

Creating a Host Group

When you create a host group, it is automatically included in the default storage domain.

1. Click Sun Storage Common Array Manager.
2. In the navigation pane, expand the array you want to work with.
3. Expand Physical Devices and choose Host Groups.

   The Host Group Summary page is displayed.
4. From the Host Group Summary page, click New.

   The New Host Group page is displayed.
5. In the New Host Group page: specify a name for the new host name, using a maximum of 30 characters including A-Z, a-z, and _(underscore). Spaces are not allowed in the host group name.
6. Specify which of the available hosts you want to add to the group: Double-click the host name or names., and then click Add All to add all of the hosts defined on the storage array to the host group.

   Note: A host can be in at most one host group at a time. If a host is already included in one host group, adding that host to another host group will move the host from one group to the other.
7. Click OK.

   The Host Group Summary page is displayed listing the new host group.

Note: You can also create a host group from the Create New Initiator wizard.

Adding/Removing Host Group Members

A host can be a member of at most one host group. To move a host from one host group to another, you must first remove it from its current host group before you can add it to another host group.

If a host is mapped to one or more volumes and you move the host from one host group to another, the mappings specific to the host are retained but mappings associated with the host group from which the host was moved are not retained. Instead, the host inherits any mappings associated with the new host group to which it is moved.

If you move a host from a host group that has no mappings and that has host members without specific mappings, the host group and hosts are moved to the default storage domain.

For example, suppose that two host groups are created on an array, Host Group 1 and Host Group 2. Host Group 1 has three member hosts: Host1, Host2, and Host3. Host Group 1 has no mappings, and Host1 is the only of its hosts with any mappings. Host Group 2 has two member hosts: Host4 and Host5. Host Group 2 is mapped to one volume, and Host4 and Host5 have no specific mappings.

When you move Host1 from Host Group 1 to Host Group 2, the following occurs:

- Host1 keeps its specific mappings and inherits the mapping associated with Host Group 2.
- Host Group 1, Host2, and Host3 become part of the default storage domain, because they have no specific mappings.
- Host4 and Host5 are unaffected because they have no specific mappings.

To add hosts to or remove hosts from a host group:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Expand Physical Devices and choose Host Groups.

   The Host Group Summary page is displayed.

4. Click the name of the host group that you want to modify.

   The Host Group Details page is displayed.

5. Click Add/Remove Members.

   The Add/Remove Host Group Members page is displayed.

6. Specify which of the available hosts you want to add to or remove from the group. To move an individual host, double-click the host name. To add all of the available hosts to the host group, click Add All. To remove all of the selected hosts from the host group, click Remove All.

7. Click OK.

   The Host Group Summary page is displayed with the updated information.

Deleting a Host Group

Deleting a host group will also delete all associated hosts and all associated initiators. In addition, all associated volume and snapshot mappings will be removed.

To delete a host group:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Expand Physical Devices and choose Host Groups.

   The Host Group Summary page is displayed.

4. Select the check box net to the name of the host group that you want to delete.

   This enables the Delete button.

5. Click Delete.

   The Host Group Summary page is displayed with the updated information.

Mapping a Host Group to a Volume

Before you can map a host group to one or more volumes, the host group must have at least one host associated to at least one initiator.

When you explicitly map a host group to a volume, the management software removes the host group and specified volume from the default storage domain and creates a separate storage domain.

To map a host group to one or more volumes:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Expand Physical Devices and choose Host Groups.

   The Host Group Summary page is displayed.

4. Click the name of the host group that you want to map.

   The Host Group Details page is displayed.

5. Click Map.

The Map Host Group page is displayed.

Note: The Map button is disabled when 256 volumes are assigned to the selected host group.

6. Select the check box next to the names of one or more volumes that you want to map to this host group.
7. From the drop-down menu, select the logical unit number (LUN) for each volume that you want to map to this host group. Note that the number of LUNs supported varies according to the array type and operating system.
8. Click OK.

   The management software maps the volume to the host group and displays the Host Group Details page with the updated information.

Unmapping a Host Group From a Volume

Unmapping a host group from a volume removes the mapping between the volume and the host group (including all host group members). The volume is moved to an unmapped state. If this mapping was the last mapping to the host group and there are no other volume mappings to the hosts in the host group, this host group and all its members become part of the default storage domain.

To unmap a host group from a volume:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.
2. In the navigation pane, expand the array you want to work with.
3. Expand Physical Devices and choose Host Groups.

   The Host Group Summary page is displayed.
4. Click the name of the host group that you want to unmap.

   The Host Group Details page is displayed.
5. Click Unmap.

   The Mapped Volumes and Snapshots page is displayed.
6. Select the check box next to volume or volumes that you want to unmap from this host group.
7. Click OK.

About Hosts

A host represents a data host, which is a server that is attached to the storage array and generates data to be saved in a storage array. The data host sends data to the storage array using a Fibre Channel (FC) connection. A host must have one or more associated initiators to enable you to map volumes to the host.

A host can access a storage array volume when both the host and the volume are included in a storage domain, which is a logical entity used to partition storage.

When you create a host, the management software automatically includes it in the default storage domain. The default storage domain contains all hosts and host groups without explicit mappings and enables them to share access to volumes assigned a default logical unit number (LUN) mapping during volume creation. When you explicitly map a host to a specific volume and LUN, the host and volume are removed from the default storage domain and create a separate storage domain, which enables only that host to access the specified volume.

An individual host can be explicitly mapped to one volume. A host can also be a member of a host group. As a member of the group it has access to all volumes that are mapped to the hostgroup, in addition to any volumes that are mapped directly to the host. For example, Host 1 is mapped to volume1, volume2, and volume3 and Hostgroup A is mapped to volume4 and volume5. If we add Host 1 to Hostgroup A, Host 1 now has access to volume1, volume2, volume3, volume4, and volume5.

Managing Hosts

The following topics describe management of hosts.

Displaying Host Information

You can display summary and detail information on existing hosts. You can also display summary information about the initiators and volumes that are associated with each host.

To display information on hosts:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Expand Physical Devices and choose Host.

   The Host Summary page is displayed.

4. Click a host name for detailed information on that host.

   The Host Details page for the selected host is displayed.

5. Go to Related Information and click any item for more information associated with the selected host.

   The Summary page for the selected item is displayed.

Creating a Host

When you create a host, you are associating a host name with which to identify a data host to the array; you are not creating a host on the network. By default, the new host is included in the default storage domain.

To create a new host:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Expand Physical Devices and choose Host.

   The Host Summary page is displayed.

4. Click New.

   The Create New Host page is displayed.

5. Specify a name for the new host, using a maximum of 30 characters including A-Z, a-z, and _(underscore). Spaces are not allowed in the storage profile name.

6. Optionally select a host group for the new host if you want the new host to share access to the volume with the other hosts in the group.
7. Click OK.

   The host is created and the Host Summary page is displayed, listing the new host.

Note: You can also create a host from the Create New Initiator wizard.

Deleting a Host

Deleting a host will delete all associated initiators and remove all mappings to volumes and snapshots associated with the host.

To delete a host:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.
2. In the navigation pane, expand the array you want to work with.
3. Expand Physical Devices and choose Host.

   The Host Summary page is displayed.
4. Select the check box next to name of the host that you want to delete.

   The Delete button becomes active.
5. Click Delete.

Mapping a Host to a Volume

Up to 256 volumes can be explicitly mapped to an individual host You can also include the same host in one or more host groups which are mapped to other volumes.

Before you map a host to a volume, make sure that it is associated with an initiator.

To map a host to a volume:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.
2. In the navigation pane, expand the array you want to work with.
3. Expand Physical Devices and choose Host.

The Host Summary page is displayed.

4. Click the name of the host that you want to map.

   The Host Details page is displayed.

5. Click Map.

   The Map Host page is displayed.

   Note: The Map button is disabled when maximum number of volumes are assigned to the selected host.

6. Click the name of the volume that you want to map to the host.

7. From the drop-down menu, select the logical unit number (LUN) of this volume to map to the host. Note that the number of LUNs supported varies according to the array type and operating system.

8. Click OK.

   A confirmation message is displayed.

Unmapping a Host From a Volume

Unmapping a host from a volume removes the mapping between the host and the volume. The volume is moved to the unmapped state.

If this mapping was the last mapping to the host and the host is not a member of a host group, this host becomes part of the default storage domain.

If this mapping was the last mapping to the host and the host is member of a host group and there are no other explicit mappings to the host group or any other host in the host group, then this host group and all of its members become part of the default storage domain.

To unmap a host from a volume:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Expand Physical Devices and choose Host.

   The Host Summary page is displayed.

4. Click the name of the host that you want to unmap.

   The Host Details page is displayed.

5. Click Unmap.

The Mapped Volumes and Snapshots page is displayed.

6. Click the volume that you want to unmap from this host.
7. Click OK.

   A confirmation message is displayed.

Page and Field Descriptions

Browser interface pages and fields related to the "Configuring Host Groups and Hosts" section are described in the following subsections:

Add/Remove Host Group Members Page

This page enables you to add or remove host group members.

TABLE 4-24 describes the fields on the Add/Remove Host Group Members page.

TABLE 4-24 Add/Remove Host Group Members Page

Field	Description
Hosts	Double-click the names of available hosts you want to add to or remove from the host group. Click Add All to add all of the hosts defined on the storage array to the host group.

Create New Host Page

This page enables you to specify a new host.

TABLE 4-25 describes the fields on the Create New Host page.

TABLE 4-25 Create New Host Page

Field	Description
Name	The name of the host, which can consist of up to 30 characters including A - Z, a - z, and _ (underscore). Spaces are not allowed.
Host Group	The host group to be associated with this host.

Host Details Page

This page enables you to map or unmap the selected host, and displays details for the host.

TABLE 4-26 describes the buttons and fields on the Host Details page.

TABLE 4-26 Host Details Page

Field	Indicates
Map	Click to map the host to a volume. The Map button is disabled when 256 volumes are assigned to the selected host.
Unmap	Click to unmap the host from a volume.
Details	
Name	The host name.
Host Group	The host group associated with this host.
PI Access Method	The host protection information access method: • Capable: host has a PI-capable access method. • None: host does not have a PI-capable access method.
Related Information	
Initiators	The number of initiators associated with this host.
Mapped Volumes and Snapshots	The number of volumes and snapshots mapped to this host.

Host Group Details Page

This page enables you to map or unmap the selected host group, and displays details for the host group.

TABLE 4-27 describes the buttons and fields on the Host Group Details page.

TABLE 4-27 Host Group Details Page

Field	Description
Add/Remove Members	Click to add hosts to or remove hosts from the host group.
Map	Click to map the host group to a volume. The Map button is disabled when 256 volumes are assigned to the selected host group.
Unmap	Click to unmap the host group from a volume.
Details	
Name	The name of the host group.
PI Access Method	The host protection information access method: • Capable: host has a PI-capable access method. • None: host does not have a PI-capable access method.
Related Information	
Hosts	The number of hosts included in the host group.
Mapped Volumes and Snapshots	The number of volumes and snapshots mapped to this host group.

Host Group Summary Page

This page provides information on all host groups. Click a host group name to view the details for that host group.

TABLE 4-28 describes the buttons and fields on the Host Group Summary page.

TABLE 4-28 Host Group Summary Page

Field	Description
New	Click to create a new host group.
Delete	Click to delete the selected host group.
Name	The host group name.

TABLE 4-28 Host Group Summary Page

Field	Description
Mapped Via	The method by which the host group is mapped: the default storage domain or a licensed storage domain.
PI	• Capable: the host group has protection information support. • None: the host group does not have protection information support.

Host Summary Page

This page provides information on all hosts. Click a host name to view details for that host.

TABLE 4-29 describes the buttons and fields on the Host Summary page.

TABLE 4-29 Host Summary Page

Field	Indicates
New	Click to create a new host.
Delete	Click to delete a host.
Name	The name of the host.
Host Group	The host group associated with this host.
PI	The protection information status of this host • Capable: host supports protection information. • None: host does not support protection information.

Map Host Page

This page enables you to select one or more volumes to which to map a host.

TABLE 4-30 describes the fields on the Map Host page.

TABLE 4-30 Map Host Page

Field	Description
Name	The name of the volume to which the host is to be mapped.
Type	The type of volume to which the host is to be mapped: volume or snapshot.

TABLE 4-30 Map Host Page *(Continued)*

Field	Description
LUN	Select, from the drop-down menu, the logical unit number (LUN) with which you want to associate this volume. Note that the number of LUNs supported varies according to the array type and operating system.

Map Host Group Page

This page enables you to select one or more volumes to which to map the host group.

TABLE 4-31 describes the fields on the Map Host Group page.

TABLE 4-31 Map Host Group Page

Field	Description
Name	The name of the volume or snapshot to which the host group is to be mapped.
Type	The type of volume to which the host group is to be mapped: volume or snapshot.
LUN	Select, from the drop-down menu, the logical unit number (LUN) with which you want to associate this volume. Note that the number of LUNs supported varies according to the array type and operating system.

Mapped Volumes and Snapshots Page

This page shows the volumes and snapshots that are mapped to the selected host or host group.

TABLE 4-32 describes the fields on the Mapped Volumes and Snapshots page.

TABLE 4-32 Mapped Volumes and Snapshots Page

Field	Indicates
Name	The volume name.
Type	The type of volume: volume or snapshot.
LUN	The logical unit number (LUN) associated with this volume.

TABLE 4-32 Mapped Volumes and Snapshots Page

Field	Indicates
Mapped Via	The method the host group or host group is mapped by: the default storage domain or a licensed storage domain.

New Host Group Page

This page enables you to create a new host group.

TABLE 4-33 describes the buttons and fields on the New Host Group page.

TABLE 4-33 New Host Group Page

Field	Description
New Host Group	
Name	Specify the name of the new host group, which can consist of up to 30 characters including A - Z, a - z, and _ (underscore). Spaces are not allowed.
Select Member Hosts	
Hosts	Double-click the names of available hosts you want to include in the new host group. Click Add All to add all of the hosts defined on the storage array to the host group.

Configuring Storage Domains

This section describes configuring storage domains. It contains the following topics:

About Storage Domains

A storage domain, also called a set or a storage partition, is a logical entity used to partition storage. To create a storage domain after volume creation, you must define a single host or a collection of hosts (called a host group) that will access the storage array. Then, you will need to define a volume-to-logical unit number (LUN) mapping, which will allow you to specify the host or host group that will have access to a particular volume in your storage array. The storage domain designates that only the selected host or host group has access to that particular volume through the assigned LUN.

When the storage domain consists of a volume mapped to a host group, it can enable hosts with different operating systems (heterogeneous hosts), to share access to a storage volume. A host within a host group can be mapped separately to a different volume.

A storage domain can contain up to 256 volumes. A volume can be included in only one storage domain and each LUN, from 0 to 255, can only be used once per storage domain.

Note: Not all operating systems support up to 256 LUN IDs. See the documentation for your operating system for more information.

A default storage domain exists to include the following:

- All host groups and hosts that are not explicitly mapped to a volume.
- All volumes that have a default volume-to-LUN mapping assigned.
- All automatically detected initiators.

Any volumes within the default storage domain can be accessed by all hosts and host groups within that storage domain.

Creating an explicit volume-to-LUN mapping for any host or host group and volume within the default storage domain causes the management software to remove the specified host or host group and volume from the default storage domain and create a new separate storage domain.

TABLE 4-34 shows the number of domains supplied by default for supported array models.

TABLE 4-34 Domain Support

Array Model	Domains Supplied by Default
Sun Storage 6180 array	1 default domain
Sun Storage 6580 array	1 default domain
Sun Storage 6780 array	1 default domain
Sun Storage 2530-M2 and 2540-M2 arrays	1 default domain and 2 storage domains
Sun StorEdge 6130 array	1 default domain and 8 storage domains
StorageTek 6140 array	1 default domain
StorageTek 6540 array	1 default domain
StorageTek 2510, 2530, and 2540 arrays	1 default domain and 2 storage domains
StorageTek FLX240 array	1 default domain
StorageTek FLX280 array	1 default domain
StorageTek FLX380 array	1 default domain

You can purchase a license for additional storage domain support.

Preparing to Create a Storage Domain

You create a storage domain by explicitly mapping a volume or snapshot to a host or host group. Before creating a storage domain, you should perform the following tasks:

1. Create one or more hosts.
2. Create one or more initiators for each host.

   A host included in a storage domain, either as an individual host or as a member of a host group, can have access to storage volumes only if it is associated with one or more initiators.
3. Create a host group, if needed, and add one or more hosts to it.
4. Create one or more volumes.

Determining How to Create a Storage Domain

There are several ways to create a storage domain:

- **During standard volume or snapshot creation**

  When you create a volume or snapshot, the wizard prompts you to map the volume either now or later.

  Create a storage domain at this time by mapping the volume to either the default storage domain or to hosts or hosts that you have already created.
- **After the total storage array capacity has been configured into volumes**
  - From the Mapping Summary page, launch the Create New Mappings wizard.

    Create a storage domain using the wizard if you want to map an existing volume or snapshot, assign a logical unit number (LUN) to it, and then select an existing host or host group to which to map the volume or snapshot.
  - From the Volume Summary or Volume Details page, you can click Map to map the volume to an existing host or host group.

    Create a storage domain from the Volume Summary page if you want to map existing standard volumes to existing hosts or host groups. Use the Volume Details page if you want to map or remap a volume after reviewing the volume details.

- From the Host Details page or Host Group Details page, click Map to map a host or host group to an existing volume.

  Create a storage domain from the Host Details page or Host Groups Details page if you want to map several standard volumes or snapshot volumes to one host or host group.

- From the Snapshot Summary page or Snapshot Details page, click Map to map a snapshot to an existing host or host group.

  Create a storage domain from the Snapshot Summary page or Snapshot Details page if you want to map existing snapshot volumes to existing hosts or host groups. Use the Snapshot Details page if you want to map or remap the snapshot volume after reviewing the snapshot volume details.

Enabling the Storage Domain Feature

The Sun Storage Domain is a premium feature. Licenses vary in quantity depending on the array. You can determine the number of configurable storage domains by obtaining the appropriate license. Contact your sales representative for more information on domain or other premium feature licensing.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. From the navigation pane, expand the array for which you want to enable additional storage domains.

3. Expand Administration and choose Licensing.

   The Licensable Feature Summary page is displayed.

4. Click Add License.

   The Add License page is displayed.

5. Select the type of storage domain license that you have purchased from the License Type menu.

6. Enter the version number and the key digest, and click OK.

   A message indicates that the operation was successful, and the Licensable Feature Summary page displays the updated information.

About Mapping Functions

The management software enables you to manage mappings from the Mapping Summary page. However, it also provides several other locations from which you can perform specific mapping functions or view mappings.

TABLE 4-35 shows the locations from which you can perform mapping operations.

TABLE 4-35 Mapping Matrix

Object to Be Mapped/Unmapped	Source of Mapping or Unmapping	Mapping Location
Volume	Host or host group	Map Volume page Mapping Summary page
Snapshot	Host or host group	Map Snapshot page Mapping Summary page
Host	Volume or snapshot	Map Host page Mapping Summary page
Host group	Volume or snapshot	Map Host Group page Mapping Summary page

Displaying All Mappings on the Array

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array for which you want to display all mappings and choose Mappings.

   The Mapping Summary page lists all mappings on the array.

Creating a Mapping

The management software enables you to map a volume or snapshot to a host or host group from the Mapping Summary page. In addition, you can perform more specific mappings from the following locations:

- Volume Summary page
- Snapshot Summary page

- Host Group Summary page
- Host Summary page

The process of mapping a volume or snapshot to a host or host group creates a storage domain

To map a volume or snapshot to a host or host group:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array for which you want to create a mapping and choose Mappings.

   The Mapping Summary page lists all mappings on the array.

3. Click New.

   The Create New Mappings wizard is displayed.

4. Follow the steps in the wizard.

   Click the Help tab in the wizard for more information.

Page and Field Descriptions

Browser interface pages and fields related to the "Configuring Storage Domains" section are described below.

Mapping Summary Page

This page enables you to view all mappings on the array.

The access volume is mapped to LUN 31, and is listed only on the Mapping Summary page. It is created on the Sun Storage 6180, 6580, and 6780 arrays, Sun Storage 2530-M2 and 2540-M2 arrays, and StorageTek 6140, 6540, 2510, 2530, and 2540 arrays for communication between in-band management software and the storage array.

TABLE 4-36 describes the fields on the Mapping Summary page.

TABLE 4-36 Mapping Summary Fields

Field	Description
New/Delete	Click New to launch the Create New Mappings wizard, which enables you to map a volume or snapshot to or click Delete to unmap it from a host or host group.
Volume Name	The name of the volume or snapshot.
Preferred Controller	The preferred controller for the mapping.
LUN	The logical unit number (LUN) assigned to the volume or snapshot.
Mapped to	The name of the host or host group to which the volume or snapshot is mapped.
Type	The type of object to which the volume is mapped. Valid values are: • Host • Host Group
Permissions	The permissions assigned to the named volume. Valid values are: • Read • Read, Write • Unknown (displayed when a volume copy is in progress)

Managing Trays and Disk Drives

This section describes managing storage trays and disk drives. It contains the following topics:

About Trays and Disk Drives

Storage trays are identified according to whether they contain a redundant array of independent disks (RAID) controller:

- A controller tray contains two redundant array of independent disks (RAID) controllers, which operate independently and provide failover capability for the data and management paths. The controller tray provides RAID functionality and caching. The controller tray for the Sun Storage 6180, 6580, 6780 arrays; Sun Storage 2530-M2 and 2540-M2 arrays, StorageTek 6140, FLX240, FLX280, 2510, 2530, and 2540 arrays; and the Sun StorEdge 6130 array also provides disk storage. For the StorageTek 6540 and FLX380 arrays, disk storage is provided by expansion trays only.
- An expansion tray is a storage tray that has disks only and no controller. An expansion tray is cabled directly to a controller tray and cannot operate independently.

TABLE 4-37 lists the number of disk drives supported per array.

TABLE 4-37 Supported Number of Disk Drives

Array	Minimum Number of Disk Drives (or FMods)	Maximum Number of Disk Drives (or FMods	Maximum Number of Trays Per Cabinet	Maximum Number of Disk Drives Per Cabinet
Sun Storage 2540-M2 and 2530-M2 arrays	5	12	4 (one controller tray and three expansion trays)	48
Sun Storage 6180 array	5	16	8	128
Sun Storage F5100 Flash Array	20 (FMods)	80 (Fmods)	For configuration details, see the *Sun Storage F5100 Flash Array Installation Guide*.	
StorageTek 6140 array	5	16	8	128
Sun StorEdge 6130 array	5	14	8	112
StorageTek 6540 array	5	16	14	224
Sun Storage 6580 array	5	16	14	224
Sun Storage 6780 array	5	16	14	224
StorageTek 2510, 2530, and 2540 arrays	5	12	4	48
StorageTek FLX240 array	3	14	8	112
StorageTek FLX280 array	6	14	8 (max. shipped in cabinet) 12 (max. the cabinet can accommodate)	224 per controller
StorageTek FLX380 array	6	14	8 (max. shipped in cabinet) 12 (max. the cabinet can accommodate)	224 per controller

When a drive is installed, the drive and tray slot designations are set automatically. Disk drives are numbered consecutively, starting at 1, from left to right.

For the StorageTek 6140 and FLX380 arrays, you can use either 4-gigabyte or 2-gigabyte Fibre Channel (FC) or Serial Advanced Technology Attachment (SATA) disk drives. Although you can mix drive types in the same tray, for optimal performance Sun recommends that all disk drives in a tray must be of the same type.

For the StorageTek FLX240 and FLX280 arrays, you can use either 1 or 2 gigabyte Fibre Channel (FC) or Serial Advanced Technology Attachment (SATA) disk drives. Although you can mix drive types in the same tray, for optimal performance Sun recommends that all disk drives in a tray must be of the same type.

For the Sun StorEdge 6130, StorageTek 6540, and Sun Storage 6580 and 6780 arrays, you can use 2 gigabyte Fibre Channel (FC) or Serial Advanced Technology Attachment (SATA) disk drives. All disk drives in a tray must be of the same type.

For the StorageTek 2510, 2530, and 2540 arrays, you can use Serial Attached SCSI (SAS) disk drives.

The Sun Storage 6580 and 6780 arrays support solid state drive (SSD) as a premium feature for both 73 GB and 300 GB capacities. You can install SSDs in the same tray as FC or SATA drives, up to a maximum of 20 SSDs per array. When configuring virtual disks, you cannot mix hard disks and SSDs; virtual disks must contain all hard disks or all SSDs.

Note: For a complete list of supported drive types, see the hardware release notes for your array.

Other characteristics of the disk drives are described in TABLE 4-38.

TABLE 4-38 Disk Drive Characteristics

Feature	Description
Mixed drive sizes	Allowed but not recommended. If drives of different sizes are mixed in a storage tray, all the drives used in a volume are treated as the smallest drive. For example, in a volume with a drive of 36 gigabytes and a drive of 146 gigabytes, only 36 gigabytes of the second drive is used. When the system is operating with mixed drive sizes, the hot-spare must be the size of the largest drive in the tray.
Array hot-spare	Available as a spare to any virtual disk in any tray in the array configuration.

Displaying Storage Utilization by Drive Type

To display storage utilization by disk drive type:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, choose the array for which you want to view storage utilization.

   The Storage Utilization page is displayed.

Displaying General Controller Information

To display general information on controllers:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Expand Physical Devices and choose Controllers.

   The Controller Summary page is displayed.

Displaying Controller Performance Statistics

To display information about the controllers' performance:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Expand Physical Devices and choose Controllers.

   The Controller Summary page is displayed.

4. Click View Performance Statistics.

   The Performance Statistics Summary - Controllers page is displayed.

Testing Controller Communication

You can determine whether the management host has direct Ethernet connectivity to a specific controller on an array.

To test the communication between the management host and the array controller:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Expand Physical Devices and choose Controllers.

   The Controller Summary page is displayed.

4. Click Test Communications.

   An informational message is displayed that identifies the controller, the Ethernet port, the IP address, and whether the array has passed or failed the communication test.

Displaying Port Information

You can display summary and detail information about the ports.

To display information on the ports:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Expand Physical Devices and choose Ports.

   The Port Summary page is displayed.

4. Click a port name for detailed information on that port.

   The Port Details page for the selected port is displayed.

Displaying Tray Information

You can display summary and detail information about existing storage trays. You can also display summary information about the disks that are associated with each tray.

To display information on trays:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Expand Physical Devices and choose Trays.

   The Tray Summary page is displayed.

4. Click a tray name for detailed information on that tray.

   The Tray Details page for the selected tray is displayed.

5. Go to Related Information and click any item for additional information associated with the selected tray.

   The Summary page for the selected item is displayed.

Displaying Disk Information

You can display summary and detail information on existing disks.

To display information on disks:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Expand Physical Devices and choose Disks.

   The Disk Summary page is displayed.

4. Click a disk name for detailed information on that disk.

   The Disk Details page for the selected disk is displayed.

5. Go to Related Information and click any item for more information associated with the selected disk.

   The Summary page for the selected item is displayed.

Managing Hot-Spare Drives

- This section describes how to manage hot-spare drives. It includes the following topics:“About Hot-Spare Drives” on page 185
- “Planning Hot-Spares” on page 186
- “Assigning and Unassigning Hot-Spares Manually” on page 186
- “Assigning and Unassigning Hot-Spares Automatically” on page 187

About Hot-Spare Drives

A hot-spare is a disk drive, containing no data, that acts as a standby in the storage array in case a drive fails in a RAID-1, RAID-3, or RAID-5 volume. The hot-spare adds another level of redundancy to the storage array. The number of supported hot-spares depends on the firmware version and array model:

- 15 for 6130 running firmware version 07.10.nn.nn or lower

- 15 for 6140 and 6540 running firmware version 07.10.nn.nn or lower, OR firmware version 07.15.nn.nn or higher.
- 15 for 2500 series arrays running firmware version 07.10.nn.nn or lower, OR firmware version 07.35.nn.nn or higher.
- Unlimited for 6180, 6580, and 6780 arrays.

If a hot-spare is available when a disk drive fails, the hot-spare is automatically substituted for the failed disk drive without intervention. The controller uses redundancy data to reconstruct the data from the failed drive onto the hot-spare. When you have physically replaced the failed disk drive, the data from the hot-spare is copied back to the replacement drive. This is called copyback.

If you do not have a hot-spare, you can still replace a failed disk drive while the storage array is operating. If the disk drive is part of a RAID-1, RAID-3, or RAID-5 volume group, the controller uses redundancy data to automatically reconstruct the data onto the replacement disk drive. This is called reconstruction.

Planning Hot-Spares

A disk drive should be assigned as a hot-spare only if it meets the following criteria:

- The hot-spare must have a capacity that is equal to or greater than the capacity of the largest drive on the storage array. If a hot-spare is smaller than a failed physical disk drive, the hot-spare cannot be used to rebuild the data from the failed physical disk drive.
- The hot-spare drive must be the same type of physical disk as the physical disk drive that failed. For example, a SATA hot-spare cannot replace a Fibre Channel physical disk drive.
- The disk drive's role must be unassigned, its state must be enabled, and it must have an optimal status.
- If the array has drives with protection information (PI), add PI capable hot-spare drives to retain data integrity protection for a failed drive.

Information about individual disk drives is available on the Disk Summary page.

Assigning and Unassigning Hot-Spares Manually

To manually assign or unassign a hot-spare:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Expand Physical Devices and choose Disks.

   The Disk Summary page is displayed.

4. Select the disk drive you want to assign or unassign as a hot-spare drive.

5. Do one of the following:
   - To assign the selected disk as a hot-spare, click Assign Hot-Spare.
   - To unassign the selected disk as a hot-spare, click Unassign Hot-Spare.

   The Disk Summary page is displayed with the updated information.

Assigning and Unassigning Hot-Spares Automatically

When the management software assigns the hot-spares, it balances the request for spares across all trays within the array and ensures that the hot-spare drive is of the same type as the other disks in the same tray. It also verifies that the disk drives are unassigned, enabled, and in the optimal state.

To enable the management software to assign or unassign a hot-spare:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page is displayed.

2. In the navigation pane, expand the array for which you want to assign a hot-spare.

3. Choose Administration.

   The Administration page is displayed.

4. In the Array Hot Spares Change field, select the number of hot-spares that you want to assign to this array.

5. Click OK.

   The management software assigns or unassigns the specified number of hot-spares, balancing the selection among trays within the array.

Page and Field Descriptions

Browser interface pages and fields related to the "Managing Trays and Disk Drives" section are described in the following subsections:

Controller Summary Page

This page provides information on the current controller configurations.

TABLE 4-39 describes the fields on the Controller Summary page.

TABLE 4-39 Controller Summary Page

Field	Indicates
View Performance Statistics	Click to view the performance statistics for the selected controller.
Reset Controller	Click to reset the controller.
Test Communications	Click to test the communication between the management host and the array.
Name	The name of the controller.
ID	An alphanumeric string the identifies the controller. For example, Tray.85.Controller.A
Mode	The current mode of the controller: Active or Inactive.
Quiesced	Whether the controller is currently quiesced – that is, slowed down or made so that one of its resources is inactive, but still available, in order to conserve power.

TABLE 4-39 Controller Summary Page *(Continued)*

Field	Indicates
Status	The current status of the controller.
Drive Interface	The array drive interface type: FC (Fibre Channel), SATA (Serial Advanced Technology Attachment), or SAS (Serial Attached SCSI).
Cache Memory (MB)	The current size of the cache memory, in megabytes.
Manufacturer	The controller manufacturer.
Serial Number	The controller serial number.
Host Board Type	The type of board on which this controller is located. **Note**: This field does not appear if running a firmware version prior to 06.16.xx.xx.
Host Board Status	The status of the host board. **Note**: This field does not appear if running a firmware version prior to 06.16.xx.xx.
Ethernet Port X	The Ethernet port configuration. Individual options are described below. **Note**: Some of the following Ethernet Port options might not apply to your array model.
Enable DHCP/BOOTP	Select this radio button to enable DHCP/BOOTP for port identification on the network. Otherwise, click the radio button *Specify Network Configuration* to manually identify this port.
Specify Network Configuration	Select this radio button to manually identify this port, then enter the following in dotted decimal notation: • IP address of the array • Gateway address • Netmask Note that the Gateway Address applies to both Ethernet Port 1 and Ethernet Port 2.
Enable IPv4 Support	Place a check mark in the box to enable IPv4 support. You must enable either IPv4 and IPv6, or you can enable both at the same time; you cannot disable both IPv4 and IPv6 at the same time. After enabling IPv4, click the radio button *Enable DHCP/BOOTP* to enable DHCP/BOOTP for port identification on the network. Otherwise, click the radio button *Specify Network Configuration* to manually identify this port. If you select *Specify Network Configuration*, enter the following in dotted decimal notation: • IP address of the array • Gateway address • Netmask Note that the Gateway Address applies to both Ethernet Port 1 and Ethernet Port 2.

TABLE 4-39 Controller Summary Page *(Continued)*

Field	Indicates
Enable IPv6 Support	Place a check mark in the box to enable IPv6 support. You must enable either IPv4 and IPv6, or you can enable both at the same time; you cannot disable both IPv4 and IPv6 at the same time. After enabling IPv6, click the radio button *Obtain Configuration Automatically* to enable the software to provide port identification. Otherwise, click the radio button *Specify Network Configuration* to manually identify this port. If you select *Specify Network Configuration*, enter the following in IPv6 notation: • IP Address - the local IP address • Routable IP Address - the network's unique address. • IP Router Address - the IP address of the router your host is physically on. This enables communication with hosts on different networks. **Note**: when entering values in IPv6 notation, leading zeros may be omitted. For example, fe80:0000:0000:0000:020c:29ff:fe78:9644 is equivalent to fe80:0000:0000:0000:20c:29ff:fe78:9644. Any group of 4 zeros can be replaced by a double colon. For example, fe80::020c:29ff:fe78:9644 would be equivalent to fe80::20c:29ff:fe78:9644.
Virtual LAN Support	Place a checkmark in the box to enable virtual LAN (VLAN) support. Enabling VLAN support causes a logical network to behave as if it is physically separate from the other physical and virtual LANs supported by the same switches, routers, or both. Specify a VLAN ID from 1 to 4096.
Ethernet Priority	Place a checkmark in the box to enable Ethernet priority and enter a value from 0 to 7.
Port Speed/Duplex Mode: Autonegotiation	Click Enable Autonegotiation to enable Sun Storage Common Array Manager to set the speed for this port. Otherwise, click Specify Port Speed and Duplex Mode to manually select the port speed and duplex mode from a drop-down menu.

Disk Details Page

This page shows details for the selected disk.

TABLE 4-40 describes the buttons and fields on the Disk Details page.

Note: Some fields may not apply to your array model.

TABLE 4-40 Disk Details Page

Field	Indicates
Assign/Unassign Hot-Spare	Click to assign or unassign a hot spare for this disk.
Revive	Click to revive the disk. **Caution:** Contact My Oracle Support (https://support.oracle.com/) before you select this option. This is a volatile operation and should be performed under the direct supervision of a Sun representative. Reviving a failed drive while IO operations continue on the volumes associated with the virtual disk can cause data validation errors.
Reconstruct	Click to reconstruct a disk drive. **Caution:** This task should be performed only under the direct supervision of a Sun Customer and Technical Support representative.
Initialize	Click to initialize a disk drive. **Caution:** This task should be performed only under the direct supervision of a Sun Customer and Technical Support representative.
Secure Erase	Click to completely erase the data from the secure disk drive. If the disk drive is part of a virtual disk, the Secure Erase button is disabled.
Fail	Click to fail the disk drive. **Caution:** This task should be performed only under the direct supervision of a Sun Customer and Technical Support representative.
Details	
Name	The name of the disk.
ID	An alphanumeric string the identifies the controller. For example, Tray.85.Controller.A
Array	The array associated with this disk.
Array Type	The model number of the array.
Tray	The tray that is associated with this disk.

TABLE 4-40 Disk Details Page *(Continued)*

Field	Indicates
Slot Number	The slot in the tray where the disk drive is installed.
Role	The role of the disk: • Array Spare • Data Disk • Unassigned
Mirror Disk	The mirror disk associated with this disk.
Virtual Disk	The virtual disk associated with this disk.
State	The state of the disk: • Enabled • Disabled • Substituted • Missing
Status	The status of the disk: • Available • Optimal • Failed • Replaced • Bypassed • Unresponsive • Removed • Predictive Failure
Capacity	The total capacity of this disk.
Type	The type of disk: FC, SATA, SAS, SSD, or Any.
Average Erase Count	The percentage of maximum erase count. The drive must be replaced when the average erase percentage reaches between 80% and 90%.
Remaining Spare Blocks	The percentage of SSD spare blocks remaining.
Speed (RPM)	Disk in revolutions per minute (RPM).
Firmware	The firmware version for the disk drive.
Serial Number	The serial number of this disk.
Disk World Wide Name	The World Wide Name of this disk.

TABLE 4-40 Disk Details Page *(Continued)*

Field	Indicates
Security	The security status of this disk: • None: disk does not support data encryption services. • Enabled: security is enabled on this disk. • Disabled: security is not enabled on this disk. • Locked: disk is locked and requires a pass phrase to unlock.
Array Lock Key Id	The full drive security key. The full key includes the user-supplied array lock key identifier, storage array identifier, and controller-generated identifier. The full drive security key is stored on the management host at the following locations: • Solaris /var/opt/SUNWsefms/lockKeys/<*devicekey*>.alk • Linux /opt/sun/cam/private/fms/var/lockKeys/<*devicekey*>.alk • Windows <System drive>/Program Files/Sun/Common Array Manager/Component/fms/var/lockKeys<*devicekey*>.alk
Protection Information	The protection information status of this disk. • Capable: disk supports protection information. • None: disk does not support protection information.
Related Information	
Volumes	The number of volumes associated with this disk.
Disk Health Details	The health details for this disk drive.

Disk Summary Page

This page displays information about all disks. Click any disk to view its details.

TABLE 4-41 describes the fields on the Disk Summary page.

TABLE 4-41 Disk Summary Page

Field	Indicates
Name	The name of the disk.
Tray	The tray associated with this disk.

TABLE 4-41 Disk Summary Page *(Continued)*

Field	Indicates
Role	The role of the disk: • Array Spare • Data Disk • Unassigned
State	The state of the disk: • Enabled • Disabled • Substituted • Missing
Status	The status of the disk: • Available • Optimal • Failed • Replaced • Bypassed • Unresponsive • Removed • Predictive Failure
Security	The security status of this disk: • None: disk does not support data encryption services. • Enabled: security is enabled on this disk. • Disabled: security is not enabled on this disk. • Locked: disk is locked and requires a pass phrase to unlock.
PI	The protection information status of the disk. • Capable: disk supports protection information. • None: disk does not support protection information.
Capacity	The total capacity of this disk.
Type	The type of disk: All, SCSI, FC, SAS, SATA, SSD.
Firmware	Firmware version of this disk drive.

Performance Statistics - Controller Details Page

This page enables you to view performance statistics for the selected controller. In addition to a timestamp indicating the time at which the displayed performance statistics were collected, it displays detailed statistics.

TABLE 4-42 describes the fields on the Performance Statistics - Controller Details page.

TABLE 4-42 Performance Statistics - Volume Details Page
Performance Statistics Summary - Volumes Page
Performance Statistics - Controller Details Page
Performance Statistics Summary - Controllers Page

Field	Description
Total IOPS	The total inputs and outputs per second (IOPS).
Average IOPS	The average number of inputs and outputs per second (IOPS).
Read %	The percentage of incoming data read.
Write %	The percentage of outgoing data sent.
Total Data Transferred	The total amount of data that was processed, in kilobytes per second.
Read	The amount of incoming data that was read, in kilobytes per second.
Average Read	The average amount of incoming data that was read, in kilobytes per second.
Peak Read	The peak amount of incoming data that was read, in kilobytes per second.
Written	The amount of outgoing data that was sent, in kilobytes per second.
Average Written	The average amount of outgoing data that was sent, in kilobytes per second.
Peak Written	The peak amount of outgoing data that was sent, in kilobytes per second.
Average Read Size	The average amount of incoming data that was read, in bytes.
Average Write Size	The average amount of outgoing data that was sent, in bytes.
Cache Hit %	The percentage of cache that is affected by the performance statistics data.

Performance Statistics Summary - Controllers Page

This page enables you to view performance statistics for the array controllers.

TABLE 4-43 describes the fields on the Performance Statistics Summary - Controllers page.

TABLE 4-43 Performance Statistics - Volume Details Page
Performance Statistics Summary - Volumes Page
Performance Statistics - Controller Details Page
Performance Statistics Summary - Controllers Page

Field	Description
Total IOPS	The total inputs and outputs per second (IOPS).
Average IOPS	The average number of inputs and outputs per second (IOPS).
Read %	The percentage of incoming data read.
Write %	The percentage of outgoing data sent.
Total Data Transferred	The total amount of data that was processed, in kilobytes per second.
Read	The amount of incoming data that was read, in kilobytes per second.
Average Read	The average amount of incoming data that was read, in kilobytes per second.
Peak Read	The peak amount of incoming data that was read, in kilobytes per second.
Written	The amount of outgoing data that was sent, in kilobytes per second.
Average Written	The average amount of outgoing data that was sent, in kilobytes per second.
Peak Written	The peak amount of outgoing data that was sent, in kilobytes per second.
Average Read Size	The average amount of incoming data that was read, in bytes.
Average Write Size	The average amount of outgoing data that was sent, in bytes.
Cache Hit %	The percentage of cache that is affected by the performance statistics data.

Port Details Page

This page displays details about the selected port.

TABLE 4-44 describes the fields on the Port Details page.

Note: Not all fields are applicable to all array models.

TABLE 4-44 Port Details Page

Field	Indicates
Name	The name of the port.
Controller	The name of the controller on which this port resides.
Port WWN	The World Wide Name for the controller port.
Node WWN	The World Wide Name for the controller node.
FC Topology	The FC topology: • Unknown • Point-to-Point • Fabric • Arbitrated Loop • Fabric Loop.
Type	The type of port: FC, SAS, or iSCSI.
Speed	The port speed, in gigabytes per second.
Maximum Speed	The maximum speed, in gigabytes per second.
Current Loop ID	The identifier of the current loop.
Preferred Loop ID	The identifier of the preferred loop: 0 to 125, N/A or Any.
Channel Number	The current channel number.
Channel Joined With Another	Whether the channel is joined with another channel.
Link Status	Whether the port is available or unavailable.
Protection Information	• Capable: the port supports protection information. • None: the port does not support protection information.
Listening Port	The TCP port number that the controller uses to listen for iSCSI logins from iSCSI initiators. Default port is 3260; otherwise, specify in the range 49152 to 65535.
Maximum Transmission Unit (MTU)	The maximum number of bytes per frame to be transmitted at once. Default value is 1500; otherwise, specify in the range 1501 to 9000, which enables Jumbo Frames Support.
IPv4 Configuration (iSCSI only)	

TABLE 4-44 Port Details Page *(Continued)*

Field	Indicates
Enable IPv4 Support	Place a check mark in the box to enable IPv4 support. You must enable either IPv4 and IPv6, or you can enable both at the same time; you cannot disable both IPv4 and IPv6 at the same time.
IP Address	Click the radio button *Use DHCP* to enable DHCP for port identification on the network. Otherwise, click the radio button *Configure Manually* and enter values in dotted decimal notation for the IP Address, Subnet Mask, and Gateway for this port.
Virtual LAN Support	Place a checkmark in the box to enable virtual LAN (VLAN) support. Enabling VLAN support causes a logical network to behave as if it is physically separate from the other physical and virtual LANs supported by the same switches, routers, or both. Specify a VLAN ID from 1 to 4096.
Ethernet Priority	Place a checkmark in the box to enable Ethernet priority and enter a value from 0 to 7.
IPv6 Configuration (Sun Storage 6180, 6580, and 6780, and StorageTek 6140, 6540, FLX380, 2510, 2530, and 2540 arrays only)	
Enable IPv6 Support	Place a check mark in the box to enable IPv6 support. You must enable either IPv4 and IPv6, or you can enable both at the same time; you cannot disable both IPv4 and IPv6 at the same time.
IP Address	The IP address of the port in dotted decimal notation. Click the radio button next to *Obtain Automatically* to enable the software to identify the port on the network. Otherwise, click *Configure Manually* and enter values in IPv6 colon notation: • IP Address • Routable IP Address #1 • Routable IP address #2 • Router IP Address
Virtual LAN Support	Place a checkmark in the box to enable virtual LAN (VLAN) support. Enabling VLAN support causes a logical network to behave as if it is physically separate from the other physical and virtual LANs supported by the same switches, routers, or both. Specify a VLAN ID from 1 to 4096.
Ethernet Priority	Place a checkmark in the box to enable Ethernet priority and enter a value from 0 to 7.

Port Summary Page

This page displays information about the ports.

TABLE 4-45 describes the fields on the Port Summary page.

TABLE 4-45 Port Summary Page

Field	Indicates
Name	The name of the port.
Controller	The name of the controller on which this port resides.
Link Status	Whether the port is available or unavailable. Up means available; Down means unavailable.
Type	The type of port: FC or SAS.
Speed	The port speed, in gigabytes per second.
Unique Identifier	The MAC address of the port.
IP Address	The IP address of the port in dotted decimal notation.
PI	• Capable: the port supports protection information. • None: the port does not support protection information.

Storage Utilization Page

This page provides a summary of the storage being used on an array, in both pie chart and table formats.

The pie chart displays the amount of storage utilized by type of disk drive: FC, SATA, SAS, SSD, FMod, and Unassigned (for zoned-out disks).

TABLE 4-46 describes the buttons and fields on the Storage Utilization page.

TABLE 4-46 Storage Utilization Page

Field	Description
Key	A color-coded key that corresponds to the type of disk drive represented in the pie chart.
Type	The type of disk drive: FC, SATA, SAS, SSD, FMod, Unassigned (for zoned-out disks), and Disabled.
Drives	The number of disk drives of the specified type.

TABLE 4-46 Storage Utilization Page *(Continued)*

Field	Description
Total Capacity	The sum of the capacities of all discovered disks, including spares and disks whose status is not optimal
Free Capacity	The storage space available for volume creation.
Used Capacity	The amount of storage space that is in use. This value is the difference between Total Capacity and Free Capacity and includes disks configured as data disks, and spares and disks whose status is not optimal.
Used Percentage	A graphical representation (bar chart) of the used capacity as a percentage of the total capacity.
Hot-Spares	The number of hot spares configured
Non Optimal	The number of disk drives that are in any of the following states: • Unknown • Failed • Replaced • Bypassed • Unresponsive • Removed • Predictive Failure

Tray Details Page

This page displays details about the selected storage tray.

TABLE 4-47 describes the fields on the Tray Details page.

TABLE 4-47 Tray Details Page

Field	Indicates
Details	
Name	The name of the tray within the array. For all array types except the Sun StorEdge 6130 array, you can change the tray name using the drop down menu. Valid values are: 0 to 99. For all arrays, you can set the tray name manually on the array hardware. For instructions, see your array hardware documentation.
ID	The tray identifier having the format Tray.xx, where xx is a numeric value.

TABLE 4-47 Tray Details Page *(Continued)*

Field	Indicates
Role	The role served by this tray. Roles include: • Controller Module • Drive Module If a controller fails over, the backup controller acquires the controller tray host name and IP address and assumes control of the array's operations.
State	The state of the tray, whether it has a controller and, if it does, whether the controller is enabled. States include: • Enabled - The tray has an enabled controller and is available for storage activity. • Disabled - The tray is disabled and unavailable for storage activity.
Status	The current status of the tray: • OK - The tray is online and available for storage activity. • ID Mismatch • ID Conflict • ESM Firmware Mismatch • ESM Miswire • Minihub Speed Mismatch • Unsupported
Disk Type	The type of physical disk: Unknown, SCSI, Fibre Channel, SAS, or SATA.
Maximum Disk Speed Supported	The maximum speed, in RPMs, of the disks in this tray.
Related Information	
Disks	The number of disks that reside in this tray.

Tray Summary Page

This page displays information about all storage trays. Click the name of a tray to see its details.

TABLE 4-48 describes the fields on the Tray Summary page.

TABLE 4-48 Tray Summary Page

Field	Indicates
Name	The name of the tray within the array.

TABLE 4-48 Tray Summary Page

Field	Indicates
Array Name	The name of the array in which this tray participates.
Tray Type	The model name of the array in which this tray participates.
Role	The role served by this tray. Roles include: • Controller Module • Drive Module If a controller fails over, the backup controller acquires the controller tray host name and IP address and assumes control of the array's operations.
State	The state of the tray, whether it has a controller and, if it does, whether the controller is enabled. States include: • Enabled - The tray has an enabled controller and is available for storage activity. • Disabled - The tray is disabled and unavailable for storage activity.
Status	The current status of the tray: • OK - The tray is online and available for storage activity. • ID Mismatch • ID Conflict • ESM Firmware Mismatch • ESM Miswire • Minihub Speed Mismatch • Unsupported
Disk Type	The type of physical disk: • FC • SAS • SATA • SCSI • SSD • Mixed • N/A (for controller module)

Configuring Initiators

This section describes configuring initiators. It contains the following topics:

About Initiators

An initiator is the protocol-specific physical port that initiates the I/O exchanges with the array. In a Fibre Channel (FC) storage area network (SAN), an initiator is the FC port that is identified by a port World Wide Name (WWN). If a data host is connected to the array by two host bus adapters (HBAs), the array handles the host as two different initiators. FC array LUN masking and mapping uses initiator port identifiers to authenticate storage customers.

When a new initiator is connected to the storage environment, the array detects it, and the management software displays it on the Initiator Summary page. To configure the initiator, select it from the list, add a description to identify it, assigning a host type, and then associate the initiator with a host. When you associate the host or its host group with a volume, you form a storage domain.

The array firmware retains all created or discovered WWNs until they are manually deleted. If the WWNs no longer apply because a server is moved or rezoned, delete the initiators with the affected WWNs from the Initiator Summary page.

To see the current initiators, go to the Initiator Summary page, as described in "Displaying Initiator Information" on page 204.

Displaying Initiator Information

You can display summary and detail information about existing initiators. You can also display summary information about mapped hosts associated with each initiator.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Expand Physical Devices and choose Initiators.

   The Initiator Summary page is displayed.

4. Click an initiator name for detailed information on that initiator.

   The Initiator Details page for the selected initiator is displayed.

5. Go to Related Information and click Mapped Volumes for more information associated with the selected initiator.

   The Summary page for the selected item is displayed.

Creating an Initiator

When you create an initiator using the Create New Initiator wizard, you name it and associate it to one specific host, and set the host type, which is usually the data host operating system, of the initiator. If a suitable host does not exist, you have the option of creating one. Optionally, you can assign the host to an existing host group or create a new host group and assign the host to it.

You will need the unique identifier for the initiator that you want to associate with a volume. The unique identifier can be either a World Wide Name (WWN) for FC initiators or an iSCSI name for iSCSI initiators.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Expand Physical Devices and choose Initiators.

   The Initiator Summary page is displayed.

4. Click New.

   The Create New Initiator wizard is launched.

5. Follow the steps in the wizard to create a new initiator.

Deleting an Initiator

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Expand Physical Devices and choose Initiators.

   The Initiator Summary page is displayed.

4. Select the initiator that you want to delete.

   This enables the Delete button.

5. Click Delete.

6. Confirm the deletion.

   The initiator disappears from the Initiator Summary page.

Page and Field Descriptions

Browser interface pages and fields related to the "Configuring Initiators" section are described in the following subsections:

- "Initiator Details Page" on page 205
- "Initiator Summary Page" on page 206

Initiator Details Page

This page shows details about the selected initiator. You can modify the initiator name, associated host, and World Wide Name (WWN) from this page.

TABLE 4-49 describes the fields on the Initiator Details page.

TABLE 4-49 Initiator Details

Field	Indicates
Name	The name of the initiator.
Unique Identifier	The unique name of the initiator.
Host	The name of the host with which this initiator is associated.
Host Type	The operating system (OS) of the associated data host.
Authentication	The authentication method being used for an iSCSI session only. Valid options are None or CHAP. If CHAP is selected, then you must supply a CHAP secret.

Initiator Summary Page

This page displays information about one of the following, depending on how you navigated to it:

- If you chose Physical Devices > Initiators in the navigation pane, it shows information about all initiators configured on the array and enables you to create or delete initiators.
- If you clicked Initiators in the Related Information section of the Host Details page, it lists the initiators that are associated with the selected host.

Click an initiator name to view details for that initiator.

You can map multiple volumes to the initiator from the Initiator Details page.

TABLE 4-50 describes the buttons and fields on the Initiator Summary page.

TABLE 4-50 Initiator Summary Page

Field	Indicates
New	Click to create a new initiator.
Delete	Click to delete the selected initiator.
Name	The name of the initiator.
Host	The name of the host with which this initiator is associated.
Host Type	The initiator host type.
Unique Identifier	The unique name of the initiator.

Accessing Storage Using iSCSI

This section provides information about iSCSI targets. It contains the following topics:

About iSCSI Targets

An iSCSI target is a storage device accessed over an Ethernet connection using the SCSI infrastructure. One iSCSI target is supported per array.

An iSCSI session consists of up to four connections between an iSCSI initiator and the iSCSI target. The iSCSI initiator and target send and receive data over an Ethernet connection while using the SCSI protocol. Across all connections within a session, an initiator sees one target. Multiple initiators may be connected to the iSCSI Target.

Communication between the initiator and the target array can be protected using CHAP authentication.

Configuring an iSCSI Target

To configure an iSCSI target, you must first perform steps using the data host and then steps using Sun Storage Common Array Manager.

1. On the data host, install an iSCSI initiator appropriate for your operating system. See your initiator vendor's documentation for instructions.
2. Identify and note the iSCSI Qualified Name (IQN) of the iSCSI initiator.
3. Identify and note the IP address of the iSCSI target array.
4. Identify and note the IP address of the iSCSI host ports on the target array.

5. Using Sun Storage Common Array Manager, create an iSCSI initiator on the target. For instructions, go to Creating an Initiator.
6. Create an iSCSI port. For instructions, go to About iSCSI Ports.
7. Create a volume on the iSCSI array and map it to the iSCSI initiator. For instructions, go to Creating a Volume.

Configuring Mutual Authentication for an iSCSI Session

Mutual authentication is two-way communication that enables a client to validate itself to a server and vice versa. You can configure mutual authentication for an iSCSI session so that both the iSCSI initiator and iSCSI target use a Challenge Handshake Authentication Protocol (CHAP) secret.

Note – For security purposes, Oracle recommends that the initiator and CHAP secrets be unique.

---

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.
2. In the navigation pane, expand the array you want to work with.

   The navigation tree is expanded for that array.
3. Expand Physical Devices and choose Initiators.

   The Initiator Summary page is displayed.
4. Select the initiator for which you want to configure mutual authentication.

   The Initiator Details page is displayed.
5. In the Authentication field, select CHAP and enter a CHAP secret.
6. Enter the CHAP secret again in the validation field.
7. Click Save.
8. In the navigation pane, expand the array you want to work with.

   The navigation tree is expanded for that array.
9. Expand Physical Devices and choose iSCSI Target.

   The iSCSI Target Details page is displayed.

10. In the iSCSI Target Authentication section, select CHAP and enter the CHAP secret.

11. Click Save.

Configuring an Unnamed Discovery Session

Unnamed discovery sessions provide a security feature for iSCSI discovery. When unnamed discovery sessions are enabled, the target will not respond to global iSCSI requests. Rather, it will respond to requests addressed specifically to this target.

If unnamed discovery sessions are disabled, an iSCSI initiator can only ask the target about a specific target or targets by iSCSI name. If the iSCSI initiator tries to ask for all targets, the target drops the request without answering, which makes it appear that the target (that is, the storage system) is not there.

To enable or disable unnamed discovery sessions:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

   The navigation tree is expanded for that array.

3. Expand Physical Devices and choose iSCSI Target.

   The iSCSI Target Details page is displayed.

4. In the SCSI Target Discovery section, place a checkmark in the box next to Unnamed Discovery to enable unnamed discovery. To disable unnamed discovery, remove the checkmark from the box.

5. Click Save.

Configuring an Internet Storage Name Service (iSNS)

Internet Storage Name Service (iSNS) is a protocol or mechanism for the intelligent discovery of storage devices in an Internet Protocol (IP) network.

To enable or disable iSNS:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

   The navigation tree is expanded for that array.

3. Expand Physical Devices and choose iSCSI Target.

   The iSCSI Target Details page is displayed.

4. In the SCSI Target Discovery section, place a checkmark in the box next to iSNS to use the iSNS server.

5. For IPv4, select whether to discover iSCSI targets using DHCP or by IP address. If you choose iSNS IP address, enter the IP address of the iSNS server and the port number of the iSNS listening port.

6. Click Save.

Enabling and Disabling ICMP Ping Responses

ICMP contains a ping tool which sends and receives ICMP Echo Request messages. These ICMP messages determine whether a host is reachable and how long it takes to get packets to and from that host.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

   The navigation tree is expanded for that array.

3. Expand Physical Devices and choose iSCSI Target.

   The iSCSI Target Details page is displayed.

4. In the SCSI Target Discovery section, place a checkmark in the box next to ICMP Ping Responses to enable ping requests.

5. Click Save.

Ending an iSCSI Session

Ending an iSCSI session removes the connection between an iSCSI initiator and an iSCSI target. You may want to end an iSCSI session for one of the following reasons.

- Unauthorized access

  If no authentication method was configured, an unauthorized initiator could access the iSCSI target.

- System downtime

  If the system needs to be taken down for any reason and initiators are still connected to an iSCSI target.

To end an iSCSI session:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

   The navigation tree is expanded for that array.

3. Click iSCSI Sessions.

   The iSCSI Sessions Summary page is displayed.

4. Select one or more iSCSI sessions that you want to end and click End Session.

Note: Ending an iSCSI session could cause data integrity issues. Refer to initiator vendor documentation before ending an iSCSI session.

About iSCSI Ports

The iSCSI port is used for communication between the iSCSI initiator and the iSCSI target. The array supports two iSCSI ports per controller, for a total of four iSCSI ports per array.

For each iSCSI port, you can perform following tasks:

- Identify the iSCSI listening port

  The iSCSI listening port is the TCP port number that the controller uses to listen for iSCSI logins from the host. The default value for the listening port is 3620.

- Set the Maximum Transmission Unit

  The maximum number of bytes per frame to be transmitted at once. Default value is 1500.

- Enable IPv4 Configuration
  - Identify the IP address discovery method

    You can enable either DHCP or manual IP address discovery.

  - Enable or Disable VLAN identification

    Enabling VLAN support causes a logical network to behave as if it is physically separate from the other physical and virtual LANs supported by the same switches, routers, or both.

- Enable or Disable Ethernet Priority

  Ethernet priority determines the priority of accessing a network. Place a checkmark in the box to enable Ethernet priority and select a value from the drop down. Without setting the Ethernet priority, access to the network is on a first-come, first served basis.

To configure an iSCSI port:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

   The navigation tree is expanded for that array.

3. Expand Physical Devices and select Ports.

   The Port Summary page is displayed.

4. Select the port that you want to configure.

   The Port Details page is displayed.

5. Enter values for the configurable fields.

About iSCSI Performance Statistics

Sun Storage Common Array Manager provides both raw statistics and baseline statistics for iSCSI sessions. Raw statistics are all of the statistics that have been collected since the controllers were started. Baseline statistics are point-in-time statistics that have been collected since you set the baseline time.

Setting the iSCSI Performance Monitoring Baseline

You can set the performance monitoring baseline for iSCSI statistics which causes the logical statistical counters to reset to zero. Baseline statistics are derived as deltas from the time that you set the baseline.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

The navigation tree is expanded for that array.

3. Expand Administration and select Performance Monitoring.

   The Performance Monitoring page for the array is displayed.

4. Click Set Baseline.

   A dialog box displays, warning you that you are about to change the baseline for your array.

5. Click OK to close the dialog box and set the baseline.

Viewing iSCSI Ethernet-MAC Performance Statistics

Ethernet-MAC statistics provide performance information about the Media Access Control (MAC) protocol. MAC provides an addressing mechanism, called the physical or MAC address. A MAC address is a unique address assigned to each network adapter. The MAC address helps deliver data packets to a destination within a subnetwork.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Expand iSCSI Performance and select Ethernet-MAC.

4. The iSCSI Ethernet-MAC Performance statistics page displays.

Viewing iSCSI Ethernet-TCP/IP Performance Statistics

iSCSI Ethernet - TCP/IP statistics provide performance information about the Transmission Control Protocol/ Internet Protocol (TCP/IP). Using the Transmission Control Protocol (TCP), applications on networked hosts can create connections to one another over which they can exchange data in packets. The Internet Protocol is a data-oriented protocol used to communicate data across a packet-switched network.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

3. Expand iSCSI Performance and select Ethernet-TCP/IP.
4. The iSCSI Ethernet-TCP/IP Performance statistics page displays.

Viewing iSCSI Target-Protocol Performance Statistics

The Target-Protocol Performance page provides statistics for the iSCSI target, which provides block-level access to storage media.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.
2. In the navigation pane, expand the array you want to work with.
3. Expand iSCSI Performance and select Target-Protocol.
4. The iSCSI Target-Protocol Performance statistics page displays.

Page and Field Descriptions

Browser interface pages and fields related to the "Accessing Storage Using iSCSI" section are described in the following subsections:

iSCSI Ethernet - MAC Performance Page

Ethernet-MAC statistics provide statistics for the media access control (MAC), which provides a MAC address used to help deliver data packets to a destination within a subnetwork.

TABLE 4-51 describes the fields on the iSCSI Ethernet-MAC Performance Statistics page

TABLE 4-51 iSCSI Ethernet - MAC Performance Page

Field	Indicates
Controller A Boot Time	Date and time when controller A was last booted.
Controller B Boot Time	Date and time when controller B was last booted.
MAC Transmit Statistics	
Port	The iSCSI port used to transmit and receive data.
F	Frame count.
B	Byte count.
MF	multicast frame count.
BF	Broadcast frame count.
PF	Pause frame count
CF	Control frame count.
FDF	Frame deferral count.
FED	Frame excess deferral count.
FLC	Frame late collisions count.
FA	Frame abort count.
FSC	Frame single collision count.
FMC	Frame multiple collisions count.
FC	Frame collisions count.
FDR	Frame dropped count.
JF	Jumbo frame count.
MAC Receive Statistics	
Port	The iSCSI port used to transmit and receive data.
F	Frame count.
B	Byte count.
MF	Multicast frame count.
BF	Broadcast frame count.
PF	Pause frame count.

TABLE 4-51 iSCSI Ethernet - MAC Performance Page *(Continued)*

Field	Indicates
CF	Control frame count.
FLE	Frame length error count
FDR	Frame dropped count.
FCRCE	Frame CRC error count
FEE	Frame encoding error count
LFE	Large frame error count
SFE	Small frame error count
J	Jabber count
UCC	Unknown control frame count
CSE	Carrier sense error count.

iSCSI Ethernet - TCP/IP Performance Page

The iSCSI Ethernet - TCP/IP Performance Statistics page provides statistics for TCP/IP, which is the Transmission Control Protocol and Internet Protocol for the iSCSI device. With TCP, applications on networked hosts can create connections to one another over which they can exchange data in packets. The Internet Protocol is a data-oriented protocol used to communicate data across a packet-switched network.

TABLE 4-52 describes the fields on the iSCSI Ethernet-TCP/IP Performance Statistics page.

TABLE 4-52 iSCSI Ethernet - TCP/IP Performance Page

Field	Indicates
Controller A Boot Time	The date and time when controller A was last booted.
Controller B Boot Time	The date and time when controller B was last booted.
TCP Statistics - Controllers	
Port	The iSCSI port used to transmit and receive data.
TxP	Transmitted packet count.
TxB	Transmitted byte count.
RtxTE	Retransmit timer expired count.

TABLE 4-52 iSCSI Ethernet - TCP/IP Performance Page *(Continued)*

Field	Indicates
TxDACK	Transmit delayed ACK count.
TxACK	Transmit ACK count.
RxACK	Received ACK count.
RxSEC	Received segment error count.
RxSOOC	Received segment out of order count.
RxWP	Received window probe count.
RxWU	Received window update count.
IPv4 Statistics - Controllers and IPv4 Statistics - Controllers	
Port	The iSCSI port used to transmit and receive data.
TxP	Transmitted packet count.
TxB	Transmitted byte count.
TxF	Transmitted fragment count.
RxP	Packets received count.
RxB	received byte count.
RxF	Received fragment count.
RxPE	Received error packet count.
DR	Datagram reassembly count.
DRE-OLFC	Datagram reassembly error, overlapped fragment count.
DR-OOFC	Datagram reassembly error, out of order fragment count.
DRE-TOC	Datagram reassembly error, time-out count.

iSCSI Session Details Page

This page shows details about the iSCSI session.

TABLE 4-53 describes the fields on the Initiator Details page.

TABLE 4-53 iSCSI Session Details Page

Field	Indicates
iSCSI Session Identification	
iSCSI Target Name	The iSCSI Qualified Name (IQN) of an iSCSI target.

TABLE 4-53 iSCSI Session Details Page *(Continued)*

Field	Indicates
iSCSI Session Identifier (SSID)	A session between an iSCSI initiator and an iSCSI target defined by a session ID that is a data object composed on an initiator part (ISID) and a target part (Target Portal Group Tag).
Initiator Session Identifier (ISID)	The initiator part of the iSCSI Session Identifier (SSID). The ISID is explicitly specified by the initiator during login.
Target Portal Group Tag	A 16-bit numerical identifier for an iSCSI target portal group.
Initiator iSCSI Name	The unique identifier name for the initiator.
Initiator iSCSI Label	The user label specified in the management software.
Initiator iSCSI Alias	A name that can also be associated with an iSCSI node. The alias allows an organization to associate a user-friendly string with the iSCSI name. However, the alias is not a substitute for the iSCSI name. The initiator iSCSI alias only can be set at the host, not via the Sun Storage Common Array Manager.
Host	The server that runs the Sun Storage Common Array Manager management software and is connected to the storage systems. It controls input and output to the storage systems.
iSCSI Session Connection ID(s)	
Connection ID	A unique ID for a connection within the session between the initiator and the target. This ID is generated by the initiator and presented to the target during login requests. The connection ID is also presented during logouts that close connections.
Ethernet Port	The controller and port that is associated with the connection.
Initiator IP Address	The IP address of the initiator.
Negotiated Login Parameters	
Authentication Method	The technique to authenticate users who want access to the iSCSI network. Valid values are CHAP and None.
Data Digest Method	The technique to show possible data values for this iSCSI session. Valid values are None or CRC32C The default value is None.
Header Digest Method	The technique to show possible data values for this iSCSI session. Valid values are None or CRC32C The default value is None.
Maximum Connections	The greatest number of connections allowed for this iSCSI session. Valid values are 1 through 4. The default is 1.
Target Alias	The label associated with the target.
Initiator Alias	The label associated with the initiator.
Target IP Address	The IP address of the target for this iSCSI session.

TABLE 4-53 iSCSI Session Details Page *(Continued)*

Field	Indicates
Target Portal Group Tag	A 16-bit numerical identifier for an iSCSI target portal group.
Initial R2T	The initial ready to transfer status. The status can be either Yes or No.
Maximum Burst Length	The maximum SCSI payload in bytes for this iSCSI session. The maximum burst length can be from 512 to 262,144 (256KB). The default value is 262,144 (256KB).
First Burst Length	The SCSI payload in bytes for the unsolicited data for this iSCSI session. The first burst length can be from 512 to 131,072 (128KB). The default value is 65,535 (64KB).
Default Time to Wait	The minimum number of seconds to wait before you attempt to make a connection after a connection termination or a connection reset. Valid values are 0 to 3600 seconds. The default is 2 seconds.
Default Time to Retain	The maximum number of seconds that the connection is still possible following a connection termination or a connection reset. Valid values are 0 to 3600 seconds. The default is 20 seconds.
Maximum Outstanding R2T	The maximum number of ready to transfers outstanding for this iSCSI session. Valid values are 1 to 16. The default is 1.
Error Recovery Level	The level of error recovery for this iSCSI session. The error recovery level is always set to 1.
Maximum Receive Data Segment Length	The maximum amount of data that either the initiator or the target can receive in any iSCSI payload. data unit (PDU).

iSCSI Sessions Summary Page

This page displays information about the iSCSI session.

TABLE 4-54 describes the buttons and fields on the iSCSI Session Summary page.

TABLE 4-54 iSCSI Sessions Summary Page

Field	Indicates
End Session	Click to end the iSCSI session by forcing the initiator off of a storage system.
Identifier (SSID)	A session between an iSCSI initiator and an iSCSI target defined by a session ID that is a data object composed on an initiator part (ISID) and a target part (Target Portal Group Tag).

TABLE 4-54 iSCSI Sessions Summary Page

Field	Indicates
iSCSI Target Name	A worldwide unique name assigned to the iSCSI target. This name has the .iqn format.
Initiator	The iSCSI initiator associated to the iSCSI target.
Host	The server that runs the Sun Storage Common Array Manager management software and is connected to the storage systems. It controls input and output to the storage systems.
Connection ID(s)-port	A unique ID for a connection within the session between the initiator and the target. This ID is generated by the initiator and presented to the target during login requests. The connection ID is also presented during logouts that close connections.

iSCSI Target Details Page

TABLE 4-55 describes the fields on the iSCSI Target Details page

TABLE 4-55 iSCSI Target Details Page

Field	Indicates
iSCSI Target Identification	
iSCSI Target Name	A worldwide unique name assigned to the iSCSI target. This name begins with the prefix .iqn.
iSCSI Target Alias	Optional. Specify an alphanumeric string of up to 30 characters to identify the iSCSI target.
iSCSI Target Authentication	
None	Specifies that no authentication is used.
CHAP	Specifies that CHAP authentication is used between the iSCSI initiator and iSCSI target.
CHAP Secret	A unique password consisting of 12 to 57 alphanumeric characters.
iSCSI Target Discovery	
Unnamed Discovery	Place a check mark in the box to enable unnamed discovery.
iSNS	Place a checkmark in the box to enable iSNS discovery.
IPV4 Settings	If iSNS discovery is enabled, select either DHCP or enter an iSNS IP address.

TABLE 4-55 iSCSI Target Details Page *(Continued)*

Field	Indicates
ICMP Ping Responses	ICMP contains a ping tool, which sends ICMP Echo Request messages (and receives Echo Response messages). These ICMP messages determine whether a host is reachable and how long it takes to get packets to and from that host.
Related Information	
Initiators	Number of initiators that can be used with this iSCSI target.
Sessions	Number of iSCSI sessions.

iSCSI Target - Protocol Performance Page

The Target-Protocol Performance page provides statistics for the iSCSI target, which provides block-level access to storage media.

TABLE 4-56 describes the fields on the iSCSI Target-Protocol Performance page.

TABLE 4-56 iSCSI Target - Protocol Performance Page

Field	Indicates
Controller A Boot Time	The date and time when controller A was last booted.
Controller B Boot Time	The date and time when controller B was last booted.
Target Statistics - Target	
Controller	Specifies the controller: A or B
Target	The iSCSI qualified name of the iSCSI target.
SL	Successful iSCSI login count.
UL	Unsuccessful iSCSI login count.
SA	Successful iSCSI authentication count (when authentication is enabled).
UA	Unsuccessful iSCSI authentication count (when authentication is enabled).
PDU	Correct iSCSI PDUs processed count.
HDE	iSCSI PDUs with header digest errors count.
DDE	iSCSI PDUs with data digest errors count.
PE	PDUs with iSCSI protocol errors count.

TABLE 4-56 iSCSI Target - Protocol Performance Page *(Continued)*

Field	Indicates
UST	unexpected iSCSI session termination counts.
UCT	unexpected iSCSI connection termination count.
IPv4 Statistics - Controllers and IPv6 Statistics - Controllers	
Port	The iSCSI port.
TxP	Transmitted packet count.
TxB	Transmitted byte count.
TxF	Transmitted fragment count.
RxP	Packets received count.
RxB	Received byte count.
RxF	Received fragment count.
RxPE	Received packet error count
DR	Datagram reassembly count.
DRE-OLFC	Datagram reassembly error, overlapped fragment count.
DR-OOFC	Datagram reassembly error, out of order fragment count.
DRE-TOC	Datagram reassembly error, time-out count.

Configuring Volume Copies

This section describes configuring volume copies. It contains the following subsections:

Array Support for Volume Copies

Array support for the Volume Copy premium feature is listed in TABLE 4-57:

TABLE 4-57 Support for Volume Copy Premium Feature by Array Type

Arrays that Support Volume Copies	Arrays that Do Not Support Volume Copies
Sun Storage 6180 array	Sun Storage J4200, J4400, and J4500 arrays
Sun Storage 6580 array	Sun Blade 6000 disk module
Sun Storage 6780 array	Sun Storage F5100 Flash Array
StorageTek 2510, 2530, and 2540 arrays	Sun Storage 2530-M2 and 2540-M2 arrays
Sun StorEdge 6130 array	
StorageTek 6140 array	
StorageTek 6540 array	
StorageTek FLX240 array	
StorageTek FLX280 array	
StorageTek FLX380 array	

About Volume Copies

A volume copy is a copy of data on one volume (called a source volume) written onto another volume (called a target volume) on the same storage array. A volume copy can be used to back up data, copy data from volumes that use small-capacity drives to volumes that use large-capacity drives, and restore snapshot data to the primary volume.

A source volume accepts host I/O and stores application data. The target volume maintains a copy of the data from the source volume.

When you create a volume copy, the management software creates a copy pair, which defines the association between the source volume and the target volume. When you no longer need a particular volume copy, you can remove the copy pair. Removing the copy pair dissociates the source volume from the target volume and causes the target and source volumes to revert their original volume types (such as standard volume or volume snapshot), enabling them to participate in other copy pairs in different roles. Removing a copy pair does not remove the data on the target volume.

The process of creating a volume copy is managed by the redundant array of independent disks (RAID) controllers and is transparent to host machines and applications. When the volume copy process starts, the controller of the source volume reads the data from the source volume and writes it to the target volume. The volume copy has a status of In-progress while the volume copy is being completed. Up to eight volume copies can have the status of In-progress at one time.

While a volume copy has a status of In-progress, the same controller must own both the source volume and the target volume. If different controllers own the source volume and target volume before the volume copy process is started, the management software automatically transfers ownership of the target volume to the controller that owns the source volume. When the volume copy process is completed or stopped, the management software restores ownership of the target volume to its original controller owner. Similarly, if ownership of the source volume is changed during the volume copy, ownership of the target volume is also changed.

The status of a volume copy can be one those described in TABLE 4-58.

TABLE 4-58 Volume Copy Status

Volume Copy Status	Description
Completed	The volume copy process finished successfully. • The source volume is available for both read and write I/O activity. • The target volume is available for read I/O activity, unless the Read-Only attribute has been set to No.
In-progress	Data is being copied from the source volume to the target volume. A maximum of eight volume copies can be in progress at one time. • The source volume is available for read I/O activity only. • The target volume is not available for read or write I/O activity.
Pending	The volume copy is waiting to be processed. If more than eight volume copies have been requested, subsequent volume copies enter a Pending state until one of the volume copies with a status of In-progress is completed. • The source volume is available for read I/O activity only. • The target volume is not available for read or write I/O activity
Failed	The volume copy process failed. • The source volume is available for read I/O activity only. • The target volume is not available for read or write I/O activity
Copy halted	The volume copy was stopped before all of the data on the source volume was copied to the target volume.

Planning Volume Copies

When you create a volume copy, be prepared to do the following:

- Select a source volume from the Volume Summary page or from the Snapshot Summary page.

  A source volume can be any of the following volume types:

  - Standard volume
  - Snapshot
  - Base volume of a snapshot (a volume of which you took a snapshot)
  - Target volume

  You can copy one source volume to several different target volumes.

- Select a target volume from the list of target volume candidates.

  The target volume must have a capacity that is equal to or greater than the usable capacity of the source volume. A target volume must be one of the following:

  - Standard volume
  - Base volume of a Failed or Disabled volume snapshot.

    Note: In order for a volume to be used as a target volume, its snapshots need to be either failed or disabled.

  Caution: A volume copy will overwrite all data on the target volume and automatically make the target volume read-only to hosts. Ensure that you no longer need the data or have backed up the data on the target volume before starting a volume copy. After the volume copy process has finished, you can enable hosts to write to the target volume by changing the target volume's Read-Only attribute on the Volume Details page.

  Because a target volume can have only one source volume, it can participate in one copy pair as a target. However, a target volume can also be a source volume for another volume copy, enabling you to make a volume copy of a volume copy. In addition, a source volume can be the target volume for another volume copy.

- Set the copy priority for the volume copy.

  During a volume copy, the storage array's resources may be diverted from processing I/O activity to completing a volume copy, which may affect the storage array's overall performance.

  Several factors contribute to the storage array's performance, including I/O activity, volume redundant array of independent disks (RAID) level, volume configuration (number of drives and cache parameters), and volume type (volume snapshots may take more time to copy than standard volumes).

  When you create a new volume copy, you will define the copy priority to determine how much controller processing time is allocated for the volume copy process and diverted from I/O activity.

  There are five relative priority settings. The Highest priority rate supports the volume copy at the expense of I/O activity. The Lowest priority rate supports I/O activity at the expense of volume copy speed.

  You can specify the copy priority before the volume copy process begins, while it is in progress, or after it has finished (in preparation for recopying the volume).

Managing Volume Copies

Before you can use the volume copy feature, you must enable it.

This section describes how to manage volume copies. It contains the following subsections:

Enabling the Volume Copy Feature

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

   The navigation tree is expanded for that array.

3. Expand Administration and choose Licensing.

   The Licensable Feature Summary page is displayed.

4. Click Add License.

   The Add License page is displayed.

5. Select StorageTek Data Volume Copy Software from the License Type menu.

6. Enter the version number and the key digest, and click OK.

Note: If you disable the volume copy feature, but volume copy pairs still exist, you can still remove the copy pair, start a copy using the existing copy pair, and change the setting of the read-only attribute for target volumes. However, you cannot create new volume copies.

Displaying Volume Copy Information

To determine which volumes are involved in a volume copy, see the Volume Details page. For the source volume, the Related Information section identifies associated target volumes. For the target volume, the Volume Details page identifies the associated source volume, the copy priority, and the target volume read-only status.

To display information on source volumes:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Volumes.

   The Volume Summary page is displayed.

3. Click a source or target volume name for detailed information on that volume.

   The Volume Details page for the selected volume is displayed.

4. Go to Related Information and click any item for more information associated with the selected volume.

5. Click Targets.

   The Volume Copies Summary page lists the target volumes associated with selected volume.

6. Click a target volume name to display information about that volume.

   The Volume Details page for the selected target volume is displayed.

Creating a Volume Copy

Before creating a volume copy, be sure that a suitable target volume exists on the storage array, or create a new target volume specifically for the volume copy. For information on planning volume copies, see "Planning Volume Copies" on page 225.

You can create a copy of a standard volume, a target volume, or a snapshot volume. For information about copying a snapshot volume, see "Copying a Volume Snapshot" on page 242.

To create a volume copy of a standard volume or a target volume:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Volumes.

   The Volume Summary page is displayed.

3. Click the name of the volume whose contents you want to copy to another volume. The volume you select must be a standard volume, a snapshot volume, or a target volume.

   The Volume Details page for that volume is displayed.

4. Click Copy.

5. When prompted to continue, click OK.

   The Copy Volume page is displayed.

6. Select the copy priority.

   The higher the priority you select, the more resources will be allocated to the volume copy operation at the expense of the storage array's performance.

7. Select the target volume you want from the Target Volumes list.

   Select a target volume with a capacity similar to the usable capacity of the source volume to reduce the risk of having unusable space on the target volume after the volume copy is created.

8. Before starting the volume copy process:

   a. Stop all I/O activity to the source and target volumes.

   b. Unmount any file systems on the source and target volumes, if applicable.

9. Review the specified information on the Copy Volume page. If you are satisfied, click OK to start the volume copy.

   A message confirms that the volume copy has successfully started.

10. After the volume copy process has finished:

    a. Remount any file systems on the source volume and target volume, if applicable.

    b. Enable I/O activity to the source volume and target volume.

Recopying a Volume Copy

You can recopy a volume copy for an existing copy pair. Recopying a volume copy is useful when you want to perform a scheduled, complete backup of the target volume that can then be copied to a tape drive for off-site storage.

Caution: Recopying a volume copy will overwrite all data on the target volume and automatically make the target volume read-only to hosts. Ensure that you no longer need the data or have backed up the data on the target volume before recopying a volume copy.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Volumes.

   The Volume Summary page is displayed.

3. Click the name of the target volume that you want to recopy.

   The Volume Details page for that volume is displayed.

4. Stop all I/O activity to the source volume and target volume.

5. Unmount any file systems on the source volume and target volume, if applicable.

6. Click Recopy.

   The management software recopies the source volume to the target volume and displays a confirmation message.

7. Remount any file systems on the source volume and target volume, if applicable.

8. Enable I/O activity to the source volume and target volume.

Changing the Copy Priority

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Volumes.

   The Volume Summary page is displayed.

3. Click the name of the volume for which you want to change the copy priority.

   The Volume Details page for the selected volume is displayed.

4. In the Copy Priority field, select the copy priority you want.

   The higher the priority you select, the more resources will be allocated to the volume copy operation at the expense of the storage array's performance.

5. Click OK.

   A confirmation message indicates that the change was successful.

Removing a Copy Pair

Removing a copy pair removes the association between a source volume and a target volume, enabling each to participate in another volume copy in a different role.

You cannot remove a copy pair while a volume copy using that copy pair is in progress.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Volumes.

   The Volume Summary page is displayed.

3. Click the name of the target volume in the copy pair that you want to remove.

   The Volume Details page for that volume is displayed.

4. Click Related Information to ensure that a volume copy using the selected volume is not in progress.

5. Return to the top of the Details page, and click Remove Copy Pair.

Page and Field Descriptions

Browser interface pages and fields related to the "Configuring Volume Copies" section are described below.

Volume Copies Summary Page

This page shows the target volumes associated with the selected volume copy.

TABLE 4-59 describes the fields on the Volume Copies Summary page.

TABLE 4-59 Volume Copies Summary Page

Field	Indicates
Target Volume Name	The name of the target volume.
Status	The current volume copy status.
Priority	The copy priority.

Configuring Volume Snapshots

This section describes configuring and managing volume snapshots. It contains the following subsections:

About Volume Snapshots

A snapshot is a copy of the data on a volume at the moment at which you create the snapshot. It is the logical equivalent of a complete physical copy, but you create it much more quickly than a physical copy, and it requires less disk space. Creating a snapshot causes the array controller tray to suspend I/O to the base volume while it creates a physical volume, called the reserve volume. The reserve volume stores information about the data that has changed since the snapshot was created. The capacity of the reserve volume is a configurable percentage of the base volume.

Snapshot is a premium feature that requires a license. You must enable the snapshot license before you can use the snapshot feature. For information on licenses, see Managing Licenses.

You work with a snapshot as you would with any other volume, with the exception that you cannot take a snapshot of a snapshot. Each snapshot can be accessed independently by other applications. A snapshot can be mounted on another server and used in the following ways:

- As an alternative backup method to reduce downtime for backup operations

  Backing up snapshots, rather than online data, enables critical transactions to keep running during the backup process. Mount the snapshot to the backup server, and then back up the snapshot's data to tape.

- For data analysis and testing of applications with actual, current data

  Instead of working with operating data or interfering with critical transactions, use the most recent snapshot for analysis or testing of data.

- To restart applications

  If an application problem causes bad data to be written to the primary volume, restart the application with the last known good snapshot until it is convenient to perform a full recovery.

  Note: A snapshot of data is not suitable for failure recovery. Continue to use offline backup methods to create full-volume backup copies.

Snapshots on the array are copy-on-write or dependent copies. In this type of snapshot, write operations to the primary volume causes the management software to copy the snapshot metadata and copy-on-write data to the reserve volume. Because the only blocks that are physically stored in the reserve volume are those that have changed since the time the snapshot was created, the snapshot uses less disk space than a full physical copy.

When a write operation occurs on the primary volume to a data block in which the data has not changed since the snapshot was created, the management software does the following:

- Copies the old data to the reserve volume
- Writes the new data to the primary volume
- Adds a record to the snapshot bitmap indicating the location of the new data

When a data host sends a read request to the snapshot, the management software checks whether the requested blocks have changed on the primary volume since the snapshot was created. If they have changed, the read request is satisfied from the data stored in the snapshot reserve volume. If blocks have not changed, the read request is satisfied from the primary volume. Snapshots can also accept write operations. Write operations to a snapshot are stored in the snapshot reserve volume.

The management software provides a warning message when the reserve volume nears the threshold, which is a configurable percentage of the full capacity of the snapshot reserve (the default is 50 percent). When the reserve volume threshold is met, the reserve volume's capacity can be expanded using the free capacity on the virtual disk.

As long as a snapshot is enabled, storage array performance is affected by the copy-on-write activity to the associated reserve volume. If a snapshot is no longer needed, you can stop the copy-on-write activity by either disabling or deleting the snapshot.

When a snapshot is disabled, it and its associated reserve volume still exist. When you need to create a different point-in-time image of the same primary volume, you can resnap the volume to reuse the disabled snapshot and its associated reserve volume. This takes less time than creating a new snapshot.

If you do not intend to re-create a snapshot, you can delete the snapshot instead of disabling it. When you delete a snapshot, the management software also deletes the associated reserve volume.

To see the current snapshots for a particular volume, go to the Related Information section of Snapshot Summary page for that volume, as described in "Displaying Volume Snapshot Information" on page 240.

Planning Volume Snapshots

Creating a volume snapshot involves a number of tasks and decisions about a variety of factors. Therefore, before running the Create a Snapshot Volume wizard, you should plan the following aspects of your snapshots:

- The name of the snapshot reserve volume

  When you create a snapshot, you must provide a unique name for the snapshot that enables you to easily identify the primary volume.

  Each snapshot has an associated reserve volume that stores information about the data that has changed since the snapshot was created. You must provide a unique name for the reserve volume that enables you to easily identify the snapshot to which it corresponds.

- The capacity of the reserve volume

  To determine the appropriate capacity, you must calculate both the management overhead required and percentage of change you expect on the base volume. For more information, see "Calculating Reserve Volume Capacity" on page 237.

- The warning threshold

  When you create a snapshot volume, you can specify the threshold at which the management software will generate messages to indicate the level of space left in the reserve volume. By default, the software generates a warning notification when data in the reserve volume reaches 50 percent of the available capacity. You can monitor the percentage of space used on the Snapshot Details page for the snapshot.

- The method used to handle snapshot failures

  When you create a snapshot volume, you can determine how the management software will respond when the reserve volume for the snapshot becomes full. The management software can do either of the following:

  - Fail the snapshot volume. In this case the snapshot becomes invalid, but the base volume continues to operate normally.
  - Fail the base volume. In this case, attempts to write new data to the primary volume fail. This leaves the snapshot as a valid copy of the original base volume.

- The virtual disk selection method

  A snapshot can be created on a virtual disk as long as the virtual disk has enough capacity for the snapshot.

  The following options are available:

  - Automatic – The management software automatically searches for and selects a virtual disk that matches the necessary criteria. If there are none, and enough space is available, it creates a new virtual disk.
  - Create Volume on an Existing Virtual Disk – You manually select the virtual disks on which you want to create the volume from the list of all available virtual disks. Be sure that the number of disks you select have enough capacity for the volume.
  - Create a New Virtual Disk – You create a new virtual disk on which to create the volume. Be sure that the virtual disk that you create has enough capacity for the volume.

- The snapshot mapping option

  You can add the snapshot to an existing storage domain, including the default storage domain, or create a new storage domain by mapping the snapshot to a host or host group. A storage domain is a logical entity used to partition storage that allows a host or host group to have read/write access to the snapshot. The default storage domain contains all hosts and host groups without explicit mappings and enables them to share access to all snapshots that are not explicitly mapped.

  During snapshot creation, you can choose between the following mapping options:

  - Map Snapshot to One Host or Host Group - this option enables you to explicitly map the snapshot to a specific host or host group, or to include the snapshot in the default storage domain.
  - Do Not Map this Snapshot - this option causes the management software to automatically include the snapshot in the default storage domain.

  Note: A host or host group will be available as a mapping option only if an initiator is associated with each individual host and each host included in a host group.

Calculating Reserve Volume Capacity

When you create a snapshot, you specify the size of the snapshot reserve volume that will store snapshot data and any other data that is needed during the life of the snapshot. When prompted to specify the size of the snapshot reserve volume, you must enter a percentage of the size of the base volume, as long as that percentage does not translate to a size of less than 8 megabytes.

The capacity needed for the snapshot reserve volume varies, depending on the frequency and size of I/O writes to the base volume and how long you need to keep the snapshot volume. In general, choose a large capacity for the reserve volume if you intend to keep the snapshot volume for a long period of time or if you anticipate heavy I/O activity, which will cause a large percentage of data blocks to change on the base volume during the life of the snapshot volume. Use historical performance to monitor data or other operating system utilities to help you determine typical I/O activity on the base volume.

When the snapshot reserve volume reaches a specified capacity threshold, you are given a warning. You set this threshold when you create a snapshot volume. The default threshold level is 50 percent.

If you receive a warning and determine that the snapshot reserve volume is in danger of filling up before you have finished using the snapshot volume, you can increase its capacity: Navigate to the Snapshot Details page and click Expand. If the snapshot reserve volume fills up before you have finished using the snapshot, the snapshot failure handling conditions specify the action that will be taken.

When you create a snapshot volume, you can allocate as large a snapshot reserve volume as you have space for.

Use the following information to determine the appropriate capacity of the snapshot reserve volume:

- A snapshot reserve volume cannot be smaller than 8 megabytes.
- The amount of write activity to the base volume after the snapshot volume has been created dictates how large the snapshot reserve volume needs to be. As the amount of write activity to the base volume increases, the number of original data blocks that need to be copied from the base volume to the snapshot reserve volume also increases.
- The estimated life expectancy of the snapshot volume contributes to determining the appropriate capacity of the snapshot reserve volume. If the snapshot volume is created and remains enabled for a long period of time, the snapshot reserve volume runs the risk of reaching its maximum capacity.

- The amount of management overhead required on the snapshot reserve volume for storage of snapshot volume data contributes to determining the appropriate capacity of the snapshot reserve volume. The amount of management overhead actually required is fairly small, and can be calculated with the simple formula that is presented later in this topic.
- There is not necessarily a one-to-one correlation between the number of data blocks that change on the base volume and the amount of data stored in the snapshot reserve volume. Depending on the location of data blocks that need to be copied, performance factors might dictate that the controller copy over a full set of 32 blocks, even if only one set of blocks has changed. Consider this when determining the percentage of the base volume's capacity that can be copied to the snapshot reserve volume.

Use the following formula to calculate the amount of management overhead required to store snapshot data on the snapshot reserve volume.

192 Kbytes + (x/2000)

where x is the capacity of the base volume in bytes.

Note: This formula is merely a guide. You should re-estimate the snapshot reserve volume capacity periodically.

The conversion process involves conversion from bytes to kilobytes and then to megabytes or gigabytes. For example, for a 5-gigabyte base volume, you would calculate the estimated snapshot reserve volume capacity as follows:

1. Convert the base volume's capacity to bytes.

   When converted, 5 gigabytes equals 5,368,709,120 bytes.

2. Divide the base volume's capacity (in bytes) by 2000.

   The result is 2,684,354.56 bytes.

3. Convert bytes to kilobytes.

   The result is 2621.44 kilobytes.

4. Add 192 kilobytes to the results from Step 3.

   192 Kbytes + 2621.44 Kbytes = 2813.44 Kbytes

5. Convert the result from Step 4 to megabytes.

   The resulting amount of management overhead required is 2.75 megabytes (or 0.002686 gigabytes).

Continuing in this example, suppose that you expect 30 percent of the data blocks on the base volume to change. To accurately calculate the snapshot reserve volume capacity, you must allow sufficient space for the snapshot reserve volume as well as for the management overhead.

To determine the snapshot reserve volume, calculate the percentage of change you expect on the base volume:

30 percent x 5 gigabytes = 1.5 gigabytes

To obtain the final estimated snapshot reserve volume capacity, add this number to the previously calculated amount of management overhead:

1.5 gigabytes + 0.002686 gigabytes = 1.502686 gigabytes

In the Create Snapshot Volume Wizard: Specify Reserve Capacity dialog box, use the percentage (%) of base volume to specify the estimated capacity of the snapshot reserve volume.

When you create a snapshot, you will specify this snapshot reserve volume capacity as a percentage of the base volume. You can increase or decrease the percentage until the Snapshot Reserve Volume Capacity value matches the estimated capacity that you calculated. Some rounding up may be required.

Managing Volume Snapshots

- This section describes managing volume snapshots. It contains the following subsections:“Enabling Volume Snapshots” on page 239
- “Displaying Volume Snapshot Information” on page 240
- “Creating a Volume Snapshot” on page 240
- “Resnapping Volume Snapshots” on page 241
- “Copying a Volume Snapshot” on page 242
- “Mapping a Volume Snapshot to a Host or Host Group” on page 243
- “Expanding Snapshot Capacity” on page 243
- “Unmapping a Volume Snapshot” on page 244
- “Disabling Volume Snapshots” on page 244
- “Deleting a Volume Snapshot” on page 245

Enabling Volume Snapshots

Before you can use the snapshots feature, you must enable it.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

   The navigation tree is expanded for that array.

3. Expand Administration and choose Licensing.

   The Licensable Feature Summary page is displayed.

4. Click Add License.

   The Add License page is displayed.

5. Select a premium feature license key file and click the Enable button.

Displaying Volume Snapshot Information

You can display summary and detail information for existing snapshots.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Snapshots.

   The Snapshot Summary page is displayed.

3. Click the snapshot name for detailed information on that snapshot.

   The Snapshot Details page for the selected snapshot is displayed.

Creating a Volume Snapshot

You must consider a number of factors and make a number of decisions before creating a snapshot. For information on planning a snapshot, see "Planning Volume Snapshots" on page 235.

Note: You cannot create a snapshot of a target volume.

To create a volume snapshot:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

   The navigation tree is expanded for that array.

3. Click the volume for which you want to create a snapshot.

   The Volume Details page for that volume is displayed.

4. Click Snapshot.

   The Create Snapshot Volume wizard is launched.

5. Follow the steps in the wizard. Click the Help tab in the wizard for more information.

Note: After you select an array to work with, you can also launch the Create Snapshot Volume wizard: In the navigation pane, select Snapshots, and then click New on the Snapshot Summary page.

Resnapping Volume Snapshots

You can resnap one snapshot or, for the StorageTek 6140, 6540, and FLX380 arrays only, you can resnap a group of up to 64 snapshots. When you resnap a group of snapshots, an array job is created. You can view the job progress from the Current Job Summary page.

When resnapping a group of snapshots, if the resnap operation fails for one snapshot, then the entire resnap operation is cancelled.

To resnap one or more volume snapshots:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Snapshots.

   The Snapshot Summary page is displayed.

3. Click the check box to the left of each snapshot that you want to resnap.

   This enables the Resnap button.

4. Click Resnap.

   Upon completion of the new snapshot, a confirmation message is displayed.

Copying a Volume Snapshot

Before copying a snapshot, be sure that a suitable target volume exists on the storage array, or create a new target volume specifically for the snapshot.

Caution: Like any volume copy, a volume copy of a snapshot overwrites all data on the target volume and automatically makes the target volume read-only to data hosts. Ensure that you no longer need the data or have backed up the data on the target volume before starting a volume copy.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Snapshots.

   The Snapshot Summary page is displayed.

3. Click the name of the snapshot that you want to copy.

   The Snapshot Details page is displayed.

4. Click Copy.

   The Copy Snapshot page is displayed.

5. Select a copy priority.

   Valid values are Highest, High, Medium, Low, and Lowest. The higher the priority, the more resources will be allocated at the expense of the storage array's performance.

6. Select a target volume from the Target Volumes list.

   Only valid target volumes with capacities equal to or greater than the capacity of the source snapshot are displayed.

   Note: Selecting a target volume with a capacity similar to that of the source snapshot reduces the risk of there being unusable space on the target volume after the volume copy has been created.

7. Stop all I/O activity to the snapshot and target volume.

8. Unmount any file systems on the source volume and target volume, if applicable.

9. Review the specified information. If you are satisfied, click OK.

10. Remount any file systems on the source volume and target volume, if applicable.

11. Enable I/O activity to the snapshot volume and target volume.

Mapping a Volume Snapshot to a Host or Host Group

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Snapshots.

   The Snapshot Summary page is displayed.

3. Click the snapshot to which you want to map the host or host group.

   This enables the Map button.

4. Click Map.

   The Map Snapshot page displays a list of available hosts and host groups. Use the filter to display only hosts and host groups.

5. Select the host or host group that you want to map to this volume, and click OK.

   A message confirms that the snapshot was mapped successfully.

Expanding Snapshot Capacity

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Snapshots.

   The Snapshot Summary page is displayed.

3. Click the snapshot whose capacity you want to expand.

   The Snapshot Details page is displayed.

4. Go to the Reserve Details section of the page, and click the Expand button.

   The Expand Volume page displays the current capacity.

5. Specify the volume capacity you want, and click OK.

A message specifies that dynamic volume expansion is in progress.

Unmapping a Volume Snapshot

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Snapshots.

   The Snapshot Summary page is displayed.

3. Select the snapshot that you want to unmap.

   The Snapshot Details page is displayed.

4. Click Unmap.

   You are prompted to confirm the unmapping.

5. Click OK.

   When the unmapping is complete, a confirmation message is displayed.

Disabling Volume Snapshots

You can disable a single snapshot (all arrays), or a group of snapshots at the same time (Sun Storage 6180, 6580, and 6780 arrays, StorageTek 6140, 6540, and FLX380 arrays). Disabling a volume snapshot does not remove the volume snapshot or its associated reserve volume.

When you disable a volume snapshot:

- You can re-enable the snapshot: Select it from the Snapshot Summary page and click the Re-snap button.
- Only the specified snapshots are disabled. All other snapshots remain functional.

To disable one or more volume snapshots:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array for which you want to disable a snapshot, and choose Snapshot.

   The Snapshot Summary page is displayed.

3. Click the check box to the left of each snapshot that you want to disable.

   This enables the Disable button.

4. Click Disable.

   You are prompted to confirm the disabling of the snapshot volumes.

5. Click OK.

   When the selected snapshots have been disabled, a confirmation message is displayed.

Deleting a Volume Snapshot

When you delete a volume snapshot, the corresponding reserve volume is also deleted, thus freeing up the capacity allocated to the reserve volume.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Snapshots.

   The Snapshot Summary page is displayed.

3. Select the snapshot that you want to delete.

   This enables the Delete button.

4. Click Delete.

   You are prompted to confirm the deletion.

5. Click OK.

   When the selected snapshot has been deleted, a confirmation message is displayed.

Page and Field Descriptions

Browser interface pages and fields related to the "Configuring Volume Snapshots" section are described in the following subsections:

Copy Snapshot Page

This page enables you to copy an existing snapshot.

TABLE 4-60 describes the buttons and fields on the Copy Snapshot page.

TABLE 4-60 Copy Snapshot Page

Field	Indicates
Select Copy Priority	Select the copy priority, which determines how much controller processing time is allocated for the volume copy process and diverted from I/O activity. There are five relative priority settings: Highest, High (default), Medium, Low, and Lowest. The Highest priority rate supports the volume copy at the expense of I/O activity. The Lowest priority rate supports I/O activity at the expense of volume copy speed.
Select Target Volume	
Name	The snapshot copy name.
Pool	The pool associated with this snapshot.
Capacity	The snapshot copy capacity.

Snapshot Details Page

This page displays details for the selected snapshot.

TABLE 4-61 describes the buttons and fields on the Snapshot Details page.

TABLE 4-61 Snapshot Details Page

Field	Indicates
Map/Unmap	Click to map or unmap a volume snapshot from a host or host group.
Resnap	Click to resnap a volume snapshot.
Copy	Click to copy a volume snapshot.
Disable	Click to disable a volume snapshot.
Delete	Click to delete a volume snapshot and its corresponding reserve volume.
Snapshot Details	
Name	The snapshot name.
World Wide Name	The World Wide Name of the snapshot.
Creation Date	The date this snapshot was created.
State	The current state of the snapshot volume: Mapped, Free.
Snapshot Status	The status of the snapshot volume: enabled or disabled.
Base Volume Name	The base volume associated with this snapshot.
Percent Full	The percentage of the snapshot reserve volume that is being used.
Failure Policy	The action the management software takes if the snapshot of the reserve volume becomes full: Fail the snapshot volume to Fail the primary volume.
Warning Threshold	The percentage of capacity filled in the reserve volume that triggers a warning message.
Reserve Details	
Expand	Click to expand the capacity of the snapshot reserve volume.
Name	The name of the snapshot reserve volume.
Virtual Disk	The virtual disk for this volume.
Capacity	The capacity of this reserve volume.The storage capacity that is allocated to this volume: KB, MB, GB (default), TB, blocks. The capacity is the usable size of the volume for data. You might need additional capacity for a snapshot reserve volume.

TABLE 4-61 Snapshot Details Page *(Continued)*

Field	Indicates
RAID Level	The specified RAID level.
Segment Size	The amount of data (in kilobytes) that the controller writes on a single physical disk in a volume before writing data on the next physical disk.
Write cache enabled	Whether the write cache is enabled: True or False.
Write cache with replication enabled	Whether the write cache is enabled with data replication.
Write cache without batteries enabled	Whether the write cache is enabled without batteries.
Flush Write Cache After	The maximum amount of time that dirty data (data that has been cached, but not yet written to physical storage for the volume) can be maintained in cache before being flushed to physical storage.
Disk scrubbing enabled	Whether disk scrubbing is enabled.
Disk scrubbing with redundancy enabled	Whether disk scrubbing with redundancy is enabled.
Condition	Whether the snapshot is optimal or in an error condition.
Status	The current status of the snapshot. Valid values are: • Active • Failed • Disabled • Offline
Action	The current action (e.g. Ready).
Preferred Controller	The controller of choice when both controllers are operational.
Owning Controller	The controller for this array: A or B.
Modification Priority	The priority according to which this volume is to be modified, at the expense of I/O activity: Highest, High, Medium, Low, or Lowest.
Protection Information Enabled	The protection information status for this snapshot volume. A snapshot volume is protected if the base volume is PI enabled. Values are True and False.
Application Tag Ownership	The component that provides the contents of the application tag field.Read-only values are Host, Controller, or N/A.
Related Information	
Mapped Initiators	The number of initiators associated to this snapshot.
Targets	The number of target volumes associated to the snapshot.

Snapshot Summary Page

This page displays information about all snapshots. Click a snapshot name to view the details and related information for that snapshot.

TABLE 4-62 describes the buttons and fields on the Snapshot Summary page.

TABLE 4-62 Snapshot Summary Page

Field	Indicates
New	Click to launch the Create a Snapshot Volume wizard.
Map	Click to map a volume snapshot to a host or host group.
Resnap	Click to resnap a volume snapshot.
Disable	Click to disable a volume snapshot.
Delete	Click to delete a volume snapshot and its corresponding reserve volume.
Name	The snapshot name.
Base Volume	The base volume associated with this snapshot.
Reserve Volume	The reserve volume associated with this snapshot.
Creation Date	The date this snapshot was created.
Percent Full	The percentage of the reserve volume that is being used.
State	The current state of the snapshot volume: Mapped, Free.
Status	The current status of the snapshot. Valid values are: • Active • Failed • Disabled • Offline
Condition	Whether the snapshot is optimal or in an error condition.
Type	The type of snapshot: Standard, Source.
WWN	The World Wide Name of the snapshot.

Configuring Data Replication

This section describes configuration of data replication. It contains the following subsections:

Array Support for Data Replication

Array support for the Data Replication premium feature is listed in TABLE 4-63:

TABLE 4-63 Support for Data Replication Premium Feature

Arrays that Support Data Replication	Arrays that Do Not Support Data Replication
Sun Storage 6180 array	StorageTek 2510, 2530, and 2540 arrays
Sun Storage 6580 array	Sun Storage J4200, J4400, and J4500 arrays
Sun Storage 6780 array	Sun Blade 6000 disk module
Sun StorEdge 6130 array	
StorageTek 6140 array	
StorageTek 6540 array	
StorageTek FLX240 array	
StorageTek FLX280 array	
StorageTek FLX380 array	

About Data Replication

This section describes data replication concepts. It contains the following topics:

About the Replication Process

The data replication software is a volume-level replication tool that protects your data. You can use this software to replicate volumes between physically separate primary and secondary arrays in real time. The software is active while your applications access the volumes, and it continuously replicates the data between volumes.

As part of a disaster recovery and business continuance plan, the software enables you to keep up-to-date copies of critical data from the primary volume on the secondary volume. You can also rehearse your data recovery strategy to fail data over to the secondary volume. Later, you can write any data changes that occurred back to the primary volume.

The software replicates data from a primary volume to a secondary volume. The association between the primary and secondary volumes constitutes a replication set. After the volumes in a replication set have been initially synchronized, the software ensures that the primary and secondary volumes contain the same data on an ongoing basis.

Note: There are exceptions if you use asynchronous replication mode. See "About Replication Modes" on page 258 for more information.

Note: Third-party applications can continue to write to the primary volume while it is replicating, but the secondary volume is read only.

The software transports data between the two arrays by means of synchronous or asynchronous replication mode, using a dedicated Fibre Channel (FC) connection (FC port 4 for the arrays with a 4-port configuration, host port 2 for arrays with a 2-port configuration, and host port 8 for an 8-port configuration). Both of the arrays with volumes participating in the replication set must be registered with Sun's management software, and must be reachable through the out-of-band management network.

Note: The system does not provide built-in authentication or encryption for data traveling outside of your data center over a long-distance replication link. It is assumed that customers implementing data replication strategies using multiple arrays will replicate data over secure leased lines or use edge devices to provide encryption and authentication. For assistance with setting up appropriate security, contact Oracle Advanced Customer Services:

http://www.oracle.com/support/advanced-customer-services/index.html

If there is a break in the network or if the secondary volume is unavailable, the software automatically switches to suspended mode, in which it ceases replication and tracks changes to the primary volume in a separate volume known as a replication repository. When communication is restored, the software uses the information in the replication repository volume to resynchronize the volumes and returns to replicating the data.

When replicating data in synchronous replication mode, the software preserves write order consistency. That is, the software ensures that write operations to the secondary volume occur in the same order as the write operations to the primary volume. This ensures that the data on the secondary volume is consistent with data on the primary volume and does not compromise an attempt to recover the data if a disaster occurs at the primary volume.

If you need to ensure write order consistency across multiple volumes, such as for an application that builds its database on multiple volumes, you can place multiple replication sets into the consistency group. Each array supports only one consistency group and replication sets in the consistency group must use asynchronous replication mode. The consistency group enables you to manage several replication sets as one. By using the consistency group, the software maintains write ordering for volumes in a group to ensure that the data on all secondary volumes is a consistent copy of the corresponding primary volumes.

You can also restore data from a secondary volume to a primary volume by reversing the roles of the primary and secondary volumes. Role reversal is a failover technique in which a primary volume failure causes the secondary volume to assume the role of the primary volume. The application software accesses the secondary volume directly until you can correct the failure at the primary volume.

About Replication Sets

A replication set includes the following:

- A volume residing on an array and a reference to a volume residing on another, physically separate array. One array contains the primary volume, which copies the data, and the other array contains the secondary volume, which is the recipient of the data.
- The replication mode between both arrays: synchronous or asynchronous.
- The role that the volume plays within the replication set, either as a primary or as a secondary volume.

The maximum number of replication sets per array is determined by the firmware revision (see the *Sun Storage Common Array Manager Release Notes* for details). You can create and configure a replication set from either array. It is not necessary to set up the replication set properties on both arrays.

Note: Multi-hop and one-to-many data replication are not supported.

You can update the secondary volumes synchronously in real time or asynchronously using a store-and-forward technique. When the replication set is first created, a primary volume is first wholly copied to a designated secondary volume to establish matching contents. As applications write to the primary volume, the data replication software copies the changes from the primary volume to the secondary volume, keeping the two images consistent.

When you activate the Sun Storage Data Replicator software premium feature on each array (see "Activating and Deactivating Data Replication" on page 266), two replication repository volumes are created on each array, one per controller. The controller stores replication information in the replication repository volume, including information about write operations to the destination volume in the replication set that are not yet completed. The controller can then use this information to recover from controller resets or array outages, by copying only the blocks that have changed since the reset or outage occurred.

After you create a replication set, you can modify its properties (see "About Replication Set Properties" on page 256 for more information). You can also perform volume operations, such as the following:

- Extend replicated volumes, by adding storage first to the secondary volume and then to the primary volume.
- Create snapshots.

  You can create a snapshot of either the primary or the secondary volume within a replication set at any time.
- Make volume copies.

A primary volume in a replication set can be a source volume or a target volume in a volume copy. Volume copies are not allowed on secondary volumes. If a copy of a secondary volume is required, perform a role reversal to change the secondary volume to a primary volume. If a role reversal is initiated during a volume copy in progress, the copy will fail and you cannot restart it. For more on role reversal, see "About Primary and Secondary Role Reversal" on page 257.

- Change volume mappings.

You can also delete a replication set. This removes the association between the primary and secondary volumes, and the volumes revert to independent volumes.

Note: You cannot replicate a volume that is already in a replication set.

If the primary volume becomes unavailable, the secondary volume assumes the role of primary volume. This role reversal allows applications to continue their operations by using the newly designated primary volume. When the former primary volume is again available, you must synchronize it with the more recent data on the other volume to restore the functions of the replication set.

About the Consistency Group

The consistency group is a collection of replication sets that have the same role and that only use asynchronous replication mode. The purpose of the consistency group is to ensure write order consistency across multiple volumes. Only one consistency group is supported per array.

When you perform an operation on the consistency group, the operation applies to all the replication sets, and consequently their volumes, in the consistency group. If you make a change to the consistency group, the change occurs on every replication set in the consistency group; if an operation fails on a single replication set in the consistency group, it fails on every replication set in the consistency group.

Note: Volume snapshot operations are the exception. You must create a snapshot of each volume in a replication set individually.

When you include replication sets in the consistency group, the system preserves write ordering among the volumes in the replication sets. Because you control the replication sets as a single unit, data replication operations are executed on every member of the consistency group. Write operations to the secondary volume occur in the same order as the write operations to the primary volume. The software maintains write ordering among volumes in a group to ensure that the data on each secondary volume is a consistent copy of the corresponding primary volume.

Before you include a replication set in the consistency group, consider the guidelines in TABLE 4-64.

TABLE 4-64 Consistency Group Guidelines

Regarding	Note
Write order	If you need to preserve write order consistency for a set of volumes, include the replication sets that comprise the volumes in the consistency group. You can add an existing replication set to the consistency group from the replication set's Replication Set Details page.
Volumes	All primary volumes in the consistency group must reside on the same primary array. You cannot preserve write ordering when you have primary volumes originating on different arrays.
Replication sets	Replication sets in the consistency group must all use asynchronous replication mode. The consistency group supports up to 32 replication sets.

A best practice is to plan the consistency group in advance and include the replication set in the consistency group at the same time that you create the replication set. To do this, select the Add to Write Consistency Group check box when you are specifying replication properties in the Create Replication Set wizard.

To add an existing replication set with asynchronous replication mode to the consistency group, select the Consistency Group check box on the Replication Set Details page for the replication set, then click OK to save.

About Replication Links

A replication link is a logical and physical connection between two arrays that allows for data replication. A replication link transports data between the primary and secondary arrays. This link transfers data as well as replication control commands.

To establish a replication link between two arrays, you must use Fibre Channel (FC) port 2 for arrays with a 2-port configuration, FC port 4 for arrays with a 4-port configuration, and FC port 8 for arrays with an 8-port configuration. Additionally, you must configure any FC switches that you use to make the connection to the array for long-distance operations and apply zoning practices. For more information on configurations and switch zoning for data replication, see the documentation for your array.

Note: The system does not provide built-in authentication/encryption for data traveling outside of your data center over a long-distance replication link. It is assumed that customers implementing data replication strategies using multiple

arrays will replicate data over secure leased lines or use edge devices to provide encryption and authentication. For assistance with setting up appropriate security, contact Oracle Advanced Customer Services:

http://www.oracle.com/support/advanced-customer-services/index.html

See the FC switch vendor's documentation for information about operating over long distances.

About Replication Set Properties

When you define a replication set or the consistency group, you set replication properties. To set these properties, do the following:

- Specify a secondary volume. When you create the replication set, the local volume assumes the primary role by default, and you are prompted to choose the secondary volume. Once the replication set is created, you can change the role of a volume on the Replication Set Details page as needed without suspending replication. See "Reversing Roles" on page 269 for more information.
- Set the replication mode to synchronous or asynchronous. See "About Replication Modes" on page 258 for more information. If the mode is asynchronous, you have the option of including the replication set in the consistency group. See "About the Consistency Group" on page 254 for more information.
- Set the priority of the synchronization rate relative to I/O activity to highest, high, medium, low, or lowest.
- If appropriate for your environment, set the resynchronization method in the Create Replication Set wizard to Automatic.

  Automatic resynchronization is an alternative to manual synchronization (to manually synchronize , click the Resume button on the Replication Set Details page). The Automatic resynchronization option supports both replication sets and the consistency group. If you enable this option, the software synchronizes the volumes on both arrays and resumes replication as soon as possible.

  For example, if a network link fails and causes the software to cease replication, resynchronization will occur when the link is restored. If the replication set is a member of the consistency group and it becomes unsynchronized (replication is suspended) due to a link failure or other problem, all replication sets in the consistency group with primary volumes on the local array will become unsynchronized. When the problem is resolved, all of the replication sets will automatically become resynchronized.

  However, the software will not perform an automatic resynchronization if you manually suspended a replication set (or all of the replication sets in the consistency group, if the replication set is a member of the group). In this case, you will need to click the Resume button to resynchronize the replication sets.

You can enable automatic resynchronization for an existing replication set by selecting the Auto-synchronize check box on the Replication Set Details page. This check box is available only if the local volume is the primary volume.

About Primary and Secondary Role Reversal

A role reversal promotes the secondary volume to the primary volume within the replication set, and demotes the primary volume to the secondary volume.

Note: If you change the role of a volume in a replication set that is a member of the consistency group, the replication set will become a member of the consistency group on the array that hosts the newly promoted primary volume.

Caution: If I/O operations to the primary and secondary volumes occur during a role reversal, data is lost when you initiate a synchronization operation. The current secondary volume is brought into synchronization with the current primary volume, and any writes that have been written to the secondary volume are lost.

Secondary to Primary

You usually promote a secondary volume to a primary volume in a replication set when a catastrophic failure has occurred on the array that contains the primary volume. You need to promote the secondary volume so that host applications that are mapped to the primary volume can still access data and so that business operations can continue. If the replication set is operating normally with a viable link, promoting the secondary volume to the primary volume automatically demotes the primary volume to the secondary volume.

When the secondary volume becomes a primary volume, any hosts that are mapped to the volume through a volume-to-LUN mapping will now be able to read or write to the volume. If a communication problem between the secondary and primary sites prevents the demotion of the primary volume, an error message is displayed. However, you are given the opportunity to proceed with the promotion of the secondary volume, even though this will lead to a dual-primary condition.

To promote a secondary volume to a primary volume, see “Reversing Roles” on page 269.

Primary to Secondary

You can demote a primary volume to a secondary role during normal operating conditions. If the replication set is operating normally with a viable link, demoting the primary volume to the secondary volume automatically promotes the secondary volume to the primary volume.

When the secondary volume becomes a primary volume, any host that accesses the primary volume through a volume-to-LUN mapping will no longer be able to write to the volume. When the primary volume becomes a secondary volume, only remote writes initiated by the primary controller will be written to the volume. If a communication problem between the primary and secondary sites prevents the promotion of the secondary volume, an error message is displayed. However, you are given the opportunity to proceed with the demotion of the primary volume, even though this will lead to a dual-secondary condition.

To demote a primary volume to a secondary volume, see "Reversing Roles" on page 269.

Note: To correct a dual-primary or dual-secondary condition, you must delete the replication set and then create a new one.

About Replication Modes

The replication mode is a user-selectable property that defines the communication mode for a replication set. The software supports two modes of data replication:

- **Synchronous mode** – In synchronous mode replication, a write operation to the primary volume is not confirmed as complete until the secondary volume has been updated. Synchronous replication forces the software to wait until the primary volume receives an acknowledgment of the receipt of the data from the secondary volume before returning to the application. This mode offers the best chance of full data recovery from the secondary volume, at the expense of host I/O performance.
- **Asynchronous mode** – In asynchronous mode replication, data is written to the primary volume and confirmed as complete before the secondary volume has been updated. Asynchronous replication enables the data replication software to return to the primary volume as soon as the write operation has been completed on the primary volume. The data is then copied to the secondary volume. This mode provides faster I/O performance, but does not guarantee that the copy to the secondary volume was completed before processing the next write request.

You can change the replication mode at any time during the life of a replication set, and you do not need to suspend replication before a mode change.

Note: If a replication set is a member of the consistency group, it must, by definition, use asynchronous mode replication. If you change the replication set to synchronous mode replication, it will no longer be part of the consistency group and will not affect the properties of the remaining replication sets in the group in any way.

Synchronous Versus Asynchronous Replication Modes

When you choose a replication mode, consider the characteristics of each, as described in TABLE 4-65.

TABLE 4-65 Synchronous and Asynchronous Mode Comparison

Synchronous Replication	Asynchronous Replication
A write operation to the primary volume is not considered complete until the user data is written to the secondary volume.	The write operation is considered complete as soon as the user data is written to the primary volume. The data is then copied to the secondary volume.
The response time depends on the network. The network latency must be low enough that your application response time is not affected dramatically by the time of the network round trip of each write operation. Also, the bandwidth of the network must be sufficient to handle the amount of write traffic generated during the application's peak write period. If the network cannot handle the write traffic at any time, the application response time will be affected.	The response time does not depend on the network. The bandwidth of the network link must be able to handle the write traffic generated during the application's average write period.
Provides high data availability at the expense of longer latency across the wide area network.	Offers higher performance and availability in exchange for delayed synchronization of all copies of data.
Might result in an increase in write response time, especially for large data sets or long-distance replication (where write operations can incur additional latency because of the time required to transfer data and return acknowledgments).	Can potentially result in a longer response time than synchronous replication.
Because every data change is replicated to the secondary volume in real-time, the secondary volume is write-order consistent with the primary volume.	The secondary volume lags behind the primary volume, depending on the latency and the number of writes.
Write ordering across volumes is preserved at the secondary array.	If write ordering is required across volumes at the secondary array, write consistency must be enabled for the volumes at the primary array.
This mode is meant for volumes that have zero tolerance of data loss at the secondary array.	This mode is meant for volumes that have some level of tolerance for data loss at the secondary array.

About Data Replication Operations

You can choose one of the following data replication operations from the Replication Set Details page:

- **Suspend** – This operation temporarily stops replication of a replication set (or all of the replication sets in the consistency group with primary volumes on the primary array). While in suspended mode, the software logs any changes to the primary volume in the replication repository volume, and all writes to the secondary volume are blocked. No replication occurs.

  You can use a suspend operation to save on telecommunications or connection costs. However, you risk data loss. If replication is suspended and then the primary volume fails, you do not have the data at the secondary volume that was written to the primary volume.

- **Resume** – This operation can occur only after suspension of a replication set (or of all of the replication sets in the consistency group with primary volumes on the primary array). At a later time, when the link is re-established or the problem resolved, the software uses the information in the replication repository volume to resynchronize the volumes. After the volumes are resynchronized, replication resumes.

  When you choose to resume replication, consider the following:

  - You can resume replication only if the local volume is the primary volume in the replication set (or the replication sets in the consistency group have their primary volumes on the local array).
  - It is possible that large quantities of I/O will occur over the replication links as the volumes are brought back into synchronization. Be aware that a resynchronization operation may affect bandwidth.

Planning for Data Replication

This section describes planning for data replication. It contains the following topics:

General Planning Considerations

Replicating data and modifying replication properties may require a significant change to your system's configuration. You must plan accordingly before you perform data replication operations. Consider the following:

- **Business needs** – When you decide to replicate your business data, consider the maximum delay: How long out of date can you allow the data on the secondary volume to become? This determines the replication mode and how often you should back up the data. Additionally, it is very important to know whether the applications that you are replicating require the write operations to the secondary volume to be replicated in the correct order.
- **Data loss** – Disaster can occur during any phase of data replication, such as during a synchronization operation. Although data replication does not affect the integrity of the data on the primary volume, the data on the secondary volume is vulnerable during synchronization because write order is not preserved. Therefore, to ensure a high level of data integrity on both volumes during normal operations or data recovery, back up the data on both volumes before you perform a synchronization operation so that you always have a consistent copy of your data. If a failure occurs, the backup provides a "known good" copy from which your data can be restored.
- **Application write load** – Understanding the average and peak write loads is critical to determining the type of network connection required between the primary and secondary volumes. To make decisions about the configuration, collect the following information:
  - The average rate and size of data write operations

    The average rate is the number of data write operations while the application is under typical load. Application read operations are not important to the provisioning and planning of your data replication.
  - The peak rate and size of data write operations

    The peak rate is the largest amount of data written by the application over a measured duration.
  - The duration and frequency of the peak write rate

    The duration is how long the peak write rate lasts, and the frequency is how often this condition occurs.
- **Network characteristics** – The most important network properties to consider are the network bandwidth and the network latency between the primary and secondary volumes.

Planning to Create Replication Sets

Before you can replicate data to a secondary volume, use the Create Replication Set wizard to create a replication set. Before you use the wizard, you must do the following:

- The storage domain definitions for the primary and secondary arrays are independent of each other. If these definitions are put into place while a volume is in a secondary role, it will reduce the administrative effort associated with site recovery if it becomes necessary to promote the volume to a primary role.
  - The size of the secondary volume must be equal to or greater than the size of the corresponding primary volume.
  - Primary and secondary volumes do not need to have the same redundant array of independent disks (RAID) level for replication.
  - The synchronization process overwrites all data on the secondary volume and makes it read-only. If you need to save any data on the secondary volume, back it up before creating the replication set.
  - You cannot use a replicated volume or a snapshot volume to create a replication set.
  - Any host mapped to a volume will no longer have write access to it once it becomes a secondary volume in a replication set. For this reason, avoid using mapped volumes as secondary volumes. However, any defined mappings will remain after the replication set is created, and any mapped host can resume writing to the volume if it is ever promoted to a primary volume or the replication set is deleted.
  - A volume can be the secondary volume for only one replication set.
- Make sure that you have configured the volumes for data replication on both arrays and that a viable Fibre Channel (FC) link exists between the arrays. Configure both the primary and secondary volumes as you would any other volume. The capacity of the secondary volume must be equal to or greater than that of the primary volume.
- Make sure that the secondary array is connected to the local primary array by means of an existing FC link. Data replication uses a dedicated FC port (FC port 2 on arrays having a 2-port configuration; FC port 4 on arrays having a 4-port configuration, and FC port 8 on arrays having an 8-port configuration).
- Configure the FC switches that provide the connection between arrays for long-distance operations. See the FC switch vendor's documentation for information about operating over long distances. For more information on configurations and switch zoning for data replication, see the documentation for your array.
- Make sure that both of the arrays with volumes participating in the replication set are registered with Sun's management software, and are reachable through the out-of-band management network.

- Record the names of the secondary array and secondary volume. You can find these names on the Volume pages for the secondary volume.
- Back up the data on both volumes so that you can restore it easily if there is a problem.
- Ensure that the Sun Storage Data Replicator software premium feature is enabled and activated on both arrays participating in data replication, as described in "Enabling Data Replication" on page 265 and "Activating and Deactivating Data Replication" on page 266.
- Define the characteristics of the replication set:
  - **Write order consistency** – Determine whether you need to preserve write order consistency across volumes and manage the volumes as a group. If so, you will include the replication set in the consistency group by selecting the Add to Write Consistency Group check box. See "About the Consistency Group" on page 254 for more information about the consistency group.
  - **Roles** – Determine which array and volume will assume the primary role. By default, the array and volume where you are running the Create Replication Wizard are assigned the primary role. For information about changing roles for existing replication sets, see "About Primary and Secondary Role Reversal" on page 257.
  - **Replication mode** – Determine whether synchronous or asynchronous data replication mode is the best method of data communication for your application. Consider network latency, bandwidth, and security when you choose the path through the storage area network (SAN) that you will use for data replication.

    Note: The full synchronization that occurs when you first create the replication set is the most time consuming data replication operation. For this reason, avoid creating a new replication set across a limited-bandwidth link.

    For more information about replication modes, see "About Replication Modes" on page 258.
  - **Synchronization priority** – Determine whether you want the system to assign a higher or lower priority to the rate of synchronization relative to I/O activity. A high synchronization rate might lead to degraded I/O performance, so you can choose a faster synchronization rate if your environment can sustain slower I/O activity. Conversely, you can choose slower synchronization rate to ensure quicker I/O activity.
  - **Synchronization method** – Determine whether you want the system to automatically synchronize the volumes on both arrays whenever there is a working link, or whether you want to initiate synchronization manually. For more information about the Resynchronization Method option, see "About Data Replication Operations" on page 260 and "About Replication Set Properties" on page 256.

Managing Data Replication

This section describes data replication tasks. It contains the following topics:

About Data Replication Status

Data replication status is managed independently for the primary array and the secondary array. There are four possible data replication statuses, as described in TABLE 4-66.

TABLE 4-66 Data Replication Status

Status	Description
Disabled/Deactivated	No data replication functions can be performed. The Sun Storage Data Replicator software premium feature is not available until it is enabled and activated. To enable data replication, see "Enabling Data Replication" on page 265. To activate data replication, see "Activating and Deactivating Data Replication" on page 266.
Disabled/Activated	Data replication is disabled, preventing new replication sets from being created. However, existing replication sets can be maintained with all functions of the Sun Storage Data Replicator software premium feature. To enable data replication, see "Enabling Data Replication" on page 265.

TABLE 4-66 Data Replication Status *(Continued)*

Status	Description
Enabled/Deactivated	Data replication is enabled, but not activated. Until data replication is activated, you cannot use any of the data replication functions. To activate data replication, see "Activating and Deactivating Data Replication" on page 266.
Enabled/Activated	Data replication is enabled and activated. Replication sets can be created and maintained with volumes on this array and any other array on which data replication is enabled and activated. To create and manage replication sets, see "Managing Data Replication" on page 264.

To determine whether data replication is enabled or disabled for an array, select the array, then choose Administration > Licensing in the navigation pane to view the Licensable Feature Summary page.

To determine whether the data replicator software has been activated click Replication Sets, in the Available Features section on the Licenseable Feature Summary page, to view the Licenseable Feature Details - Replication Sets page.

Enabling Data Replication

Installing the license for the Sun Storage Data Replicator software premium feature on an array enables data replication for that array only. Since two arrays participate in a replication set, you must install a license on both arrays that you plan to have participate in a replication set.

Note: Arrays having a 2-port configuration dedicate Fibre Channel (FC) port 2, a 4-port configuration dedicate port 4, and an 8-port configuration dedicate port 8 on each controller for use with the Sun Storage Data Replicator software premium feature. Before enabling data replication on an array, make sure the port for your array configuration is available, as shown in TABLE 4-67:

TABLE 4-67 FC Port Numbers, by Array Configuration

FC port number	Array configuration
2	2-port
4	4-port
8	8-port

If the dedicated FC port is use, you must move all connections from the dedicated FC to an available port on the array.

To enable data replication on an array:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array on which you want to enable data replication.

   The navigation tree is expanded for that array.

3. Expand Administration and choose Licensing.

   The Licensable Feature Summary page is displayed.

4. Click Add License.

   The Add License page is displayed.

5. Select a premium feature license key file and click the Enable button.

Activating and Deactivating Data Replication

Activating the Sun Storage Data Replicator software premium feature prepares the array to create and configure replication sets. After data replication is activated, the secondary ports for each of the array's controllers are reserved and dedicated to data replication. In addition, a replication repository volume is automatically created for each controller in the array.

Note: The replication repository volumes require 256 megabytes of available capacity on an array. The two replication repository volumes are created with this capacity, one for each controller. Because of the critical nature of the data being stored, the RAID level of replication repository volumes cannot be RAID-0 (data striping).

If no replication sets exist and the Sun Storage Data Replicator software premium feature is no longer required, you can deactivate data replication in order to re-establish normal use of dedicated ports on both storage arrays and delete both replication repository volumes.

Note: You must delete all replication sets before you can deactivate the premium feature.

To activate or deactivate the Sun Storage Data Replicator software premium feature:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

   The navigation tree is expanded for that array.

3. Expand Administration and choose Licensing.

   The Licensable Feature Summary page is displayed.

4. Click Replication Sets.

   The Licenseable Feature Details - Replication Sets page is displayed.

5. Click Activate or Deactivate, as appropriate.

   A confirmation dialog box indicates success or failure.

Disabling Data Replication

When data replication is in the disabled/activated state, previously existing replication sets can still be maintained and managed; however, new data replication sets cannot be created. When in the disabled/deactivated state, no data replication activity can occur.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with.

   The navigation tree is expanded for that array.

3. Expand Administration and choose Licensing.

   The Licensable Feature Summary page is displayed.

4. Click the check box to the left of Replication Sets.

   This enables the Disable button.

5. Click Disable.

Displaying Replication Set Information

To display information about the replication sets in an array:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Replication Sets.

   The Replication Set Summary page is displayed.

3. Click the name of a replication set.

   The Replication Set Details page for the selected replication set is displayed.

Creating Replication Sets

You must do three things before creating a replication set:

- Consider a number of factors and make a number of decisions. For information on planning a replication set, see "Planning for Data Replication" on page 260.
- Stop all I/O activity and unmount any file systems on the secondary volume. Do this just before creating the replication set.
- Log in to the system using the `storage` user role.

The Create Replication Set wizard enables you to create a replication set, either standalone or as part of the consistency group.

To create a replication set:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Volumes.

   The Volume Summary page is displayed.

3. Click the name of the primary volume that you want to replicate to the secondary volume.

   The Volume Details page for the selected volume is displayed.

   Note: You cannot replicate a volume that is already in a replication set.

4. Click Replicate.

   The Create Replication Set wizard is displayed.

5. Follow the steps in the wizard. The Create Replication Set wizard also allows you to include the new replication set in the consistency group, if desired.

   When creating the replication set, the system copies all data from the primary volume to the secondary volume, overwriting any existing data on the secondary volume. If replication is suspended, either manually or due to a system or communication problem, and then resumed, only the differences in data between volumes are copied.

Note: An alternative method of creating a replication set is to go to the Replication Set Summary page and click the New button. In this case, an additional step in the wizard prompts you to filter and select the primary volume from the current array.

Deleting Replication Sets

When you delete a replication set, the primary volume stops replicating data to the secondary volume. The association between the primary and secondary volumes is removed, and both revert to conventional volumes. The data stored on the volumes is not affected, and the volumes can remain mapped. You can delete multiple replication sets simultaneously.

To remove the replication relationship between volumes:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Replication Sets.

   The Replication Set Summary page is displayed.

3. Select the replication set that you want to delete, and click Delete.

   A confirmation message is displayed.

4. Click OK.

   The replication set is deleted.

Reversing Roles

You can reverse the roles of the primary and secondary volumes in a replication set in the event of a failure of the primary volume. The secondary volume assumes the role of the primary volume so that the application software now accesses the secondary volume directly while the primary volume failure is corrected.

You can perform the role reversal from either volume in the replication set. For example, when you promote the secondary volume to a primary role, the existing primary volume is automatically demoted to a secondary role (unless the system cannot communicate with the existing primary volume).

Note: If you change the role of a volume in a replication set that is a member of the consistency group, the replication set will become a member of the consistency group on the array that hosts the newly promoted primary volume.

To reverse the role of volumes within a replication set:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Replication Sets.

   The Replication Set Summary page is displayed.

3. Click the name of the replication set that includes the volume.

   The Replication Set Details page is displayed.

4. Click Role to Secondary or Role to Primary, as appropriate.

   A confirmation message is displayed.

5. Click OK.

   The roles of the volumes are now reversed.

Changing Replication Modes

You must consider a number of factors and make a number of decisions before changing the replication mode of a replication set. For information on planning replication modes, see "About Replication Modes" on page 258.

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Replication Sets.

   The Replication Set Summary page is displayed.

3. Click the name of the replication set whose replication mode you want to change.

   The Replication Set Details page is displayed.

4. Select Asynchronous or Synchronous, as appropriate, from the mode drop-down list.

   If you select Asynchronous, write order consistency is disabled by default. To enable write order consistency for all replication sets using asynchronous mode, select the Consistency Group check box.

5. Click OK to save the changes.

Suspending and Resuming Data Replication

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to work with, and choose Replication Sets.

   The Replication Set Summary page is displayed.

3. Click the name of the replication set for which you want to suspend or resume replication.

   The Replication Set Details page is displayed.

4. Do one of the following:

   - If you want to suspend replication and track changes between the volumes, click Suspend.

     Note: If the replication set is already in a Suspended, Unsynchronized, or Failed/Suspended state, only the Resume button is available.

     Note: Suspending a replication set will stop the coordination of data between the primary and the secondary volume. Any data that is written to the primary volume will be tracked while the replication set is suspended and will automatically be written to the secondary volume when replication is resumed. A full synchronization will not be required.

   - If you want to resume replication and copy only the data changes, not the entire contents of the volume, click Resume.

     Note: Any data that is written to the primary volume will be tracked while the replication set is suspended and will automatically be written to the secondary volume when replication is resumed. A full synchronization will not be required.

5. When prompted to confirm the selected action, click OK.

Note: If you are suspending or resuming replication for a replication set that is part of the consistency group, all other replication sets in the group with primary volumes on the primary array will also be suspended or resumed.

Testing Replication Set Links

1. On the Replication Set Details page, click Test Communication.

   If a viable link exists between primary and secondary volumes, a message displays indicating that communication between the primary and secondary volume is normal.

If there is a problem with the link, a message displays details about the communication problem.

2. If you cannot fix the problem, contact Support Services at https://support.oracle.com.

Troubleshooting Data Replication

If data replication does not occur, make sure that:

- There is a working Fibre Channel connection on both the primary and secondary controllers: port 2 on a 2-port array configuration, port 4 on a 4-port array configuration, or port 8 for an 8-port array configuration. To test link communication, see "Testing Replication Set Links" on page 271.
- You selected the correct secondary array and volume names in the Create Replication Set wizard. If you did not, you must delete the replication set and create a new one with the correct secondary array and volume names.

TABLE 4-68 describes some of the other problems that you may encounter when using data replication, possible causes, and resolution.

TABLE 4-68 Troubleshooting Data Replication

Symptom	Cause	Resolution
After a replication set is deleted on the primary array, the secondary array shows that the replication set still exists.	During the deletion operation, there was a link failure between primary and secondary arrays.	Delete the replication set on the secondary array.
After a replication set is deleted on the secondary array, the primary array shows that the replication set still exists.	During the deletion operation, there was a link failure between primary and secondary arrays.	Delete the replication set on the primary array.

TABLE 4-68 Troubleshooting Data Replication *(Continued)*

Symptom	Cause	Resolution
The Synchronization Progress field shows an Unsynchronized state for the primary volume.	The data replicated between the primary and secondary volumes is no longer identical. Link errors, a failed primary or secondary volume, or a dual-primary or dual-secondary condition (see "About Primary and Secondary Role Reversal" on page 257) can all cause an Unsynchronized state.	If the controller owner of the primary volume can communicate with the controller owner of the secondary volume and the volume is online and replicating, and the Auto-synchronize option is selected, a full synchronization automatically takes place. Otherwise, click the Resume button to start full synchronization.

Page and Field Descriptions

Browser interface pages and fields related to the "Configuring Data Replication" section are described in the following subsections:

- "Replication Set Details Page" on page 274
- "Replication Set Summary Page" on page 278

Replication Set Details Page

This page displays details about a selected replication set.

TABLE 4-69 describes the buttons and fields on the Replication Set Details page.

TABLE 4-69 Replication Set Details Page

Field	Description
Resume	This button is enabled only for the primary volume of a replication set and only if the Synchronization Progress field value on the Replication Set Summary page is Unsynchronized, Suspended, or Failed/Suspended. Click to resynchronize data on the primary and secondary volumes. Any data that was written to the primary volume while the replication set was suspended is copied to the secondary volume so that the volumes are identical to each other. **Note:** If the replication set is a member of the consistency group on this array, the Resume button resumes replication for all members of the consistency group with primary volumes on this array.

TABLE 4-69 Replication Set Details Page *(Continued)*

Field	Description
Suspend	This button is enabled only for the primary volume and only if the Synchronization Progress field value on the Replication Set Summary page is Replicating, Synchronization in progress, Unsynchronized, or Failed. Click to track the data written to the primary volume only and suspend data replication to the secondary volume. **Note:** If the replication set is a member of the consistency group on this array, the Suspend button suspends replication for all members of the consistency group with primary volumes on this array.
Role to Primary/Role to Secondary	Click to reverse the roles of the primary and secondary volumes. The Role to Primary button promotes the selected secondary volume to the primary role. The Role to Secondary button demotes the selected primary volume to the secondary role. For more on role reversal, see About Primary and Secondary Role Reversal.
Test Communication	Click to test the link between the primary and secondary volumes in the replication set to determine whether they are communicating successfully.
Delete	Click to delete the replication set. This action discontinues replication and removes the association between the primary and secondary volumes.
OK	Click to save changes entered on this page.
Cancel	Click to exit to the Replication Set Summary page without saving changes on this page.
Name	The name of the replication set, which uses the following convention: *local-volume-name/1* where */1* is the replication set number. Only one replication set per volume pair is supported.
Local Volume	The name of the local volume, which resides on the local array. This links to the Volume Details page for this volume.
Role	The local volume's role in the replication set: • Primary • Secondary

TABLE 4-69 Replication Set Details Page *(Continued)*

Field	Description
Size	The size of the local volume.
Replication Peer	The name of the remote array. **Note:** If the remote array of the replication set is not in the list of registered arrays, then "`Array is Not Registered`" is displayed in this field.
Replication Peer WWN	The World Wide Name of the remote array.
Remote Volume Name	The name of the remote volume in the replication set. This volume is located on the remote array.
Remote Volume WWN	The World Wide Name of the remote volume in the replication set.
Mode	Select to change the replication mode to synchronous or asynchronous. If you select asynchronous mode, the Consistency Group check box is available; select it to make the replication set a member of the consistency group. Deselect the check box to remove the replication set from the group. **Note:** If the replication set is a member of the consistency group, the Mode setting applies to all members of the consistency group.
Replication Priority	The priority of synchronization activity relative to I/O activity. This priority is enabled only for the primary volume: • Highest - The system synchronizes volumes as quickly as possible, at the expense of I/O activity. • High - The system attempts to synchronize volumes quickly. This can noticeably slow down I/O activity. • Medium - The system balances I/O activity with synchronization requests. • Low - The system processes I/O activity quickly and waits between those actions to synchronize volumes. • Lowest - The system places the highest priority on I/O requests and synchronizes volumes only when there is little or no I/O activity.

TABLE 4-69 Replication Set Details Page *(Continued)*

Field	Description
Synchronization Progress	The state of data replication: • Unsynchronized - Indicates that no replication is occurring. • Synchronization in progress - Indicates that the software is in the process of synchronizing the volumes and that no replication is occurring. This is displayed on the primary volume. • Not Ready - Indicates a transient state that occurs either immediately after creation of the replication set but before it is ready for use *or* during a controller reboot. This is a routine phase in the process of starting up replication. • Replicating - Indicates that the volumes are synchronized and that the software is replicating. This is the normal state for a fully functioning replication set. • Suspended - Indicates that no replication is occurring and that the software is tracking changes to the primary volume. • Failed - Indicates problems (such as corruption) in the primary, secondary, or replication repository volumes that prevent synchronization of the replication set. This may require repair or replacement of a failed component, or deletion of the replication set. • Failed/Suspended - Indicates a replication set that is in the Failed state and was manually suspended by the user. The replication set remains in the Suspended state after the failed condition is cleared.
Percent Complete	The completion percentage for synchronization progress.
Time To Completion	The time to completion for synchronization progress.
Auto-synchronize	Select the check box to automatically synchronize the volumes in the replication set whenever there is a functioning link between the two arrays.
Replication Dedicated Port	The host port on each controller dedicated to replication data transmission. Dedicated host ports will not accept any read / write requests from a host application as long as replication is active.

Replication Set Summary Page

This page displays information about all the replication sets on your system.

TABLE 4-70 describes the buttons and fields on the Replication Set Summary page.

TABLE 4-70 Replication Set Summary Page

Field	Description
New	Click to create a new replication set. **Note:** Clicking the Replicate button on the Volume Details page performs the same function. However, if you create a replication set from the Replication Set Summary page, the wizard will first prompt you to select a volume name for the primary volume before you select the secondary array and volume.
Delete	Click to delete the selected replication set or sets. This action discontinues replication and removes the association between the primary and secondary volumes.
Replication Set	The name of the replication set. Click to view the replication set's Replication Set Details page.
Write Consistency Group	Whether the replication set is a member of the consistency group.
Mode	The replication mode: • Synchronous mode replication • Asynchronous mode replication
Role	The local volume's role in the replication set: • Primary • Secondary
Replication Peer	The name of the remote array. **Note:** If the remote array of the replication set is not in the list of registered arrays, then "`Array is Not Registered`" will display in this field.
Remote Volume	The name of the remote volume.

TABLE 4-70 Replication Set Summary Page *(Continued)*

Field	Description
Synchronization Progress	The state of data replication: • Unsynchronized - Indicates that no replication is occurring. • Synchronization in progress - Indicates that the software is in the process of synchronizing the volumes and that no replication is occurring. This is displayed on the primary volume. • Not Ready - Indicates a transient state that occurs either immediately after creation of the replication set but before it is ready for use *or* during a controller reboot. This is a routine phase in the process of starting up replication. • Replicating - Indicates that the volumes are synchronized and that the software is replicating. This is the normal state for a fully functioning replication set. • Suspended - Indicates that no replication is occurring and that the software is tracking changes to the primary volume. • Failed - Indicates problems (such as corruption) in the primary, secondary, or replication repository volumes that prevent synchronization of the replication set. This may require repair or replacement of a failed component, or deletion of the replication set. • Failed/Suspended - Indicates a replication set that is in the Failed state and was manually suspended by the user. The replication set remains in the Suspended state after the failed condition is cleared.

CHAPTER 5

Monitoring Arrays

This chapter describes monitoring arrays. It contains the following sections:

Monitoring Overview

- This section describes monitoring and diagnosing storage systems. It contains the following topics:"How the Monitoring Software Works" on page 282
- "About Monitoring Strategy" on page 283
- "About the Monitoring Cycle" on page 283
- "About the Event Life-Cycle" on page 284

How the Monitoring Software Works

The Fault Management Service (FMS) is a software component of the Sun Storage Common Array Manager that can be used to monitor and diagnose storage systems. The primary monitoring and diagnostic functions of the software are:

- Array health monitoring
- Event and alarm generation
- Notification to configured recipients
- Diagnostics
- Device and device component reporting

An FMS agent, which runs as a background process, monitors all devices managed by the Sun Storage Common Array Manager.

The agent runs at configured intervals, or can be run manually, to probe devices. Events are generated with content, such as probable cause and recommended action, to help facilitate isolation to a single field-replaceable unit (FRU).

The agent sends all messages to event notification recipients. Events can be sent as local email to administrators of the site or sent remotely to the Technical Support Center as events and alarms.

About Monitoring Strategy

The following procedure is a typical strategy for monitoring.

1. Monitor devices.

   To get a broad view of the problem, the site administrator or Technical Support Center personnel can review reported information in context. This can be done by:

   - Displaying the device itself
   - Analyzing the device's event log

2. Isolate the problem.

   For many alarms, information regarding the probable cause and recommended action can be accessed from the alarm view. In most cases, this information enables you to isolate the source of the problem. In cases where the problem is still undetermined, diagnostic tests are necessary.

   You can initiate diagnostics from the browser interface or command-line interface (CLI):

   - Browser interface - Using the online help's Search function (Help --> Search tab), search for "diagnostic" to obtain a list of array diagnostic topics.
   - CLI - refer to the *Sun Storage Common Array Manager CLI Guide* for information about commands that can provide diagnostic information.

   Once the problem is fixed, in most cases, the management software automatically clears the alarm for the device.

About the Monitoring Cycle

The agent is a process of the Fault Management Service (FMS), which is always running in the background. The high-level steps of a monitoring cycle are as follows.

1. Verify that the agent is idle.

   If the previous run of the agent has not finished, allow it to finish. Only one instance of the monitoring agent should be running at any time.

2. Generate instrumentation reports and health-related events.

The system generates instrumentation reports by probing the device for all relevant information, and it saves this information. The system then compares the report data to previous reports and evaluates the differences to determine whether health-related events need to be generated.

Events are also created from problems reported by the array. If the array reports a problem, an alarm is generated directly. When the problem is no longer reported by the array, the alarm is removed.

3. Store instrumentation reports for future comparison.

   Event logs are accessible by accessing the Events page for an array from the navigation pane in the user interface. The software updates the database with the necessary statistics. Some events require that a certain threshold be attained before an event is generated. For example, having the cyclic redundancy count (CRC) of a switch port increase by one is not sufficient to trigger an event, since a certain threshold is required.

   Sun Storage Common Array Manager supports email thresholds that prevent the generation of multiple emails about the same component of the same device. By keeping track of the number of events that were already sent in a specified timeframe, redundant email alarms can be prevented. Other notification recipients (non-email) do not support this feature.

4. Send the alarms to interested parties.

   Alarms are sent only to recipients that have been set up for notification. The types of alarms can be filtered so that only pertinent alarms are sent to each individual.

   Note: If they are enabled, the email providers and Technical Support Center receive notification of all alarms.

About the Event Life-Cycle

Most storage network events are based on health transitions. For example, a health transition occurs when the state of a device goes from online to offline. It is the transition from online to offline that generates an event, not the actual offline value. If the state alone were used to generate events, the same events would be generated repeatedly. Transitions cannot be used for monitoring log files, so log events can be repetitive. To minimize this problem, the agent uses predefined thresholds to entries in the log files.

The software includes an event maximums database that keeps track of the number of events generated about the same subject in a single eight-hour time frame. This database prevents the generation of repetitive events. For example, if the port of a

switch toggles between offline and online every few minutes, the event maximums database ensures that this toggling is reported only once every eight hours instead of every five minutes.

Event generation usually follows this process:

1. The first time a device is monitored, a discovery event is generated. It is not actionable, but is used to set a monitoring baseline. When Auto Service Request (ASR) is enabled, a discovery event is generated to re-establish the monitoring baseline. This event describes, in detail, the components of the storage device. Every week after a device is discovered, an audit event is generated with the same content as the discovery event.

2. A log event can be generated when interesting information is found in storage log files. This information is usually associated with storage devices and sent to all users. These events can be made actionable based on thresholds, and then sent using ASR, if it is enabled.

3. Events are generated when the software detects a change in the content of the instrumentation report, probes the device, and compares the report to the last instrumentation report, which is usually only minutes old. ProblemEvent, LogEvent, and ComponentRemovalEvent categories represent most of the events that are generated.

Note: Aggregated events and events that require action by service personnel (known as actionable events) are also referred to as alarms. Some alarms are based on a single state change and others are a summary of events where the event determined to be the root cause is advanced to the head of the queue as an alarm. The supporting events are grouped under the alarm and are referred to as aggregated events.

Performing Monitoring Administration

This section describes how to monitor and manage devices. It contains the following topics:

General Site Setup Tasks

Use general site setup tasks to configure various features to enable monitoring and diagnostics of storage system devices.

Displaying and Editing Site Information

Site information parameters are required for service personnel to identify contact and installation information for the customer.

To display and edit site information:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, choose General Configuration.

   The Site Information page is displayed.

3. To edit any parameter:

   a. Click in the value field for the parameter and enter the new value.

   b. Click Save after completing all required changes.

Displaying and Editing Agent Timeout Settings

You can display and edit agent timeout settings to match the specific requirements of your storage network. The default timeout settings are appropriate for most storage area network (SAN) devices. However, network latencies, I/O loads, and other device and network characteristics may require that you customize these settings to meet your configuration requirements.

To display and edit system timeout settings:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand General Configuration and choose General Health Monitoring.

   The General Health Monitoring Setup page is displayed.

3. In the Agent Configuration and Timeout Settings sections, make any desired changes, then click Save.

About Notification

The monitoring and diagnostic software provides mechanisms to provide alarm notification to local recipients using email and to remote recipients using SNMP traps and Auto Service Request.

Using Email Notification

This section describes email notification. It contains the following topics:

About Email Notification

Email notification options include the ability to send alarm notification to one or more email and pager addresses. For each recipient, you can define the level of alarms that will trigger notification.

Configuring Email Notification

To configure email notification:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand General Configuration.

3. Expand Notification and choose Email.

   The Notification Setup page is displayed.

4. Navigate to the Email Notification Setup section.

5. If the host on which the software is installed is behind a firewall, specify a Simple Mail Transfer Protocol (SMTP) server to use for email instead of the host server.

6. (Optional) Identify the SMTP username and password, and determine whether or not to use a secure SMTP connection.

7. Identify the SMTP port.

8. Specify a server path to email program if an SMTP server is unavailable.

9. (Optional) Specify an email address to be used as the sender's address for all sent email.
10. Specify the maximum size allowed for email messages to be sent.
11. Click Save.

    The configured email notification setup parameters are saved.

Testing a Notification Email Address

To test an email notification address:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.
2. In the navigation pane, expand General Configuration and choose Notification.

   The Notification Setup page displays notification setup parameters.
3. Specify the Use this Simple Mail Transfer Protocol (SMTP) Server for Email parameter.
4. Click Test Email.

   The Send Test Email window is displayed.
5. In the To field, specify the email address that you want to test.
6. (Optional) Specify a text message in the Message field.
7. Click Test Local Email.

   A confirmation message appears at the top of the Send Test Email window if the test email is successfully sent.
8. Verify that the email was received by the specified email address.

Adding an Email Notification Recipient

To add an email notification recipient:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.
2. In the navigation pane, expand General Configuration.
3. Expand Notification and choose Email.

The Email Notification page is displayed.

4. Click New.

   The Add Email Notification page is displayed.

5. Define the email address and, optionally, other email properties for the notification recipient.

6. Click Save.

   The Email Notification page is redisplayed, and the new email notification recipient is listed.

Editing an Email Notification Recipient

To edit email properties for an email notification recipient:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand General Configuration.

3. Expand Notification and choose Email.

   The Email Notification page is displayed.

4. Select the check box of the email notification recipient that you want to edit.

5. Click Edit.

   The Edit Email Notification page is displayed.

6. Edit the email properties for the notification recipient as needed.

7. Click Save.

   The Email Notification page is redisplayed, and the edited email notification recipient is listed. The following confirmation message is displayed at the top of the page: “This notification successfully updated.”

Deleting an Email Notification Recipient

To delete an email notification recipient:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand General Configuration.

3. Expand Notification and choose Email.

   The Email Notification page is displayed.

4. Select the check box to the left of each email notification recipient that you want to delete.

5. Click Delete.

   The Email Notification page is redisplayed, and the selected email notification recipients are no longer listed.

Using Email Filters

This section describes email filters. It contains the following topics:

About Email Filters

You can use email filters to prevent email notification about specific events.

To prevent email notification about specific events that occur frequently, obtain the event code for the event from the Event Details page of the event and add an email filter to prevent email notification for events with that event code.

You can still view filtered events in the event log.

Adding an Email Filter

To add an email filter:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand General Configuration.

3. Expand Notification and choose Email Filters.

   The Email Filters page is displayed.

4. Click Add New Filter.

   The Add New Filter page is displayed.

5. Define the Event Code and Decreased Severity for the filter, and click Save.

   The Email Filters page is redisplayed with the new email filter.

Editing an Email Filter

To edit an email filter:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand General Configuration.

3. Expand Notification and choose Email Filters.

   The Email Filters page is displayed.

4. Select the check box of the filter you want to edit and click Edit.

   The Edit Email Filter page is displayed.

5. Edit the Event Code and Decreased Severity parameters as needed, and click Save. Event codes are available from the Event Summary page.

   The Email Filters page is redisplayed with the edited email filter.

Deleting an Email Filter

To delete an email filter:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand General Configuration.

3. Expand Notification and choose Email Filters.

   The Email Filters page is displayed.

4. Select the check boxes of the filters you want to delete, and click Delete.

   The Email Filters page is redisplayed without the deleted email filters.

Remote Notification - Using the Auto Service Request (ASR) Service

This section describes the Auto Service Request (ASR) service. It contains the following topics:

About Auto Service Request (ASR)

Oracle Auto Service Request is available as a feature of your Oracle hardware warranty and Oracle Premier Support for Systems support plans. ASR addresses problems faster by using auto-case generation for Oracle's Sun server and storage systems when specific hardware faults occur.

- Sun Storage Common Array Manager provides the interface to activate ASR on behalf of the devices it manages. It also provides the fault telemetry to notify Oracle Support of specific fault events on those devices.
- To use ASR, you must provide My Oracle Support account information to register CAM for the ASR service. You can choose which arrays you want to be monitored and enable them individually.
- ASR uses SSL security and leverages Oracle SSO account credentials to authenticate transactions. The service levels are based on contract level and response times of the connected devices.
- ASR requires an active Oracle hardware warranty or Oracle Premier Support for Systems support plan. Once activated, the service runs continuously until the end of the warranty or contract period.
- To register CAM with ASR and complete ASR activation, see the following sections:
  - "Subscribing to and Editing Properties of Auto Service Request" on page 296
  - "Activating ASR with My Oracle Support" on page 296.

Note – Activation of ASR is required to maintain your array's warranty. Ensure that ASR is enabled throughout the duration of the warranty period.

Full product details and security documentation are available online at http://oracle.com/asr.

Event Information Collected Using Auto Service Request (ASR)

Only the event information listed in the following table is collected. Your stored data is not read and remains secure.

The event information is sent by secure connection to:

https://asr-services.oracle.com

TABLE 5-1 Event Information Collected by ASR

Information	Purpose
Activation Event	Static information collected for purpose of client registration and entitlement.
Heart Beat Event	Dynamic pulse information periodically collected to establish whether a device is capable of connecting.
Alarm Event	Critical events trigger Auto Service Request and generate a case. Additional events are collected to provide context for existing or imminent cases.
Test Event	A test to validate the successful communication between Auto Service Request service connection and the email address specified on the General Configuration page and Oracle SSO Account services.

Client Security

To configure firewalls, you will need information about the security aspects of communication between components in the client environment. Port 443 must be opened to the URLs in the following table.

The following table depicts the data collected for case creation, used to determine entitlement.

TABLE 5-2 Data Collected for Case Creation

Data Collected	Destination URL	Port and Description
Activation event	Client Registration: https://inv-cs.oracle.com/SCRK/ClientRegistrationV1_1_0 Agent Registration: https://inv-cs.oracle.com/ProductRegistrationService/agent/ Product Registration: https://inv-cs.oracle.com/ProductRegistrationService/scrk/ Case Generation: https://asr-services.oracle.com/ServiceInformation/ServiceInformation	Port = 443; Static Data collected for purpose of registration and entitlement.
Heartbeat event	Case Generation: https://asr-services.oracle.com/ServiceInformation/ServiceInformation	Port 443; Dynamic data periodically collected to establish a device is capable of connecting. Sent every 6 hours. Event type = daily
Audit event	Case Generation: https://asr-services.oracle.com/ServiceInformation/ServiceInformation	Port 443; Dynamic configuration data collected and sent every seven days. Event type = audit
Alert event	Case Generation: https://asr-services.oracle.com/ServiceInformation/ServiceInformation **Note**: Not all events generate cases; some represent information collected to provide context for already existing cases.	Port 443; Potential case-generating events are sent via the secure transport to trigger case generation. Event type = alert

Subscribing to and Editing Properties of Auto Service Request

During the initial storage array registration process, Sun Storage Common Array Manager prompts you to register with the Auto Service Request service by displaying the Auto Service Request (ASR) Setup page. This page continues to display until you either fill out the page and click OK, or click Decline to either decline or defer ASR service registration.

After you register with ASR, you can choose which arrays you want to be monitored.

To register with the Auto Service Request service:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand General Configuration and choose Auto Service Request.

   The Auto Service Request Setup page displays.

3. Provide the following information:
   - Oracle SSO Account username and password
   - Type of internet connection to be used

4. Click OK.

After registering CAM with ASR, use My Oracle Support to activate ASR. See "Activating ASR with My Oracle Support" on page 296 for more information.

Activating ASR with My Oracle Support

To complete ASR activation, use the My Oracle Support web site: http://support.oracle.com.

Note: Before activating ASR with My Oracle Support, be sure you have registered the CAM software with ASR by following the instructions in "Subscribing to and Editing Properties of Auto Service Request" on page 296.

- Your My Oracle Support account must have the administrator privilege for the Support Identifiers (SIs) associated with your ASR assets. To see a list of administrators for your Support Identifier, click More -> Settings -> Account and Privileges and then click the Support Identifier. If you need administrator permissions, you can email the listed administrator to request access.

- You can look up SIs by going to More -> Settings -> Account and Privileges and entering a system serial number and organization. **Note**: If the SI cannot be found, work with your account team or contact Oracle Support at: http://support.oracle.com
- Use More -> Settings -> Pending ASR Activations to:
  - Add a contact who will be notified when Service Requests are created.
  - Add/edit the assets installation address
  - Optionally, provide an email distribution list address to receive ASR email notifications in addtion to the contact you have specified.
  - View ASR activation status

  Note: The Pending ASR Activations menu is only available to My Oracle Support accounts with the administrator privilege on the Support Identifiers associated with your Assets (array devices).

For more information about ASR, go to:
http://oracle.com/asr.

Unregistering From Auto Service Request Service

When you unregister from Auto Service Request service, ASR will stop monitoring array health for your system.

To unregister from the Auto Service Request service:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand General Configuration and choose Auto Service Request.

   The Auto Service Request Setup page displays.

3. Click Unregister.

Testing Auto Service Request

You can test the Auto Service Request service connection to ensure that communication between the email address specified on the General Configuration page and Oracle SSO Account services is successful.

To test the Auto Service Request service:

1. Click Sun Storage Common Array Manager.

The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand General Configuration and choose Auto Service Request.

   The Auto Service Request Setup page displays.

3. Click Test ASR.

   The Oracle SSO Account service will send a confirmation email to the email address on record for your Oracle SSO Account, which is specified on the General Configuration page. If you do not receive a confirmation email within approximately 30 minutes, contact the Oracle SSO Account personnel.

Enabling/Disabling Auto Service Request for an Array

After registering with ASR, you can choose which arrays to monitor using ASR. In order for an array to be monitored using ASR, the following settings must be in effect:

- the health monitoring agent must be active
- health monitoring must be enabled for the array type
- health monitoring must be enabled for this array
- ASR must be enabled for this array

To enable ASR for an array:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array you want to monitor using ASR.

3. In the navigation pane, expand Administration and click on Array Health Monitoring

   The Array Health Monitoring Setup page is displayed.

4. In the Health Monitoring section, ensure that the Health Monitoring Agent Active and the Device Category Monitored fields are set to Yes. If either are set to No, go to the General Health Monitoring Setup page and change the settings.

5. In the Monitoring this Array section, select the checkbox next to both Health Monitoring and Auto Service Request.

6. Click OK.

Remote Notification - Using SNMP Traps

You can configure remote notification to send SNMP traps upon receipt of alarms. You can also configure the minimum alarm level at which SNMP traps are sent.

The following topics provide information about configuring SNMP traps:

Enabling SNMP Notification

To enable SNMP notification:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.
2. In the navigation pane, expand General Configuration and choose Notification.

   The Notification Setup page displays notification setup parameters.
3. In the Remote Notification Setup section, select the SNMP Trap check box.
4. Click Save.

   SNMP notification setup is enabled.

Adding an SNMP Notification Recipient

To add a Simple Network Management Protocol (SNMP) notification recipient:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.
2. In the navigation pane, expand General Configuration.
3. Expand Notification and choose SNMP.

   The SNMP Notification page is displayed.

4. Click New.

   The Add SNMP Notification page is displayed.

5. Define the SNMP Properties for the new SNMP notification recipient.

6. Click OK.

   The SNMP Notification page is redisplayed, and the new SNMP notification recipient is listed.

Editing an SNMP Notification Recipient

To edit Simple Network Management Protocol (SNMP) properties for an SNMP notification recipient:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand General Configuration.

3. Expand Notification and choose SNMP.

4. Select the check box of the SNMP notification recipient that you want to edit.

5. Click Edit.

   The Edit SNMP Notification page is displayed.

6. Edit the SNMP Properties for the notification recipient as needed.

7. Click OK.

   The SNMP Notification page is redisplayed and the edited SNMP notification recipient is listed. The confirmation message “This notification successfully updated” is displayed at the top of the page.

Deleting an SNMP Notification Recipient

To delete a Simple Network Management Protocol (SNMP) notification recipient:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand General Configuration.

3. Choose Notification and Click SNMP.

   The SNMP Notification page is displayed.

4. Select the check box to the left of each SNMP notification recipient that you want to delete.
5. Click Delete.

   The SNMP Notification page is redisplayed and the selected SNMP notification recipients are no longer listed.

Editing Notification Setup Parameters

To reset notification setup parameters to their last saved values:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.
2. In the navigation pane, expand General Configuration.
3. Choose Notification.

   The Notification Setup page displays notification setup parameters.
4. Configure Email Notification and Remote Notification setup parameters as needed.
5. (Optional) Click Reset to return all notification setup parameters to their last saved values.

Agent Tasks

This section describes agent tasks. It contains the following topics:

Configuring the Agent

To configure the agent:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand General Configuration.

3. Choose General Health Monitoring.

   The General Health Monitoring Setup page is displayed.

4. Select the types of arrays that you want to monitor from the Categories to Monitor field. Use the shift key to select more than one array type.

5. Specify how often you want to monitor the arrays by selecting a value in the Monitoring Frequency field.

6. Specify the maximum number of arrays to monitor concurrently by selecting a value in the Maximum Monitoring Thread field.

7. Click Save.

   The configuration is saved.

Activating/Deactivating the Agent

To activate or deactivate the agent:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand General Configuration.

3. Choose Health Monitoring.

   The General Health Monitoring Setup page is displayed.

4. Click Activate or Deactivate to activate or deactivate the agent.

   A confirmation message displays.

Displaying and Editing Health Monitoring Status on an Array

To display and edit an array's health monitoring status:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, select an array for which you want to display or edit the health monitoring status.

3. Expand Administration for that array.

4. Choose Array Health Monitoring.

   The Array Health Monitoring Setup page is displayed.

5. For the array to be monitored, ensure that the monitoring agent is active and that the Device Category Monitored is set to Yes.

6. Select the checkbox next to Health Monitoring to enable health monitoring for this array; deselect the checkbox to disable health monitoring for the array.

Running the Agent

To run the agent:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand General Configuration.

3. Choose Health Monitoring.

   The General Health Monitoring Setup page is displayed.

4. Click Run Agent to run the agent.

   The Agent Summary page is redisplayed, and the change in agent activation is reflected.

Page and Field Descriptions

Browser interface pages and fields related to the "Performing Monitoring Administration" section are described in the following subsections:

Add/Edit Email Filters Page

TABLE 5-3 describes the buttons and fields on the Add/Edit Email Filters page.

TABLE 5-3 Add/Edit Email Filters Page

Field	Description
Event Code	The event code to which this filter applies.
Decreased Severity	The alarm types to which the filter applies. Options include: • Information • No Event

Add/Edit Email Notification Page

TABLE 5-4 describes the buttons and fields on the Add/Edit Email Notification page.

TABLE 5-4 Add/Edit Email Notification Page

Field	Description
Type	The format of the email notification. Valid options include: email or pager.
Email Address	The email address of the new email notification recipient.
Categories	The types of devices for which the email recipient will receive email notifications. Options include one, multiple categories, or all categories of device types.
Priority	The alarm types for which the email recipient will receive email notifications. Options include: • All • Major and Above • Critical and Above
Active	Select Yes to enable email notification for the new email notification recipient.
Apply Email Filters	Select Yes to apply email filters to this recipient. Otherwise, select No.
Skip Components of Aggregated Events	Select Yes if you do not want notification sent for single events that are also part of aggregated events. Otherwise, select No.
Turn Off Event Advisor	Select Yes if you do not want Event Advisor messages included in email notifications. Otherwise, select No.
Send Configuration Change Events	Select Yes if you want configuration changes included in email notifications. Otherwise, select No.

Add/Edit SNMP Notification Page

TABLE 5-5 describes the buttons and fields on the Add/Edit SNMP Notification page.

TABLE 5-5 Add/Edit SNMP Notification Page

Field	Description
IP Name/Address	The identifying Internet Protocol (IP) address or name of the new SNMP recipient.
Port	The port to which SNMP notifications are to be sent.

TABLE 5-5 Add/Edit SNMP Notification Page

Field	Description
Minimum Alert Level	The minimum alarm level for which SNMP notifications are to be sent to the new SNMP recipient. Options include: • Down • Critical • Major • Minor

Array Health Monitoring Setup page

Use the Array Health Monitoring Setup page to display the monitoring status for all arrays registered with this instance of Sun Storage Common Array Manager software, and to display and edit the health monitoring status for an individual array.

To edit health monitoring settings that apply to all arrays, see the General Health Monitoring Setup page.

TABLE 5-6 describes the buttons and fields on the Array Health Monitoring Setup page.

TABLE 5-6 Array Health Monitoring Setup Page

Field/Button	Description
Health Monitoring Status	
Health Monitoring Agent Active	Identifies whether the health monitoring agent is active or inactive.
Device Category Monitored	Identifies whether health monitoring is enabled for this array type.
Monitoring for this Array	
Health Monitoring	Enables or disables health monitoring for this array. Select the checkbox to enable health monitoring for the array; deselect the checkbox to disable health monitoring for this array.
Auto Service Request	Enables or disables the Auto Service Request monitoring service for this array. Select the checkbox to enable the Auto Service Request service for this array; deselect the checkbox to disable the Auto Service Request service for this array. **Note:** to enable Auto Service Request, you must also enable Health Monitoring for this array and the monitoring agent must be active.

Auto Service Request (ASR) Setup Page

TABLE 5-7 describes the buttons and fields on the Auto Service Request Setup page. For more ASR details, see the following:

- Remote Notification - Using the Auto Service Request (ASR) Service
- http://www.oracle.com/us/support/systems/premier/auto-service-request-155415.html

TABLE 5-7 Auto Service Request Setup Page

Field	Description
Unregister	Click to unregister an array.
Test ASR	Click to test communication between Sun Storage Common Array Manager and Oracle Support services.
Oracle Support Information	
My Oracle Support	Click this link to create an account.
Oracle Services Privacy Policy	Click this link to read the privacy policy.
Registration Status:	
Oracle Support User Name	The name of the online account.
Password	The password that corresponds to the Oracle Support account.
Internet Connection Settings	
Connection Type	Select the type of internet connection to be used by Auto Service Request. Options include: • Direct Connection to the Internet • Use Proxy Server If using a proxy server, you must supply the proxy host name and port number. • Enable Proxy Authentication Optionally, you can enable proxy authorization by supplying a user name and password for the proxy host.

Email Filters Page

TABLE 5-8 describes the buttons and fields on the Email Filters page.

TABLE 5-8 Email Filters Page

Field	Description
Add New Filter	Click to add a new email filter.
Delete	Click to delete the selected email filter.
Edit	Click to edit the selected email filter.
Filter ID	The identification (ID) for the email filter.
Event Code	The event code to which this filter applies.
Decreased Severity	Select Information or No Event to prevent email notification for the specified event code.

Email Notification Page

This page displays details on email notification recipients.

TABLE 5-9 describes the buttons and fields on the Email Notification page.

TABLE 5-9 Email Notification Page

Field	Description
New	Click to add an email recipient.
Delete	Click to delete an email recipient.
Edit	Click to edit an email recipient's information.
Email Address	The email address of a current email recipient.
Active	Whether the current email recipient is configured as active and receiving email notifications.
Category	The types of devices for which the corresponding email recipient receives email notifications. Options include one, multiple categories, or all categories of device types.
Priority	The alarm types for which the corresponding email recipient receives email notifications. Options include: • All • Major and Above • Critical and Above

General Health Monitoring Setup Page

TABLE 5-10 describes the buttons and fields on the General Health Monitoring Setup page.

TABLE 5-10 General Health Monitoring Setup Page

Field/Button	Description
Activate	Click to activate the health monitoring agent.
Deactivate	Click to deactivate the health monitoring agent.
Run Agent	Click to manually run the health monitoring agent.
Agent Information	
Active	The status of the agent.
Categories to Monitor	The type of arrays to be monitored. You can select more than one type of array by using the shift key.
Monitoring Frequency	How often, in minutes, the agent monitors the selected array categories.
Maximum Monitoring Thread Allowed	The maximum number of arrays to be monitored concurrently. If the number of arrays to be monitored exceeds the number selected to be monitored concurrently, the agent will monitor the specified number of additional arrays serially.
T*imeout Settings*	
Agent HTTP	The amount of time for which the agent will attempt to connect to the Internet before generating a timeout.
Ping	The amount of time for which the management station will attempt a ping operation before generating a timeout.
SNMP Access	The amount of time, in seconds, before an SNMP notification will generate a timeout.
Email	The amount of time, in seconds, before an email notification will generate a timeout.

Notification Setup Page

TABLE 5-11 describes the buttons and fields on the Notification Setup page.

TABLE 5-11 Notification Setup Page

Field	Description
Email Notification Setup	
Use this SMTP Server for Email	The address of the Simple Mail Transfer Protocol (SMTP) server that will process remote email transmission.
Test Email	Click to send a test email to a test email service.
SMTP Server User Name	The user name used with the SMTP server.
SMTP Server Password	The password used with the SMTP server.
Use secure SMTP connection	Check the box to enable the secure SMTP (SMTPS) protocol. Otherwise, the SMTP protocol will be used.
SMTP Port	The port used with by SMTP server.
Path to Email Program	The server path to the email application that is to be used when the SMTP server is unavailable.
Email Address of Sender	The email address to be specified as the sender for all email transmissions.
Maximum Email Size	The largest size allowed for a single email message.
Remote Notification Setup	
Select Providers	Select the check box to enable the SNMP remote notification provider.

General Configuration Page

TABLE 5-12 describes the buttons and fields on the General Configuration page.

TABLE 5-12 General Configuration Page

Field	Description
Site Information	
Company Name	The name of the company owning the system.

TABLE 5-12 General Configuration Page

Field	Description
Site Name	The name of the site at which the system is installed.
Address	The first address line for the site.
Address 2	The second address line for the site.
Mail Stop	The mail stop address for the site.
City	The city in which the site is located.
State/Province	The state in which the site is located.
Postal Code	The postal code for the site.
Country	The country in which the site is located. Country names are selected from a drop down menu.
Contact Information	
Name	The name of the customer representative to contact at this site.
Telephone Number	The telephone number where the customer representative can be contacted.
Contact Email	The email address where the customer representative can be contacted.

SNMP Notification Page

TABLE 5-13 describes the buttons and fields on the SNMP Notification page.

TABLE 5-13 SNMP Notification Page

Field	Description
New	Click to add a Simple Network Management Protocol (SNMP) recipient.
Delete	Click to delete an SNMP recipient.
Edit	Click to edit an SNMP recipient's information.
IP Name/Address	The identifying Internet Protocol (IP) address or name of the current SNMP recipient.
Port	Port to which (SNMP) notifications are sent.

TABLE 5-13 SNMP Notification Page

Field	Description
Minimum Alert Level	The minimum alarm level for which SNMP notifications are sent to the corresponding SNMP recipient. Options include: • Down • Critical • Major • Minor

Monitoring Alarms and Events

This section describes alarms and events. It contains the following topics:

About Alarms and Events

Events are generated to signify a health transition in a monitored device or device component. Events that require action are classified as alarms.

There are four event severity levels:

- Down – Identifies a device or component as not functioning and in need of immediate service
- Critical – Identifies a device or component in which a significant error condition is detected that requires immediate service
- Major – Identifies a device or component in which a major error condition is detected and service may be required
- Minor – Identifies a device or component in which a minor error condition is detected or an event of significance is detected

About Alarm Management

Though alarms are typically cleared and removed from Sun Storage Common Array Manager when problems are resolved, you can select the Auto Clear option to manually delete an alarm.

An alarm that has the Auto Clear function set will be automatically deleted from the alarms page when the underlying fault has been addressed and corrected. To determine whether an alarm will be automatically deleted when it has been resolved, view the alarm summary page and examine the Auto Clear column. If the Auto Clear column is set to yes, then that alarm will be automatically deleted when the fault has been corrected, otherwise, the alarm will need to be manually removed after a service operation has been completed.

If the Auto Clear function is set to No, when resolved that alarm will not be automatically deleted from the Alarms page and you must manually delete that alarm from the Alarms page.

Displaying Alarm Information

This section describes how to display alarm information. It contains the following topics:

Displaying an Alarm Summary for All Arrays

To display alarm summary information for all arrays:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, choose Alarms.

   The Alarm Summary page for all arrays is displayed.

Displaying an Alarm Summary for an Individual Array

To display an alarm summary for an individual array:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. Expand the array for which you want to view alarms, and choose Alarms below it.

   The Alarm Summary page for that array is displayed.

Displaying Alarm Details

To display detailed information about an alarm:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. Display the Alarm Summary page by doing one of the following in the navigation pane:
   - To see the Alarm Summary page for all arrays, choose Alarms.
   - To see alarms for a particular array, expand that array and choose Alarms below it.

3. Click Details for the alarm for which you want to display detailed information.

   The Alarm Details page is displayed for the selected alarm.

Displaying Aggregated Events

To display aggregated events associated with an alarm:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. Display the Alarm Summary page by doing one of the following in the navigation pane:
   - To see the Alarm Summary page for all arrays, choose Alarms.
   - To see alarms for a particular array, expand that array and choose Alarms below it.

3. Click Details for the alarm for which you want to display detailed information.

   The Alarm Details page is displayed for the selected alarm.

4. Click View Aggregated Events.

   A list of all events associated with the displayed alarm is displayed.

Note: The aggregation of events associated with an alarm can vary based on the time that an individual host probes the device. When not aggregated, the list of events, is consistent with all hosts.

Acknowledging Alarms

When an alarm is generated, it remains open in the Alarm Summary page until you acknowledge it. Acknowledging an alarm is a way for administrators to indicate that an alarm has been seen and evaluated; it does not affect if or when an alarm will be cleared.

To acknowledge one or more alarms:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. Display the Alarm Summary page by doing one of the following in the navigation pane:
   - To see the Alarm Summary page for all arrays, choose Alarms.
   - To see alarms for a particular array, expand that array and choose Alarms below it.

3. Select the check box for each alarm you want to acknowledge, and click Acknowledge.

   The Acknowledge Alarms confirmation window is displayed.

4. Enter an identifying name to be associated with this action, and click Acknowledge.

   The Alarm Summary page is redisplayed, and the state of the acknowledged alarms is displayed as Acknowledged.

Note: You can also acknowledge an alarm from the Alarm Details page.

Reopening Acknowledged Alarms

To reopen one or more previously acknowledged alarms:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. Display the Alarm Summary page by doing one of the following in the navigation pane:
   - To see the Alarm Summary page for all arrays, choose Alarms.
   - To see alarms for a particular array, expand that array and choose Alarms below it.

3. Select the check box for each acknowledged alarm you want to reopen, and click Reopen.

   The Reopen Alarms confirmation window is displayed.

4. Enter an identifying name to be associated with this action, and click Reopen.

   The Alarm Summary page is redisplayed, and the state of the reopened alarms is displayed as Open.

Note: You can also reopen an alarm from the Alarm Details page.

Deleting Alarms

When you delete an open or acknowledged alarm, it is permanently removed from the Alarm Summary page.

Note: You cannot delete alarms which are designated as Auto Clear alarms. These alarms are removed from the Alarm Summary page either when the array is removed from the list of managed arrays or when the condition related to the problem is resolved.

To delete one or more alarms:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. Display the Alarm Summary page by doing one of the following in the navigation pane:
   - To see the Alarm Summary page for all arrays, choose Alarms.
   - To see alarms for a particular array, expand that array and choose Alarms below it.

3. Select the check box for each acknowledged alarm you want to delete, and click Delete.

   The Delete Alarms confirmation window is displayed.

4. Click OK.

   The Alarm Summary page is redisplayed without the deleted alarms.

Displaying Event Information

To gather additional information about an alarm, you can display the event log to view the underlying events on which the alarm is based.

Note: The event log is a historical representation of events in an array. In some cases the event log may differ when viewed from multiple hosts since the agents run at different times on separate hosts. This has no impact on fault isolation.

To display event log information:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array for which you want to view the event log.

   The navigation tree is expanded for that array.

3. To view the Events page:

   a. For the J4000, F5000, and B6000 Array Families, click Events.

   b. For the Sun Storage and StorageTek 6000 Series, 2500 Series, and supported FLX arrays, expand Troubleshooting and choose Events.

   The Events page displays a summary of all events in the system event log.

4. To see detailed information about an event, click Details in the row that corresponds to the event.

   The Event Details page is displayed for the selected event.

Page and Field Descriptions

Browser interface pages and fields related to the "Monitoring Alarms and Events" section are described in the following subsections:

Alarm Details Page

This page displays details on a specific alarm.

TABLE 5-14 describes the buttons and fields on the Alarm Details page.

TABLE 5-14 Alarm Details Page

Field	Description
Acknowledge	Click to change the state of this alarm from Open to Acknowledged.
Reopen	Click to change the state of this alarm from Acknowledged to Open. This button is grayed out until the alarm has been acknowledged.
View Aggregated Events	Click to display all events associated with this alarm.
Details	
Severity	The severity level of the event. The possible severity levels are: • Down • Critical • Major • Minor
Date	The date and time when the alarm was generated.

TABLE 5-14 Alarm Details Page *(Continued)*

Field	Description
State	The current state of the alarm; for example, Open or Acknowledged.
Acknowledged by:	The user who acknowledged the alarm. This field displays only if an alarm has not yet been acknowledged.
Reopened by:	The user who reopened the alarm. This field displays only after an alarm has been acknowledged and then reopened.
Auto Clear	Select this option to manually delete an alarm. Note: Alarms are typically cleared and removed from Sun Storage Common Array Manager when problems are resolved.
Description	A technical explanation of the condition that caused the alarm.
Info	A non-technical explanation of the condition that caused the alarm.
Device	The device to which the alarm applies. Click the device name for detailed information about the component; for example, sp-87 (se2).
Component	The component element to which the alarm applies.
Event Code	The event code used to identify this alarm type.
Aggregated Count	The number of events aggregated for this alarm.
Probable Cause	
The most likely reasons that the alarm was generated.	
Recommended Action	
The procedure, if any, that you can perform to attempt to correct the alarm condition. A link to the Service Advisor is displayed if replacement of a field-replaceable unit (FRU) is recommended.	
Notes	
Optional. You can specify text to be stored with the alarm detail to document the actions taken to address this alarm.	

Alarm Summary Page

This page displays summary information for all alarms on all storage arrays.

TABLE 5-15 describes the buttons and fields on the Alarm Summary page.

TABLE 5-15 Alarm Summary Page

Field	Description
Acknowledge	Click to change the state of any selected alarms from Open to Acknowledged.
Reopen	Click to change the state of any selected alarms from Acknowledged to Open. This button is grayed out until the alarm has been acknowledged.
Delete	Click to remove selected alarms. This button is grayed out for any auto-clear alarm.
Severity	The severity level of the event. Possible severity levels are: • Black – Down • Red – Critical • Orange – Major • Yellow – Minor
Alarm Details	Click to display detailed information about the alarm.
Device	The device to which the alarm applies. Click the device name for detailed information about the component; for example, sp-87 (se2).
Component	The component to which the alarm applies.
Type	The general classification of the alarm.
Date	The date and time when the alarm was generated.
State	The current state of the alarm; for example, open or acknowledged.
Auto Clear	Select this option to manually delete an alarm. Note: Alarms are typically cleared and removed from Sun Storage Common Array Manager when problems are resolved.

Alarms Page

This page displays summary information for all alarms on an individual array.

TABLE 5-16 describes the buttons and fields on the Alarms page.

TABLE 5-16 Alarms Page

Field	Description
Acknowledge	Click to change the state of any selected alarms from Open to Acknowledged.
Reopen	Click to change the state of any selected alarms from Acknowledged to Open. This button is grayed out until the alarm has been acknowledged.
Delete	Click to remove selected alarms. This button is grayed out for any auto-clear alarm.
Severity	The severity level of the event. Possible severity levels are: • Black – Down • Red – Critical • Orange – Major • Yellow – Minor
Alarm Details	Click to display detailed information about the alarm.
Component	The component to which the alarm applies.
Type	The general classification of the alarm.
Date	The date and time when the alarm was generated.
State	The current state of the alarm; for example, open or acknowledged.
Auto Clear	Select this option to manually delete an alarm. Note: Alarms are typically cleared and removed from Sun Storage Common Array Manager when problems are resolved.

Event Details Page

This page displays detailed information for a selected event.

TABLE 5-17 describes the buttons and fields on the Event Details page.

TABLE 5-17 Event Details Page

Field	Description
Details	
Severity	The severity level of the event. Possible severity levels are: • Down • Critical • Major • Minor
Date	The date and time when the event was generated.
Description	A technical explanation of the condition that caused the event.
Data	Additional event data.
Component	The component to which the alarm applies.
Type	A brief identifier of the nature of the event, such as Log, State Change, or Value Change.
Info	A non-technical explanation of the condition that caused the event.
Event Code	The event code used to identify this event type.
Aggregated	Whether the event is aggregated behind another event. The value can be Yes or No.
Probable Cause	
The most likely reasons that the event was generated.	
Recommended Action	
The procedure, if any, that you can perform to correct the event condition.	

Events Page

This page displays summary information on all events in the system event log.

TABLE 5-18 describes the buttons and fields on the Events page.

TABLE 5-18 Events Page

Button/Field	Description
	Click to open the Advanced Filter - Events window.
Date	The date and time when the event occurred.
Event Details	Click Details to display detailed information for the corresponding event.
Component	The component to which the event applies.
Type	A brief identifier of the nature of the event, such as Log, State Change, or Value Change.

Monitoring Devices for RAID Arrays

This section provides information about monitoring the FRU components for Oracle's RAID arrays.

Displaying the FRU List for a RAID Array

To view the listing of FRUs in a RAID array:

1. In the navigation pane, click the arrow next to the name of the array you want to work with to expand the menu.
2. Expand the Troubleshooting category, then click FRUs.

   The FRU Summary page is displayed. It lists the FRU types available for the selected array, identifies how many FRUs are installed in the array, and indicates if an alarm is associated with a particular FRU type. The types of FRU components available depend on the model of your array.

   For detailed information about each FRU type, refer to the hardware documentation for your array.

Displaying FRU Components for a RAID Array

To view the list of FRU components of a particular type:

1. In the navigation pane, click the arrow next to the name of the array you want to work with to expand the menu.
2. Expand the Troubleshooting category, then click FRUs.

   The FRU Summary page is displayed.
3. Click a FRU component in the FRU Type field.

   The Component Summary page for that FRU component is displayed.

   The Component Summary page displays the list of components available for the particular FRU type, along with the FRU component's status, operational state, revision and unique identifier. When you click on a specific component, you can display detailed health information for the selected component.

Displaying FRU Health Information for a RAID Array

To display health details for a FRU component:

1. In the navigation pane, click the arrow next to the name of the array you want to work with to expand the menu.
2. Expand the Troubleshooting category, then click FRUs.

   The FRU Summary page is displayed.
3. Click a FRU type.

   The Component Summary for page for that FRU type is displayed.
4. Click on the name of a FRU component for which you want detailed information.

   The Health Details page for the selected FRU component is displayed.

Page and Field Descriptions - Common to All Arrays

FRU component browser interface pages and fields applicable to all arrays are described in the following subsections:

- "Component Summary Page" on page 346

Page and Field Descriptions - 6000 Series, 2500 Series, and FlexLine Arrays

FRU component browser interface pages and fields applicable to Oracle's Sun Storage and StorageTek 6000 series, StorageTek 2500 series, and FlexLine arrays are described in the following subsections:

Battery Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays

TABLE 5-19 describes the buttons and fields on the Battery Health Details page.

TABLE 5-19 Battery Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays

Field	Indicates
Automatic Age Reset	Whether the smart battery supports automatic age reset. Possible values are True or False. **Note**: This field is not displayed for all array models and firmware versions.
Availability	A measure of the component's availability to perform its function (e.g. Other, Unknown, Running Full Power, Warning, Off Line, Degraded).
Battery Age	The age of the battery in days. This value indicates the number of days since battery installation, but can be reset at any time.
Battery Type	The type of battery configuration on this array. Possible values are: • Dual Individual CRU • Dual Individual FRU • Dual Shared CRU • Single Shared CRU
Description	Text description of the component.
Enabled State	The state of the component, displayed as a text string.
Last Learn Cycle	The date of the smart battery's last learn cycle. **Note**: This field is not displayed for all array models and firmware versions.
Learn Interval (Weeks)	The number of weeks between the smart battery's learn cycles. **Note**: This field is not displayed for all array models and firmware versions.
Life Remaining	The number of days before this battery reaches its rated life. This value is calculated by subtracting the battery age from the battery's rated life span. A value of -1 indicates the cache battery expiration event notification has been disabled. **Note**: This field is not displayed for all array models and firmware versions.
Name	The name of the component as it relates to the array.
Next Learn Cycle	The date the next smart battery learn cycle is scheduled to run. **Note**: This field is not displayed for all array models and firmware versions.

TABLE 5-19 Battery Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays *(Continued)*

Field	Indicates
Physical ID	The physical ID associated with this component. **Note**: This field is not displayed for all array models and firmware versions.
Raw Status	The raw status of the component, displayed as a text string.
Status	The current status of the component (e.g. OK, Error).

Controller Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays

TABLE 5-20 describes the buttons and fields on the Controller Health Details page.

TABLE 5-20 Controller Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays

Field	Indicates
ID	The controller ID.
Active	Whether the controller is in active mode. Possible values are True or False.
Availability	A measure of the component's availability to perform its function (e.g. Other, Unknown, Running Full Power, Warning, Off Line, Degraded).
Board ID	The board type of this controller.
Board Submodel	The submodel identifier of this controller. **Note**: This field is not displayed for all array models and firmware versions.
Cache Physical Size	The size, in megabytes, of the physical cache on this controller.
Cache Utilized by Controller	The amount of memory, in megabytes, the controller will use as cache.
CPU Memory Size	The size of the controller's CPU memory.
Description	Text description of the component.
Drive Side Interface	The drive interface type. Possible values are: • Fibre Channel • SAS • SATA

TABLE 5-20 Controller Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays *(Continued)*

Field	Indicates
Enabled State	The state of the component, displayed as a text string.
Ethernet Port *X* Addresses	The valid IP address(es) for this port (IPv6 support only). **Note**: This field is not displayed for all array models and firmware versions.
Ethernet Port *X* DHCP/BOOTP Used	Whether the Dynamic Host Configuration Protocol (DHCP) / Bootstrap Protocol (BOOTP) is being used for this Ethernet port. Valid values are True or False.
Ethernet Port *X* Gateway Address	The gateway IP address used by this port. **Note**: This field is not displayed for all array models and firmware versions.
Ethernet Port *X* IPv4 Address	The IPv4 address of the port, if IPv4 is enabled. **Note**: This field is not displayed for all array models and firmware versions.
Ethernet Port *X* IPv4 Enabled	Whether IPv4 capability is enabled for this port. Possible values are True or False. **Note**: This field is not displayed for all array models and firmware versions.
Ethernet Port *X* IPv4 Router	The router address for this port, if IPv4 is enabled. **Note**: This field is not displayed for all array models and firmware versions.
Ethernet Port *X* IPv6 Enabled	Whether the IPv6 capability is enabled for this port, if IPv6 is supported by the array. Possible values are True or False. **Note**: This field is not displayed for all array models and firmware versions.
Ethernet Port *X* IPv6 Global Address	The IPv6 Global Unicast address of this port, if IPv6 is enabled. **Note**: This field is not displayed for all array models and firmware versions.
Ethernet Port *X* IPv6 Link Local Address	The IPv6 link local address of this port, if IPv6 is enabled. **Note**: This field is not displayed for all array models and firmware versions.
Ethernet Port *X* IPv6 Router	The IPv6 router address used for this port, if IPv6 is enabled. **Note**: This field is not displayed for all array models and firmware versions.
Ethernet Port *X* MAC Address	The MAC address for this port.
Ethernet Port *X* Remote Access	Whether remote access is enabled on this port. Possible values are True or False.
Ethernet Port *X* Speed	The current speed of this port.

TABLE 5-20 Controller Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays *(Continued)*

Field	Indicates
Ethernet Port *X* Status	The status of this port. Possible values are: • Up • Down • Failed
Ethernet Port *X* Subnet Mask	The subnet mask of this port.
Ethernet Port *X* Type	The capability of this port. Possible values are: • IPv4 only (default) • IPv4 and IPv6 Capable
Firmware Version	The firmware version running on this controller.
Name	The name of the component as it relates to the array.
Physical ID	The physical ID associated with this component.
Quiesced	Whether the controller is currently quiesced. Possible values are True or False.
Raw Status	The raw status of the component, displayed as a text string.
Status	The current status of the component (e.g. OK, Error).

Disk Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays

TABLE 5-21 describes the buttons and fields on the Disk Health Details page.

TABLE 5-21 Disk Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays

Field	Indicates
ID	The identifier for this disk drive. For example, t0d02 is drive 02 in tray 00.
Assignable	The drive's availability for inclusion in a virtual disk. Possible values are True or False.
Availability	A measure of the component's availability to perform its function (e.g. Other, Unknown, Running Full Power, Warning, Off Line, Degraded).
Block Size	The block size used by the drive.

TABLE 5-21 Disk Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays *(Continued)*

Field	Indicates
Capacity (Raw)	The theoretical capacity of the disk drive.
Capacity (Useable)	The amount of space on the drive available for data storage.
Data Speed (Current)	The current interface speed, in Mbps, of this drive.
Data Speed (Max)	The maximum data transfer speed, in Mbps, of the drive. **Note**: This information may be unknown for some drives.
Degraded Channel Flag	Whether there are any degraded channels on this drive. Possible values are True or False.
Degraded Channels	The IDs of any degraded channels associated with this drive. Possible values are: • A space-delimited list of IDs • N/A
Description	Text description of the component.
Drive Firmware	The firmware running on this drive. **Note**: This field only applies to SATA drives.
Drive Type	The physical type of drive. Possible values are: • Fibre Channel • SATA • SAS
Enabled State	The state of the component, displayed as a text string.
FDE Security	The current full drive encryption (Data Encryption Services) status of the drive. Possible values are: • None • Capable • Enabled • Locked **Note**: This field is not displayed for all array models and firmware versions.
Firmware Package Version	The firmware version for this drive. For SATA drives, this indicates the package that contains both firmware and interposer firmware. For other drives, this indicates the drive firmware only.
FPGA Version	The current Field Programmable Gate Array (FPGA) firmware version. **Note**: This field applies only to SSD drives in Sun Storage 6580 and 6780 arrays.
Hot Spare	Whether the drive is a hot spare. Possible values are True or False.

TABLE 5-21 Disk Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays *(Continued)*

Field	Indicates
Interposer Firmware	The firmware level of the interposer card. **Note**: This field applies only to SAS and SATA drives.
Invalid Drive Data	Whether drive information is unavailable. Possible values are True or False.
Physical ID	The physical ID associated with this component.
Lock Key ID	The array lock key written to this drive, displayed only when an array lock key is set and assigned to the drive. **Note**: This field is not displayed for all array models and firmware versions.
Media	The type of media used by the drive. Possible values are HDD or SSD. **Note**: This field is not displayed for all array models and firmware versions.
Name	The name of the component as it relates to the array.
Non Redundant Access	Whether access to this drive is redundant. Possible values are True or False.
Offline	Whether the drive is offline. Possible values are True or False.
PFA	If True, indicates vendor thresholds have been passed and disk failure is imminent.
Raw Status	The raw status of the component, displayed as a text string.
Role	The role assigned to this drive. Possible values are: • Data Disk • Hot Spare • Unassigned
Spindle Speed	The rotational speed of the disk drive in revolutions per minute (rpm). For SSD drives, this value is always zero.
SSD Average Erase Count	The average erase count percent. **Note**: This field is only displayed for SSD drives in arrays supporting SSD drives.
SSD Spare Blocks Remaining	The percentage of the total blocks set as spare. **Note**: This field is only displayed for SSD drives in arrays supporting SSD drives.
Status	The current status of the drive, normalized. Possible values are: • OK • Error • Other
Status Cause	The cause for the current status of the drive if not optimal.

TABLE 5-21 Disk Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays *(Continued)*

Field	Indicates
Uncertified	Whether the drive is uncertified for use in this array. Possible values are True or False.
Virtual Disk Assignment	The identifier of the virtual disk to which this drive is assigned. Possible values are: • Virtual disk identifier • Unassigned
WWN	The disk world wide name.

Fan Health Details Page - 6130, FLX240, FLX280, and FLX380 Arrays

TABLE 5-22 describes the buttons and fields on the Fan Health Details page.

TABLE 5-22 Fan Health Details Page - 6130, FLX240, FLX280, and FLX380 Arrays

Field	Indicates
Availability	A measure of the component's availability to perform its function (e.g. Other, Unknown, Running Full Power, Warning, Off Line, Degraded).
Description	Text description of the component.
Element Status	The raw status of the component, displayed as a text string.
Enabled State	The state of the component, displayed as a text string.
Id	Unique identifier assigned to this component.
Name	The name of the component as it relates to the array.
Status	The current status of the component (e.g. OK, Error).

Midplane Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays

TABLE 5-23 describes the buttons and fields on the Midplane Health Details page.

TABLE 5-23 Midplane Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays

Field	Indicates
ID	Unique identifier assigned to this component.
Availability	A measure of the component's availability to perform its function (e.g. Other, Unknown, Running Full Power, Warning, Off Line, Degraded).
Controller Slot Count	The number of controller slots on this tray.
Description	Text description of the component.
Drive Slot Count	The number of drive slots in this tray.
Drive Speed Mismatch	Whether the drive speeds are mismatched. Possible values are True or False.
Element Status	The current raw status of the tray. Possible values are: • Optimal • Degraded • Removed
Enabled State	The state of the component, displayed as a text string.
IOM Miswire	Whether one of the IOMs in this tray is incorrectly wired to another IOM. Possible values are True or False.
IOM Version Mismatch	Whether the IOMs in this chassis have mismatched firmware. Possible values are True or False.
Max Data Speed	The maximum data transfer rate supported by this tray.
Name	The name of the component as it relates to the array.
Non Redundant Channel	If only one channel is connected/working, the channel is displayed. Otherwise, N/A is displayed.
Physical ID	The physical ID associated with this component. **Note**: This field is not displayed for all array models and firmware versions.
Redundant Access	Whether this tray has redundant path access (i.e. both IOMs have active connections). Possible values are True or False.
Role	The role of the tray. Possible values are Controller Module or Expansion Module.

TABLE 5-23 Midplane Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays *(Continued)*

Field	Indicates
Status	The current status of the component (e.g. OK, Error).
Tray ID Conflict	Whether the ID on this tray conflicts with another tray ID. Possible values are True or False.
Tray ID Mismatch	Whether the IOM IDs are mismatched. Possible values are True or False.
Unsupported Tray Type	Whether this tray type is unsupported. Possible values are True or False.

PCU Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays

TABLE 5-24 describes the buttons and fields on the Power Supply Module (PCU) Health Details page.

TABLE 5-24 PCU Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays

Field	Indicates
Availability	A measure of the component's availability to perform its function (e.g. Other, Unknown, Running Full Power, Warning, Off Line, Degraded).
Description	Text description of the component.
Element Status	The raw status of the component, displayed as a text string.
Enabled State	The state of the component, displayed as a text string.
Name	The name of the component as it relates to the array.
Physical ID	The physical ID associated with this component. **Note**: This field is not displayed for all array models and firmware versions.
Status	The current status of the component (e.g. OK, Error).

SFP Health Details Page - 6000 Series, 2540-M2 Array, 2540 Array, and FlexLine Arrays

TABLE 5-25 describes the buttons and fields on the Small Form-factor Pluggable (SFP) Health Details page.

TABLE 5-25 SFP Health Details Page - 6000 Series, 2540-M2 Array, 2540 Array, and FlexLine Arrays

Field	Indicates
Availability	A measure of the component's availability to perform its function (e.g. Other, Unknown, Running Full Power, Warning, Off Line, Degraded).
Channel	The channel carried on this SFP.
Connector Type	The connector type of this SFP.
Data Speed	The supported speeds of the SFP in Gbps.
Description	Text description of the component.
Enabled State	The state of the component, displayed as a text string.
IEEE Company ID	The IEEE company ID of the manufacturer.
Ident Type	The identifier type of the SFT. Possible values are: • SFP • GBIC • Soldered • Unknown
Link Type	The link length of the connection. Possible values are: • Very Long • Long • Intermediate • Medium • Short • Unknown
Name	The name of the component as it relates to the array.
Parent Type	The type of hosting component. Possible values are: • Controller • IOM • Minihub
Physical ID	The physical ID associated with this component.
Port	The port in which this SFP is installed.

TABLE 5-25 SFP Health Details Page - 6000 Series, 2540-M2 Array, 2540 Array, and FlexLine Arrays *(Continued)*

Field	Indicates
Raw Status	The raw status of the component, displayed as a text string.
Status	The current status of the component (e.g. OK, Error).
Transmission Media	The transmission media used for this SFP.
Transmitter Type	The transmitter type of this SFP.
Type	The type of SFP. Possible values are Hostside or Driveside. **Note**: This field applies only to controller-hosted SFPs.

IOM Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays

TABLE 5-26 describes the buttons and fields on the I/O Module (IOM) Health Details page.

TABLE 5-26 IOM Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays

Field	Indicates
Availability	A measure of the component's availability to perform its function (e.g. Other, Unknown, Running Full Power, Warning, Off Line, Degraded).
Description	Text description of the component.
Enabled State	The state of the component, displayed as a text string.
Factory Default Version	The factory default version. **Note**: This information is only available if the IOM firmware version supports this feature.
Firmware	The version of the firmware running on the IOM.
Interface Type	The IO interface type. Possible values are: • Fibre Channel • SCSI • SATA • Not Implemented
Name	The name of the component as it relates to the array.
Non Redundant Channel	If a channel is failed, the working channel is displayed.

TABLE 5-26 IOM Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays *(Continued)*

Field	Indicates
Physical ID	The physical ID associated with this component.
Raw Status	The raw status of the component, displayed as a text string.
Redundant Access	Whether both channels are connected and online. Possible values are True or False.
Speed (Current)	The current data rate.
Speed (Maximum)	The maximum rated data transfer speed.
Status	The current status of the component (e.g. OK, Error).
Switching Technology	Whether switching technology is used. Possible values are True or False. **Note**: This field applies only to IOMs with a Fibre Channel interface.
Type	The physical type of IOM.
Version Management Support	Whether version management is supported on this IOM. Possible values are True or False. **Note**: This information is only available if the IOM firmware version supports this feature.

HIC Health Details Page - 2500-M2 Series, 6580 and 6780 Arrays

TABLE 5-27 describes the buttons and fields on the Host Interface Controller (HIC) Health Details page.

TABLE 5-27 HIC Health Details Page - 2500-M2 Series, 6580 and 6780 Arrays

Field	Indicates
Board ID	The identifier type for this card.
Board Type	The type of card, including an indication of the interface type (e.g. Quad Port Fibre Channel).
Description	Text description of the component.
Enabled State	The state of the component, displayed as a text string.
Name	The name of the component as it relates to the array.
Number of Ports	The number of host ports on this card.
Physical ID	The physical ID associated with this component.

TABLE 5-27 HIC Health Details Page - 2500-M2 Series, 6580 and 6780 Arrays *(Continued)*

Field	Indicates
Raw Status	The raw status of the component, displayed as a text string.
Status	The current status of the component (e.g. OK, Error).

Cache Memory DIMM Health Details Page - 6580 and 6780 Arrays

TABLE 5-28 describes the buttons and fields on the Cache Memory DIMM Health Details page.

TABLE 5-28 Cache Memory DIMM Health Details Page - 6580 and 6780 Arrays

Field	Indicates
Capacity	The size of the memory card.
Description	Text description of the component.
Enabled State	The state of the component, displayed as a text string.
Name	The name of the component as it relates to the array.
Physical ID	The physical ID associated with this component.
Raw Status	The raw status of the component, displayed as a text string.
Status	The current status of the component. Valid values are: • OK • Error • Empty • Unknown

Cache Backup Device Health Details Page - 2500-M2 Series, 6580 and 6780 Arrays

TABLE 5-29 describes the buttons and fields on the Cache Backup Device Health Details page.

TABLE 5-29 Cache Backup Device Health Details Page - 2500-M2 Series, 6580 and 6780 Arrays

Field	Indicates
Availability	A measure of the component's availability to perform its function (e.g. Other, Unknown, Running Full Power, Warning, Off Line, Degraded).
Capacity	The capacity of the cache backup device.
Controller USB Slot	The controller-relative slot in which the device is installed.
Description	Text description of the component.
Enabled State	The state of the component, displayed as a text string.
Media	The type of media the device uses (e.g. USB Flash).
Name	The name of the component as it relates to the array.
Physical ID	The physical ID associated with this component.
Raw Status	The raw status of the component, displayed as a text string.
Status	The current status of the component (e.g. OK, Error).

ICC Health Details Page - 6540, 6580, and 6780 Arrays

TABLE 5-30 describes the buttons and fields on the Interconnect CRU (ICC) Health Details page.

TABLE 5-30 ICC Health Details Page - 6540, 6580, and 6780 Arrays

Field	Indicates
Description	Text description of the component.
Enabled State	The state of the component, displayed as a text string.
Name	The name of the component as it relates to the array.
Physical ID	The physical ID associated with this component.

TABLE 5-30 ICC Health Details Page - 6540, 6580, and 6780 Arrays

Field	Indicates
Raw Status	The raw status of the component, displayed as a text string.
Ready to Remove	Whether the component has been placed in a state for removal. Possible values are True or False.
Status	The current status of the component (e.g. OK, Error).

Minihub Health Details Page - FLX280 Arrays

TABLE 5-31 describes the buttons and fields on the Minihub Health Details page.

TABLE 5-31 Minihub Health Details Page - FLX280 Arrays

Field	Indicates
Availability	A measure of the component's availability to perform its function (e.g. Other, Unknown, Running Full Power, Warning, Off Line, Degraded).
Description	Text description of the component.
Enabled State	The state of the component, displayed as a text string.
Name	The name of the component as it relates to the array.
Physical ID	The physical ID associated with this component.
Raw Status	The raw status of the component, displayed as a text string.
Status	The current status of the component (e.g. OK, Error).

Monitoring Devices for JBOD Arrays

This section provides information about monitoring the FRU components for Oracle's JBOD arrays:

FRU Components Available for the J4000, F5100, and B6000 Array Families

Depending on your array type, one or more of the following FRU components are available for monitoring using Sun Storage Common Array Manager:

- Disk (all arrays) - The disks installed in the array.
- SIM (J4200/J4400 arrays) - The SAS Interface Module (SIM) is a hot-swappable board that contains two SAS outbound connectors, one SAS inbound connector, and one serial management port.
- System Controller (J4500 and F5100) - The system controller contains SAS expanders. These expanders provide a redundant set of independent SAS fabrics, enabling redundant paths to the array's disk drives.
- Storage Module (B6000 array family) - The storage module contains SAS expanders. These expanders provide a redundant set of independent SAS fabrics, enabling redundant paths to the array's disk drives.
- Sun Blade 6000 Multi-Fabric Network Express (NEM) (B6000 array family)
- Energy Storage Module (F5100 array)
- Fans (J4200, J4500, and F5100 arrays)
- Power Supply (J4000 and F5100 array families)

For detailed hardware information about each FRU type, refer to the hardware documentation for your array.

Data Aggregation for the Sun Storage F5100 Flash Array

The Sun Storage F5100 array can have up to 4 SAS expanders. In order for Sun Storage Common Array Manager to access the data for expander and for each disk drive connected to a SAS expander, each of the expanders must have an in-band management path to the management host. If communication to the expander fails, the software returns a Lost Communication error.

For information about how to set up the in-band management path, refer to the *Sun Storage Common Array Manager Software Installation and Setup Guide*.

Sun Storage Common Array Manager aggregates the data it collects from the 4 SAS expanders and presents the FRU and asset details for each F5100 array as one entity. In the event that any of the SAS expanders are not visible, the software returns a status of No Contact for that expander.

Note: Sun Storage Common Array Manager aggregates data that may have been taken at different points in time. The time of the report is considered the time of the earliest sub-report collected from an expander and used in the data aggregation. If the Sun Storage F5100 array's state, status, or availability changes between the time of the initial report and the time of the last report, inconsistent data may be reported.

Monitoring JBOD Array FRU Components

The Sun Storage Common Array Manager software enables you to view a listing of the FRU components in an array, and to get detailed information about the health of each FRU component:

- "Displaying the FRU List for a JBOD Array" on page 345
- "Displaying FRU Components for a JBOD Array" on page 345
- "Displaying FRU Health Information for a JBOD Array" on page 345

Displaying the FRU List for a JBOD Array

To view the listing of FRUs in an array:

1. In the navigation pane, click the arrow next to the name of the array you want to work with to expand the menu.
2. Click FRUs.

   The FRU Summary page is displayed. It lists the FRU types available for the selected array, identifies how many FRUs are installed in the array, and indicates if an alarm is associated with a particular FRU type. The types of FRU components available depend on the model of your array.

   For detailed information about each FRU type, refer to the hardware documentation for your array.

Displaying FRU Components for a JBOD Array

To view the list of FRU components of a particular type:

1. In the navigation pane, click the arrow next to the name of the array you want to work with to expand the menu.
2. Click FRUs.

   The FRU Summary page is displayed.
3. Click a FRU component in the Name field.

   The Component Summary page for that FRU component is displayed.

   The Component Summary page displays the list of components available for the particular FRUs type, along with the FRU component's status, operational state, revision and unique identifier. When you click on a specific component, you can display detailed health information for the selected component.

Displaying FRU Health Information for a JBOD Array

To display health details for a controller:

1. In the navigation pane, click the arrow next to the name of the array you want to work with to expand the menu.
2. Click FRUs.

The FRU Summary page is displayed.

3. Click a FRU type.

   The Component Summary for page for that FRU type is displayed.

4. Click on the name of a FRU component for which you want detailed information.

   The Health Details page for the selected FRU component is displayed.

Page and Field Descriptions - Common to All Arrays

FRU component browser interface pages and fields applicable to all arrays are described in the following subsections:

- "Component Summary Page" on page 346
- "Component Health Details Page" on page 347
- "FRU Summary Page" on page 348

Component Summary Page

The Component Summary page provides a brief summary about the FRUs available on the array. For detailed information about a specific FRU component, click on the FRU name.

TABLE 5-32 describes the buttons and fields on the Component Summary page.

TABLE 5-32 Component Summary Page

Field	Indicates
Name	Name of the FRU component.
State	The state of the FRU component. Valid values are: • Enabled • Disabled • Other • Unknown
Status	Status of the FRU component, displayed as a text string.
Revision	The revision of the FRU component.

TABLE 5-32 Component Summary Page

Field	Indicates
Unique Identifier	The unique identifier associated with this FRU component.

Component Health Details Page

Click a link below for health details about a specific FRU component:

For the J4000 array family:

- "Disk Health Details Page - J4000 Array Family" on page 349
- "Fan Health Details Page - J4200/J4500 Arrays" on page 351
- "Power Supply Health Details Page - J4000 Array Family" on page 352
- "SIM Health Details Page - J4200/J4400 Arrays" on page 353
- "System Controller Health Details Page - J4500 Array" on page 356

For the Sun Storage F5100 Flash Array:

- "Disk Health Details Page - F5100 Array" on page 359
- "Energy Storage Module Health Details Page - F5100 Array" on page 361
- "Fan Health Details Page - F5100 Array" on page 362
- "Power Supply Health Details Page - F5100 Array" on page 363
- "System Controller Health Details Page - F5100 Array" on page 364

For the B6000 array family:

- "Disk Health Details Page - B6000 Array Family" on page 367
- "NEM Health Details Page - B6000 Array Family" on page 369
- "Storage Module Health Details Page - B6000 Array Family" on page 371

For the 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine arrays:

- "Battery Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays" on page 328
- "Controller Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays" on page 329
- "Disk Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays" on page 331
- "Fan Health Details Page - 6130, FLX240, FLX280, and FLX380 Arrays" on page 334
- "Midplane Health Details Page - 6000 Series, 2500-M2 Series, 2500 Series, and FlexLine Arrays" on page 335

FRU Summary Page

The FRU Summary page provides basic information about the FRUs available on an array. For detailed information about a particular FRU, click on the name of the FRU type to display the Component Summary page. From the Component Summary page, you can click on the name of a specific FRU to get detailed information.

TABLE 5-33 describes the buttons and fields on the FRU Summary page.

TABLE 5-33 FRU Summary Page

Field	Indicates
FRU Type	The type of FRU installed in the array.
Alarms	If an alarm icon is present, indicates that an alarm is associated with that particular FRU type.
Installed	The quantity of FRU components of a particular type installed on the array.
Slot Count	The quantity of slots allocated for the particular FRU type.

Page and Field Descriptions - J4000 Array Family

FRU component browser interface pages and fields applicable to Oracle's Sun Storage J4200, J4400, and J4500 arrays are described in the following subsections:

Disk Health Details Page - J4000 Array Family

The Disk Health Details page provides detailed information about the selected disk.

TABLE 5-34 describes the buttons and fields on the Disk Health Details page.

TABLE 5-34 Disk Health Details Page - J4000 Array Family

Field	Indicates
Availability	The availability of this disk. Valid values are: • Running Full Power • Degraded • Not Installed • Unknown
Capacity	The total capacity of this disk.
Drive Slot Disabled	Specifies whether the drive slot for the selected drive is disabled (False) or enabled (True) for use.
Drive Zoned Out	• If True, access configuration is enabled and this disk is configured such that no monitored host has access to this disk. • If False, then access configuration is disabled or there is a host being monitored that is configured to have access to this disk.

TABLE 5-34 Disk Health Details Page - J4000 Array Family *(Continued)*

Field	Indicates
Enabled State	Current state of this disk. Valid values are: • Enabled • Disabled • Removed • Other • Unknown
Host Path	The path where the disk drive is located.
Host Providing Data	The host that is supplying the information for the array. If there are multiple hosts attached to the same array, only one of the hosts is used as the reporting host.
Id	Unique identifier assigned to this disk drive.
Model	The model ID of this disk drive.
Name	Name assigned to this disk drive. For example, Disk.01.
Physical ID	The physical ID assigned to this disk drive.
Product Firmware Version	The version of firmware running on this disk drive.
Product Name	Name of the disk drive manufacturer.
Ready to Remove	The state of this FRU to identify whether or not it can be safely removed. Valid values are True or False.
SAS Address	The SAS address assigned to this disk drive.
Serial Number	The serial number associated with this disk drive.
Slot Number	The slot number where this disk drive is installed.
Status	Status of this disk drive. Valid values are: • OK • Uninstalled • Degraded • Disabled • Failed • Critical • Unknown
Type	The type of disk drive, such as SAS or SATA.

Fan Health Details Page - J4200/J4500 Arrays

TABLE 5-35 describes the buttons and fields on the Fan Health Details page.

TABLE 5-35 Fan Health Details Page - J4200/J4500 Arrays

Field	Indicates
Availability	The availability of this fan. Valid values are: • Running Full Power • Degraded • Not Installed • Unknown
Enabled State	Current state of this fan. Valid values are: • Enabled • Removed • Other • Unknown
Host Providing Data	The host that is supplying the information for the array. If there are multiple hosts attached to the same array, only one of the hosts is used as the reporting host.
Id	Unique identifier assigned to this fan.
Name	Name assigned to this fan. For example, Fan.00.
Position (J4200 only)	The location of this fan in the chassis when viewing the chassis from the back. Valid values are: • Left • Right
Speed%	The percentage of maximum speed at which the fan is running.
Speed	The speed, in rotations per minute (RPMs) at which the fan is operating.
Status	Status of this fan. Valid values are: • OK • Uninstalled • Degraded • Disabled • Failed • Critical • Unknown
Type	The type of FRU.

Power Supply Health Details Page - J4000 Array Family

TABLE 5-36 describes the buttons and fields on the Power Supply Health Details page.

TABLE 5-36 Power Supply Health Details Page - J4000 Array Family

Field	Indicates
Availability	The availability of this power supply. Valid values are: • Running Full Power • Degraded • Not Installed • Unknown
Enabled State	State of this power supply. Valid values are: • Enabled • Removed • Other • Unknown
Failed (J4500 only)	The failed state of this power supply. Valid values are True if the power supply is in the failed state, or False if the power supply is not in the failed state.
Fan *X* Speed (J4400 only)	The speed, in rotations per minute (RPMs), at which the fan is operating.
Fan *X* Status (J4400 only)	Status of this fan. Valid values are: • OK • Uninstalled • Degraded • Disabled • Failed • Critical • Unknown
Host Providing Data	The host that is supplying the information for the array. If there are multiple hosts attached to the same array, only one of the hosts is used as the reporting host.
Id	Unique identifier assigned to this power supply.
Is Power Off (J4500 only)	The current power status of this power supply. Values are True or False.
Name	Name assigned to this power supply.
Part Number	The part number assigned to this power supply. (Not provided for J4200.)

TABLE 5-36 Power Supply Health Details Page - J4000 Array Family *(Continued)*

Field	Indicates
Physical ID	The physical ID assigned to this power supply. (Not provided for J4200.)
Serial Number	The serial number of the power supply. (Not valid for J4200.)
Status	Status of this FRU component. Valid values are: • OK • Uninstalled • Degraded • Disabled • Failed • Critical • Unknown
Type	The type of FRU component.

SIM Health Details Page - J4200/J4400 Arrays

TABLE 5-37 describes the buttons and fields on the SIM Health Details page.

TABLE 5-37 SIM Health Details Page - J4200/J4400 Arrays

Field	Indicates
Availability	The availability of this SIM. Valid values are: • Running Full Power • Degraded • Not Installed • Unknown
Cable Host or SIM Link In Status	JBOD SAS external connector status. Valid values are: • OK - cable status is known and a cable is attached to the connector, indicating an active SAS connection from the SAS port to a device (data host or another JBOD). • Removed - cable status is known and a cable is unattached from the connector, indicating no active connection on the SAS port. • Unknown - cable status is unknown, likely due to a lack of management path (because of physical or supported protocol reasons). **Note**: This field appears only if the server has a management connection to the SIM.

TABLE 5-37 SIM Health Details Page - J4200/J4400 Arrays *(Continued)*

Field	Indicates
Cable SIM Host Out Status	JBOD SAS external connector status. Valid values are: • OK - cable status is known and a cable is attached to the connector, indicating an active SAS connection from the SAS port to a device (data host or another JBOD). • Removed - cable status is known and a cable is unattached from the connector, indicating no active connection on the SAS port. • Unknown - cable status is unknown, likely due to a lack of management path (because of physical or supported protocol reasons). **Note**: This field appears only if the server has a management connection to the SIM.
Cable SIM Link Out Status	JBOD SAS external connector status. Valid values are: • OK - cable status is known and a cable is attached to the connector, indicating an active SAS connection from the SAS port to a device (data host or another JBOD). • Removed - cable status is known and a cable is unattached from the connector, indicating no active connection on the SAS port. • Unknown - cable status is unknown, likely due to a lack of management path (because of physical or supported protocol reasons). **Note**: This field appears only if the server has a management connection to the SIM.
Chassis Serial Number	The serial number of the chassis.
Enabled State	State of this FRU component. Valid values are: • Enabled • Removed • Other • Unknown
Enclosure SAS Address	SCSI Enclosure Services Target Address. **Note**: This field appears only if the server has a management connection to the SIM.
Host Providing Data	The host that is supplying the information for the array. If there are multiple hosts attached to the same array, only one of the hosts is used as the reporting host. **Note**: This field appears only if the server has a management connection to the SIM.
Id	Unique identifier assigned to this SIM (e.g. sim01)
Model	The model ID of this array.
Name	The name assigned to this SIM (e.g. SIM.01)

TABLE 5-37 SIM Health Details Page - J4200/J4400 Arrays *(Continued)*

Field	Indicates
Over Temperature Failure	A failure indicator to identify whether the temperature of the system controller has exceeded operating limits, resulting in a failure to operate.
Over Temperature Warning	A warning indicator to identify whether the temperature of the system controller may exceed operating limits.
Part Number	The part number assigned to this SIM.
Physical ID	The physical ID associated with this SIM.
Product Firmware Version	The version of the firmware loaded on the SIM.
Product Name	The name of the array. For example, SUN Storage J4200.
SAS Address	The SAS address assigned to this SIM card. **Note**: This field appears only if the server has a management connection to the SIM.
Serial Number	Serial number of the SIM.
Status	Status of this FRU component. Valid values are: • OK • Uninstalled • Degraded • Disabled • Failed • Critical • Unknown
Temperature Midplane Sensor *X* Failure	A failure indicator to identify whether the temperature of this sensor has exceeded operating limits, resulting in a failure to operate. Values are True or False.
Temperature Midplane Sensor *X* Warning	A warning indicator to identify whether the temperature of this sensor exceeded operating limits. Values are True or False.
Temperature Midplane Sensor *X*	The temperature, reported as degrees Celsius, of sensor *X*.
Temperature Sensor *X* Failure	A failure indicator to identify whether the temperature of this sensor has exceeded operating limits, resulting in a failure to operate. Values are True or False.
Temperature Sensor *X* Warning	A warning indicator to identify whether the temperature of this sensor exceeded operating limits. Values are True or False.
Temperature Sensor *X*	The temperature, reported as degrees Celsius, of sensor *X*.
Type	The type of FRU.

TABLE 5-37 SIM Health Details Page - J4200/J4400 Arrays *(Continued)*

Field	Indicates
Voltage Sensor (*n.n*V)	The actual voltage of the SIM sensor. If the voltage is not within acceptable limits, an alarm is reported.

System Controller Health Details Page - J4500 Array

TABLE 5-38 describes the buttons and fields on the System Controller Health Details page.

TABLE 5-38 System Controller Health Details Page - J4500 Array

Field	Indicates
Availability	The availability of this system controller. Valid values are: • Running Full Power • Degraded • Not Installed • Unknown
Chassis Serial Number	The serial number of the chassis.
Enabled State	State of this FRU component. Valid values are: • Enabled • Removed • Other • Unknown
Expander *X* Host Path	The path the operating system uses to access this expander.
Expander *X* Host Providing Data	The host name that is providing the information for this expander.
Expander *X* Internal Phy Diagnostic Result Value	The actual value of the diagnostic result, which is a bitmap of the phys that have failed.
Expander *X* Internal Phy Diagnostic Result	The result of the diagnostic. Valid values are OK or Failed.
Expander *X* Name	The location of this expander.
Expander *X* Product Revision	Revision of the firmware on this expander.

TABLE 5-38 System Controller Health Details Page - J4500 Array *(Continued)*

Field	Indicates
Expander *X* SCSI Product Revision	The SCSI product revision number for this expander.
Expander *X* Serial Number	The serial number assigned to this expander.
Expander *X* Status	The operating status of this expander. Valid values are OK or Failed. **Note**: This field applies only to Outer expanders (0 and 2).
Host Providing Data	The host that is supplying the information for the array. If there are multiple hosts attached to the same array, only one of the hosts is used as the reporting host.
Id	Unique ID assigned to this controller.
Name	The name assigned to this controller.
Over Temperature Failure	A failure indicator to identify whether the temperature of the system controller has exceeded operating limits, resulting in a failure to operate.
Over Temperature Warning	A warning indicator to identify whether the temperature of the system controller may exceed operating limits.
Overall Internal Phy Diagnostic Result	The overall result of SAS Expander Phy (port) diagnostics. Valid values are OK or Failed.
Part Number	The part number assigned to this controller.
Physical ID	The physical ID associated with this controller.
Product Firmware Version	The version of the firmware loaded on the controller.
Product Name	Name of the SIM manufacturer.
Serial Number	Serial number assigned to the system controller.
Status	Status of this FRU component. Valid values are: • OK • Uninstalled • Degraded • Disabled • Failed • Critical • Unknown
Temperature Sensor Ambient Temperature Failure	One of two temperature sensors on the system controller board. If the temperature at this location is not within acceptable limits, an alarm is reported.

TABLE 5-38 System Controller Health Details Page - J4500 Array *(Continued)*

Field	Indicates
Temperature Sensor Ambient Temperature Warning	One of two temperature sensors on the system controller board. If the temperature at this location is not within acceptable limits, an alarm is reported.
Temperature Sensor Ambient Temperature	The actual temperature (Celsius) of the sensor.
Temperature Sensor LM75 Sensor *X* Failure	One of two temperature sensors on the system controller board. If the temperature at this location is not within acceptable limits, an alarm is reported.
Temperature Sensor LM75 Sensor *X* Warning	One of two temperature sensors on the system controller board. If the temperature at this location is not within acceptable limits, an alarm is reported.
Temperature Sensor LM75 Sensor *X*	The actual temperature (Celsius) of the LM75 sensor.
Voltage Sensor 12V In	The actual voltage of this 12 volt circuit. If the voltage is not within acceptable limits, an alarm is reported.
Voltage Sensor 3.3V Main	The actual voltage of this main 3.3 volt circuit. If the voltage is not within acceptable limits, an alarm is reported.
Voltage Sensor 3.3V Stby	The actual voltage of this standby 3.3 volt circuit. If the voltage is not within acceptable limits, an alarm is reported.
Voltage Sensor 5V In	The actual voltage of this 5 volt circuit. If the voltage is not within acceptable limits, an alarm is reported.
Voltage Sensor AIN0	The actual voltage of this 5 volt circuit. If the voltage is not within acceptable limits, an alarm is reported.
Voltage Sensor VCCP	The actual voltage of this VCCP circuit. If the voltage is not within acceptable limits, an alarm is reported.

Page and Field Descriptions - F5100 Flash Array

FRU component browser interface pages and fields applicable to Oracle's Sun Storage F5100 Flash Array are described in the following subsections:

Disk Health Details Page - F5100 Array

The Disk Health Details page provides detailed information about the selected disk.

TABLE 5-39 describes the buttons and fields on the Disk Health Details page.

TABLE 5-39 Disk Health Details Page - F5100 Array

Field	Indicates
Availability	The availability of this disk. Valid values are: • Running Full Power • Degraded • Not Installed • Unknown
Capacity	The total capacity of this disk.
Drive Zoned Out	• If True, access configuration is enabled and this disk is configured such that no monitored host has access to this disk. • If False, then access configuration is disabled or there is a host being monitored that is configured to have access to this disk.
Enabled State	The state of this FRU component. Valid values are: • Enabled • Disabled • Other • Unknown

TABLE 5-39 Disk Health Details Page - F5100 Array *(Continued)*

Field	Indicates
Host Providing Data	The host that is supplying the information for the array. If there are multiple hosts attached to the same array, only one of the hosts is used as the reporting host.
Expander SAS Address	The SAS address of the expander.
Host Path	The logical host path that is used to access this disk drive.
Id	The unique ID assigned to this disk drive.
Model	The model number of this disk drive.
Name	The name assigned to this FRU component.
Physical ID	The physical ID associated with this FRU component.
Product Firmware Version	The firmware version loaded on this disk drive.
Product Name	Name of the disk drive manufacturer.
Ready to Remove	The state of this disk to identify whether or not it can be safely removed. Valid values are True or False.
SAS Address	The SAS address assigned to this disk.
Serial Number	The serial number of this disk.
Slot Number	The slot number where this disk is installed.
Status	Status of this FRU component. Valid values are: • Critical • Degraded • Disabled • Failed • OK • Removed • Unassigned • Uninstalled • Unknown
Type	The type of disk drive, such as FMod (Flash Module).
Write Through Mode	The Write Through Mode capability of the disk. Possible values are Supported and Not Supported.

Energy Storage Module Health Details Page - F5100 Array

The Energy Storage Module Health Details page for the F5100 array provides detailed information about the selected energy storage module.

TABLE 5-40 describes the buttons and fields on the Energy Storage Module Health Details page.

TABLE 5-40 Energy Storage Module Health Details Page - F5100 Array

Field	Indicates
Availability	The availability of this FRU component. Valid values are: • Running Full Power • Degraded • Not Installed • Unknown
Charging Status	The charging status of this ESM. Valid values are: • Charging • Not Charging • Unknown
Enabled State	The state of this FRU component. Valid values are: • Enabled • Unknown
Failed	The operational state of this FRU component. Valid values are True or False.
Host Providing Data	The host that is supplying the information for the array. If there are multiple hosts attached to the same array, only one of the hosts is used as the reporting host.
Id	The unique ID assigned to this FRU component.
Low Battery	The status of the battery. Valid values are True if the battery has low power, or false if the battery does not have low power.
Name	The name assigned to this FRU component.
Status	Status of this FRU component. Valid values are: • OK • Removed • Degraded • Error
Type	The type of FRU component.

Fan Health Details Page - F5100 Array

TABLE 5-41 describes the buttons and fields on the Fan Health Details page.

TABLE 5-41 Fan Health Details Page - F5100 Array

Field	Indicates
Availability	The availability of this fan. Valid values are: • Running Full Power • Degraded • Not Installed • Unknown
Enabled State	State of this fan. Valid values are: • Enabled • Removed • Other • Unknown
Host Providing Data	The host that is supplying the information for the array. If there are multiple hosts attached to the same array, only one of the hosts is used as the reporting host.
Id	The unique ID assigned to this fan.
Name	Name assigned to the fan.
Speed%	The percentage of maximum speed at which the fan is running.
Speed	The speed, in rotations per minute (RPMs) at which the fan is operating.
Status	Status of this FRU component. Valid values are: • OK • Uninstalled • Degraded • Disabled • Failed • Critical • Unknown
Type	The type of FRU component.

Power Supply Health Details Page - F5100 Array

TABLE 5-42 describes the buttons and fields on the Power Supply Health Details page.

TABLE 5-42 Power Supply Health Details Page - F5100 Array

Field	Indicates
Availability	The availability of this power supply. Valid values are: • Running Full Power • Degraded • Not Installed • Unknown
Enabled State	The enabled state of this power supply. Valid values are: • Enabled • Removed • Other • Unknown
Failed	The failed state of this power supply. Valid values are True if the power supply is in the failed state, or False if the power supply is not in the failed state.
Host Providing Data	The host that is supplying the information for the array. If there are multiple hosts attached to the same array, only one of the hosts is used as the reporting host.
Id	Unique identifier assigned to this power supply.
Is Power Off	The operational state of this power supply. Valid values are: • True - the power supply is not operational and not supplying power. • False - the power supply is operational and supplying power.
Name	Name assigned to this power supply.
Part Number	The part number assigned to this power supply.
Status	Status of this FRU component. Valid values are: • OK • Uninstalled • Degraded • Disabled • Failed • Critical • Unknown
Type	The type of FRU component.

System Controller Health Details Page - F5100 Array

TABLE 5-43 describes the buttons and fields on the System Controller Health Details page.

TABLE 5-43 System Controller Health Details Page - F5100 Array

Field	Indicates
Availability	The availability of this FRU component. Valid values are: • Running Full Power • Degraded • Not Installed • Unknown
Chassis Master Expander Location	The location of the master expander.
Chassis Serial Number	The serial number of the chassis.
Enabled State	State of this FRU component. Valid values are: • Enabled • Removed • Other • Unknown
Expander *X* Name	The location of this expander.
Expander X Port X Cable Status	The cable status for each reporting expander mini-SAS port. Expander and Port values range from 0 to 3. Possible status values are: • OK - a SAS cable is attached to the port and all four phys of the wide port have normal link status. • Removed - there is no mini-SAS cable attached to the port, or the attached cable is not connected to an electrified HBA or expander. • Degraded - one or more phys of the attached wide port has a "link down" status while at least one phy has a "link up" status. While this technically indicates an operational connection, the throughput is less than optimal. A damaged cable can cause this status. **Note**: Cable status is only shown for an expander physically attached to a registered data host. If there is no electrical connection from a registered data host to a given expander, none of that expander's four statuses will be shown.
Expander *X* Status Reason	The reason why no connection exists to this expander, No inband path to expander.

TABLE 5-43 System Controller Health Details Page - F5100 Array *(Continued)*

Field	Indicates
Expander *X* Status	The operating status of this expander. Valid values are • OK • Failed • Unknown
Expander *X* Host Path	The path the operating system uses to access this expander.
Expander X Name	The name assigned to the expander.
Expander *X* Product Revision	Revision of the firmware on this expander.
Expander X Reporting Host	The host name that is providing the information for this expander.
Expander *X* SAS Address	The SAS address assigned to the expander.
Expander *X* SCSI Product Revision	The SCSI product revision number for this expander.
Expander *X* SCSI Target Address	The SCSI target address for this expander.
Host Providing Data	The host that is supplying the information for the array. If there are multiple hosts attached to the same array, only one of the hosts is used as the reporting host.
Id	Unique ID assigned to this FRU component.
Mixture of FMod Types	Specifies whether a mixture of Flash Module (FMod) types exists. If True, both SAS and SATA FMods are installed on the array. This configuration is illegal and will generate an alarm.
Name	The name assigned to this FRU component.
Over Temperature Failure	A failure indicator to identify whether the temperature of the system controller has exceeded operating limits, resulting in a failure to operate.
Over Temperature Warning	A warning indicator to identify whether the temperature of the system controller may exceed operating limits.
Part Number	The part number assigned to this FRU component.
Path to expander *X*	Indicates whether or not a connection exists to one of the four expanders. Values are True, a connection exists, or False, no connection.
Physical ID	The physical ID associated with this FRU component.
Product Firmware Version	The version of the firmware loaded on the FRU component.

TABLE 5-43 System Controller Health Details Page - F5100 Array *(Continued)*

Field	Indicates
Product Name	The name associated with this FRU component.
Serial Number	The serial number for this component.
Status	Status of this FRU component. Valid values are: • OK • Uninstalled • Degraded • Disabled • Failed • Critical • Unknown
Temperature Sensor Enclosure Intake Failure	A temperature sensor in the enclosure. If the temperature at this location is not within acceptable limits, a failure error is reported.
Temperature Sensor Enclosure Intake Warning	A temperature sensor in the enclosure. If the temperature at this location is nearing unacceptable limits, a warning error is reported.
Temperature Sensor Enclosure Intake	The temperature, in Celsius, at this enclosure location.
Temperature Sensor Expander *X* Ambient Failure	A temperature sensor in the expander. If the temperature at this location is not within acceptable limits, a failure error is reported.
Temperature Sensor Expander *X* Ambient Warning	A temperature sensor in the expander. If the temperature at this location is nearing unacceptable limits, a warning error is reported.
Temperature Sensor Expander *X* Ambient	The temperature, in Celsius, at this expander location.
Temperature Sensor Expander *X* Junction Failure	A temperature sensor in the expander. If the temperature at this location is not within acceptable limits, a failure error is reported.
Temperature Sensor Expander *X* Junction Warning	A temperature sensor in the expander. If the temperature at this location is nearing unacceptable limits, a warning error is reported.
Temperature Sensor Expander *X* Junction	The temperature, in Celsius, at this expander location.

Page and Field Descriptions - B6000 Array Family

FRU component browser interface pages and fields applicable to Oracle's Sun Storage B6000 Array Family are described in the following subsections:

Disk Health Details Page - B6000 Array Family

The Disk Health Details page provides detailed information about the selected disk.

TABLE 5-44 describes the buttons and fields on the Disk Health Details page.

TABLE 5-44 Disk Health Details Page - B6000 Array Family

Field	Indicates
Availability	The availability of this disk drive. Valid values are: • Running Full Power • Degraded • Not Installed • Unknown
Capacity	The total capacity of this disk.
Drive Slot Disabled	Specifies whether the drive slot for the selected drive is disabled (False) or enabled (True) for use.
Element Status	The raw status of the disk drive, displayed as a text string.
Enabled State	State of this disk drive. Valid values are: • Enabled • Disabled • Removed • Other • Unknown
Host Path	The path where the disk drive is located.

TABLE 5-44 Disk Health Details Page - B6000 Array Family *(Continued)*

Field	Indicates
Host Providing Data	The host that is supplying the information for the array. If there are multiple hosts attached to the same array, only one of the hosts is used as the reporting host.
Id	The unique ID assigned to this disk drive.
Model	The model ID of this disk drive.
Name	The name assigned to this disk drive.
Physical ID	The physical ID assigned to this disk drive.
Product Firmware Version	The version of firmware running on this disk drive.
Product Name	Name of the disk drive manufacturer.
Ready to Remove	Whether or not this disk drive is ready to be removed from the chassis. Valid values are True or False.
SAS Address	The SAS address assigned to this disk.
Serial Number	The serial number associated with this disk.
Slot Number	The slot number in which this disk drive is installed.
Status	Status of this FRU component. Valid values are: • OK • Uninstalled • Degraded • Disabled • Failed • Critical • Unknown
Type	The type of disk drive, such as SAS or SATA.

NEM Health Details Page - B6000 Array Family

TABLE 5-45 describes the buttons and fields on the NEM Health Details page.

TABLE 5-45 NEM Health Details Page - B6000 Array Family

Field	Indicates
Availability	The availability of this component. Valid values are: • Running Full Power • Degraded • Not Installed • Unknown
Chassis Serial Number	The serial number of the chassis.
Enabled State	State of this FRU component. Valid values are: • Enabled • Removed • Other • Unknown
Host Providing Data	The host that is supplying the information for the array. If there are multiple hosts attached to the same array, only one of the hosts is used as the reporting host.
Id	The unique ID assigned to this component.
Name	Name assigned to the component.
Over Temperature Failure	A failure indicator to identify whether the temperature of the FRU has exceeded operating limits, resulting in a failure to operate.
Over Temperature Warning	A warning indicator to identify whether the temperature of the FRU may exceed operating limits.
Physical ID	The physical ID assigned to this FRU.
Product Firmware Version	The version of firmware running on this FRU.
Product Name	The name associated with this FRU component.
SCSI Product Revision	The SCSI product revision number for this FRU.
Serial Number	Serial number of the FRU. The serial number is assigned by the FRU manufacturer.

TABLE 5-45 NEM Health Details Page - B6000 Array Family *(Continued)*

Field	Indicates
Status	Status of this FRU component. Valid values are: • OK • Uninstalled • Degraded • Disabled • Failed • Critical • Unknown
Temperature Sensor Ambient Temp	The actual temperature (Celsius) of the sensor.
Temperature Sensor Ambient Temp Failure	One of two temperature sensors on the FRU. If the temperature at this location is not within acceptable limits, an alarm is reported.
Temperature Sensor Ambient Temp Warning	One of two temperature sensors on the FRU. If the temperature at this location is not within acceptable limits, an alarm is reported.
Temperature Sensor Exp Junction Temp	The actual temperature (Celsius) of the sensor.
Temperature Sensor Exp Junction Temp Failure	One of two temperature sensors on the FRU. If the temperature at this location is not within acceptable limits, an alarm is reported.
Temperature Sensor Exp Junction Temp Warning	One of two temperature sensors on the FRU. If the temperature at this location is not within acceptable limits, an alarm is reported.
Voltage Sensor 1.2V Voltage Sensor	The actual voltage of this 1.2 volt circuit. If the voltage is not within acceptable limits, an alarm is reported.
Voltage Sensor 12V Voltage Sensor	The actual voltage of this 12 volt circuit. If the voltage is not within acceptable limits, an alarm is reported.
Voltage Sensor 3.3V Voltage Sensor	The actual voltage of this 3.3 volt circuit. If the voltage is not within acceptable limits, an alarm is reported.
Voltage Sensor 5V Voltage Sensor	The actual voltage of this 5 volt circuit. If the voltage is not within acceptable limits, an alarm is reported.

Storage Module Health Details Page - B6000 Array Family

TABLE 5-46 describes the buttons and fields on the Storage Module Health Details page.

TABLE 5-46 Storage Module Health Details Page - B6000 Array Family

Field	Indicates
Availability	The availability of this storage module. Valid values are: • Running Full Power • Degraded • Not Installed • Unknown
Chassis Serial Number	The serial number of the chassis.
Enabled State	State of this FRU component. Valid values are: • Enabled • Removed • Other • Unknown
Expander *X* Chassis	The ID of this expander chassis; for example, 080020000675d00.
Expander *X* Host Path	The path the operating system uses to access this expander.
Expander *X* Host Providing Data	The host name that is providing the information for this expander.
Expander *X* Model	The ID of this expander chassis.
Expander *X* Name	The location of this expander.
Expander *X* Product Revision	Revision of the firmware on this expander.
Expander *X* SCSI Product Revision	The SCSI revision for this expander; for example, 502E.
Expander *X* Serial Number	The serial number assigned to this expander.
Expander *X* Status	The operating status of this expander. Valid values are OK or Failed.
Host Providing Data	The host that is supplying the information for the array. If there are multiple hosts attached to the same array, only one of the hosts is used as the reporting host.
Id	Unique ID assigned to this storage module.

TABLE 5-46 Storage Module Health Details Page - B6000 Array Family *(Continued)*

Field	Indicates
Name	The name assigned to this storage module.
Over Temperature Failure	A failure indicator to identify whether the temperature of the system controller has exceeded operating limits, resulting in a failure to operate.
Over Temperature Warning	A warning indicator to identify whether the temperature of the system controller may exceed operating limits.
Part Number	The part number assigned to this storage module.
Physical ID	The physical ID associated with this storage module.
Product Firmware Version	The version of the firmware loaded on the storage module.
Product Name	The model number of the array.
Serial number	Serial number assigned to the storage module.
Status	Status of this FRU component. Valid values are: • OK • Uninstalled • Degraded • Disabled • Failed • Critical • Unknown
Temp Sensor Ambient Temp Failure	One of two temperature sensors on the storage module. If the temperature at this location is not within acceptable limits, an alarm is reported.
Temperature Sensor Ambient Temp Warning	One of two temperature sensors on the system controller board. If the temperature at this location is not within acceptable limits, an alarm is reported.
Temperature Sensor Ambient Temp	The actual temperature (Celsius) of the sensor.
Temp Sensor Exp Junction Temp Failure	One of two temperature sensors on the storage module. If the temperature at this location is not within acceptable limits, an alarm is reported.
Temp Sensor Exp Junction Temp Warning	One of two temperature sensors on the storage module. If the temperature at this location is not within acceptable limits, an alarm is reported.
Temp Sensor Exp Junction Temp	The actual temperature (Celsius) of the sensor.
Voltage Sensor 1.2 V Voltage Sensor	The actual voltage of this 1.2 volt circuit. If the voltage is not within acceptable limits, an alarm is reported.

TABLE 5-46 Storage Module Health Details Page - B6000 Array Family *(Continued)*

Field	Indicates
Voltage Sensor 12 V Voltage Sensor	The actual voltage of this 12 volt circuit. If the voltage is not within acceptable limits, an alarm is reported.
Voltage Sensor 3.3V	The actual voltage of this 3.3 volt circuit. If the voltage is not within acceptable limits, an alarm is reported.
Voltage Sensor 5V In	The actual voltage of this 5 volt circuit. If the voltage is not within acceptable limits, an alarm is reported.

CHAPTER 6

Troubleshooting

This chapter describes troubleshooting arrays. It contains the following sections:

Collecting Application Support Data

This section describes collecting application support data. It contains the following topics:

About Application Support Data

When troubleshooting Sun Storage Common Array Manager problems with Service, you might be asked to collect support data and send to service for help in isolating a problem.

Sun Storage Common Array Manager collects application support data during installation and operation. The data collected includes logs, installation detail, and other data captured by the software.

If you want to collect support data for a specific storage device, use Service Advisor.

Collecting Application Support Data

To collect support data generated by Sun Storage Common Array Manager:

1. In the left navigation pane, go to General Configuration > Support Data.
2. Click Collect Data to start the data collection process.
3. Click View Latest Job Details to monitor the progress of the data collection process.
4. When the job completes, go to Support Data > Collection Application Support Data, and click Download Latest Data.
5. Click on the application support data file link, and save the file.

Page and Field Descriptions

Browser interface pages and fields related to the "Collecting Application Support Data" section are described below.

Collect Application Support Data Page

This page enables you to collect application support data generated by Sun Storage Common Array Manager. You send the generated data to Service for interpretation.

TABLE 6-1 describes the buttons and fields on the Collect Application Support Data page.

TABLE 6-1 Collect Application Support Data Page

Field	Description
Collect Data	Collects application support data which includes logs, installation data, and other related Sun Storage Common Array Manager data.
View Latest Job Details	View the progress of the collection process.
Download Latest Data	Provides a link for downloading the collected data.

Troubleshooting With the Software

This section describes troubleshooting arrays from the user interface:

Testing an Email Address

To verify that the monitoring and diagnostic software can successfully send email to a specific email address:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand General Configuration and choose Notification.

   The Notification Setup page is displayed.

3. Click Test Email.

   The Send Test Email window is displayed.

4. In the To field, specify the email address you want to test.

5. (Optional) Specify a test message in the Message field.

6. Click Send.

   If the message is successfully sent, the following message is displayed:

   ```
   The test email has been sent successfully.
   ```

7. Click Close to close the Send Test Email window.

8. Check email to verify that the test message was received.

Viewing Log Files

The array logs its events to the same log file maintained by the Web Console.

To view system messages:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array for which you want to view log files.
3. Expand Troubleshooting and choose Events.

Critical Alarm Generated After Upgrading J4200 Array

After upgrading a J4200 array to a later CAM version, a critical alarm is generated for each drive that is in an “Unknown" state with "Unassigned" status. This error indicates no host can access these disks. You will see a description similar to the following in the email notification:

```
The property Drive Zoned Out for Disk.00 on J4200_J04D_Top has changed
to True.
```

Workaround:

1. **Discover the host that has access to the disks.**
2. **Change access configuration so the host being monitored has access to the disks.**

About Sun Storage Common Array Manager Services

Sun Storage Common Array Manager has two services: the Oracle Java Web Console and Fault Management Service (FMS). The Web console is the management console on which the Sun Storage Common Array Manager web application is hosted.

Solaris OS and Linux Commands

TABLE 6-2 lists the Solaris OS and Linux commands for Sun Storage Common Array Manager services.

TABLE 6-2 Solaris OS and Linux Commands

OS / Task	Command	Notes
Solaris 10		
Web console	svc:/system/webconsole:console	svc: is a fault management resource identifier (FMRI). For more information about FMRI abbreviations, see the `svcs`(1) man page.
FMS	svn://system/fmservice:default `/opt/SUNWsefms/sbin/fmservice.sh` `smcwebserver`(1M)	
Solaris 9		
Web console	/etc/init.d/webconsole	
FMS	/etc/init.d/fmservice	The FMS and Web console processes are controlled by `init` scripts. See the `init.d`(4) man page for more information about `init` scripts.
Linux		
Web console	`/etc/init.d/webconsole`	

TABLE 6-2 Solaris OS and Linux Commands *(Continued)*

OS / Task	Command	Notes
	`smcwebserver`(1M)	
FMS	`/etc/init.d/fmservice`	
	`/opt/sun/cam/private/fms/sbin/fmservice.sh`	

Windows Commands

FMS and the Web console are controlled through the Windows Services control panel

Control Panel > Administrative Tools

or by typing `Services.msc` in the Run window from the Start menu.

TABLE 6-3 shows service information for each process. Note that the executable information is for reference purposes only.

TABLE 6-3 Windows Commands

Service	Description
FMS	
Display Name	StorageTek Fault Management Service
Service Name	Sun_STK_FMS
Executable	%ProgramFiles%\Sun\Common Array Manager\Component\fms\sbin\wrapper.exe" -s "%ProgramFiles%\Sun\Common Array Manager\Component\fms\sbin\..\System\wrapper.conf" "wrapper.java.command =%ProgramFiles%\Java\jdk1.5.0_11\bin\java.exe"
Web Console	
Display Name	console-3.0.2
Service Name	console-3.0.2
Executable	%SystemDrive%\Sun\WebConsole\bin\swc.exe

Starting and Stopping Sun Storage Common Array Manager Services

TABLE 6-4 lists commands for starting and stopping Sun Storage Common Array Manager services.

TABLE 6-4 Starting and Stopping Sun Storage Common Array Manager Services

OS / Task	Command
Solaris 10 and OpenSolaris	
Start FMS	`# svcadm enable fmservice`
Stop FMS	`# svcadm disable fmservice`
Check FMS status	`# svcs fmservice`
Start Web console	`# /usr/sbin/smcwebserver start`
Stop Web console	`# /usr/sbin/smcwebserver stop`
Check Web console status	`# /usr/sbin/smcwebserver status`
Solaris 9	
Start FMS	`# /etc/init.d/fmservice start`
Stop FMS	`# /etc/init.d/fmservice stop`
Linux	
Start FMS	`# /etc/init.d/fmservice start`
Stop FMS	`# /etc/init.d/fmservice stop`
Start Web console	`# /usr/sbin/smcwebserver start`
Stop Web console	`# /usr/sbin/smcwebserver stop`
Check Web console status	`# /usr/sbin/smcwebserver status`
Windows	
Start Web console	`%SystemDrive%\Sun\WebConsole\sbin cwebserver start`
Stop Web console	`%SystemDrive%\Sun\WebConsole\sbin cwebserver stop`
Check Web console status	`%SystemDrive%\Sun\WebConsole\sbin cwebserver status`

Hardware Troubleshooting Basics

This section describes array hardware troubleshooting basics:

Keeping Firmware and Patches Up To Date

Because components in the array are interdependent, you should upgrade all components to their current version whenever a patch or new version becomes available.

For the latest patches available for your system, go to My Oracle Support:

https://support.oracle.com/

The upgradable components are:

- Array firmware
- Controller image
- Disk image

During the upgrade procedure, check that each component has upgraded successfully.

If a component's upgrade procedure fails, repeat the procedure. If this second attempt also fails, you must back out the changes on the components that were successful so that the array operates properly. Then contact Service with a description of the component's failed upgrade process.

Note: Sun Storage Common Array Manager installation procedures are described in the *Sun Storage Common Array Manager Software Installation and Setup Guide*. Refer to current Release Notes for more information about patches.

Checking LEDs

Light-emitting diodes (LEDs) provide status information on each array tray and its components. Green lights indicate a normal operating status, and amber lights indicate a hardware fault. Always check the status lights on the front and back of each array tray whenever you turn on the power. During power-up, the lights blink intermittently as the array and components complete the power-up process.

Caution: Electrostatic discharge can damage sensitive components. Touching the command tray or its components without using a proper ground may damage the equipment. To avoid damage, use proper antistatic protection before handling any components.

Responding to an Array Boot-Up Failure

If the array does not boot after a shutdown, the failure could have several causes, both hardware and software. Check the messages reported on the console and in the event log to diagnose the problem.

Replacing Field-Replaceable Units

Field-replaceable units (FRUs) can be replaced by Sun field engineers or by Sun-trained customer administrators.

To see a list of the hardware components that can be replaced at the customer site:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the top right of the page, click Service Advisor.

   The Service Advisor page is displayed. The Service Advisor provides information and procedures for replacing storage network device components. Choose one of the types of FRUs or other options to see the procedures.

Test Types

TABLE 6-5 lists test types available for troubleshooting.

Note: In-band managed arrays are able to successfully run all out-of-band tests.

TABLE 6-5 Test Types

Test Name	Test Type
Array Communication Test	Out of Band
Controller Read Test	Out of Band
Controller Write Test	Out of Band
Internal Loopback Test	Out of Band
All Controller Tests	Out of Band
Remote Peer Communication Check	Out of Band

Troubleshooting RAID Arrays

Note: For the most up-to-date information about Known Issues, refer to the current Release Notes document.

This section describes troubleshooting procedures that apply to Oracle's Sun Storage and StorageTek 6000 series, StorageTek 2500 series, and FlexLine arrays only. It contains the following topics:

Running a Diagnostic Test on a Device

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array on which you want to run a diagnostic test and choose Troubleshooting.

   The Troubleshooting Test List page is displayed.

3. Select the diagnostic test you want to run and click Run Test.

   The Test Setup page is displayed for the selected diagnostic test.

   Note: When running diagnostics on a Sun Storage 6180, 6580, or 6780 array, Sun Storage 2530-M2 and 2540-M2 arrays, Sun StorEdge 6130 array, StorageTek 6140 or 6540 array, or StorageTek 2510, 2530, or 2540 array, both controllers must be installed and online.

4. Complete the diagnostic setup options and click Run.

   The Job Details - Diagnostics page displays while the test executes. The Test Results page is displayed. Results are added when the test is completed.

Note: Refer to the man pages for information about command line interface (CLI) diagnostic test options.

Array Diagnostics

The following diagnostic options are available:

- Controller Read Test

  The Read Test initiates a read command as it would be sent over an I/O data path. It compares data with a known, specific data pattern, checking for data integrity and redundancy errors. If the read command is unsuccessful or the data compared is not correct, the controller is considered to be in error and is failed.

- Controller Write Test

  A Write Test initiates a write command as it would be sent over an I/O data path (to the Diagnostics region on a specified drive). This Diagnostics region is then read and compared to a specific data pattern. If the write fails or the data compared is not correct, the controller is considered to be in error and is failed and placed offline.

- Internal Loopback Test

  The Internal Loopback Test passes data through each controller's drive-side channel, out onto the loop and then back again. Enough data is transferred to determine error conditions on the channel. If the test fails on any channel, then this status is saved so that it can be returned if all other tests pass.

- All Controller Tests

  All controller tests, including Controller Read Test, Controller Write Test, and the Internal Loopback Test, are run. See the description for each individual test for further information.

Resetting a Storage Array Configuration

Resetting a storage array configuration deletes the entire array configuration. In addition, it removes all data from the array and refreshes the settings to factory defaults. Reset the array configuration only to correct errors that cannot be corrected by any other method.

Resetting an array configuration produces the following results:

- Removes all volumes and virtual disks

- Clears the user-supplied array name
- Clears the array password
- Removes all data from the array

Note: Before you begin, be sure that all data on the storage array has been backed up to tape or another storage array.

To reset the array configuration:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, choose the array whose configuration you want to reset.

   The Administration page is displayed.

3. Click Reset Configuration.

   The Reset Configuration page displays.

4. Select Reset Storage Array Configuration and click OK to continue.

   Note: The array will not be available and will be in an error state until the reconfiguration process has been completed.

Resetting the Volume Configuration

Resetting the volume configuration for a storage array deletes all volumes and virtual disks for the array. Any related storage pools and storage profiles will also be deleted. Reset the volume configuration only to correct errors that cannot be corrected by any other method.

Note: Before you begin, be sure that all data on the storage array has been backed up to tape or another storage array.

To reset the volume configuration:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, choose the array whose volume configuration you want to reset.

   The Administration page is displayed.

3. Click Reset Configuration.

   The Reset Configuration page displays.

4. Select Reset Volume Configuration and click OK to continue.

   Note: The array will not be available and will be in an error state until the reconfiguration process has been completed.

Redistributing Volumes

When volumes are created, they are assigned a preferred owner controller. The owner controller of the volume sometimes shifts from the preferred controller when the controller is being replaced or is undergoing a firmware download. In addition, multipath drivers move volumes from their preferred controller owner when a problem occurs along the data path between the host and the storage array. When you redistribute the volumes, you cause the volumes to move back to their preferred controller owners.

Note: Redistributing the volumes while an application is using the affected volumes causes I/O errors unless a multipath driver is installed on the data host. Therefore, before you redistribute volumes, verify either that the volumes are not in use or that there is a multipath driver installed on all hosts using the affected volumes.

To redistribute volumes:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, choose the array on which you want to redistribute the volumes.

   The Administration page is displayed.

3. Click Redistribute Volumes.

   The Redistribute Volumes confirmation dialog box is displayed.

4. Click OK.

Resetting a Controller

The ability to reset the controller is a recovery option available in the event of serious controller errors. Resetting a controller makes it unavailable for I/O until the reset has been completed. If a host is using volumes owned by the controller being reset, the I/O directed to the controller will be rejected. Before resetting the controller, either verify that the volumes owned by the controller are not in use or ensure that there is a multipath driver installed on all hosts using these volumes.

To reset a controller:

1. Click Sun Storage Common Array Manager.

   The navigation pane and the Storage System Summary page are displayed.

2. In the navigation pane, expand the array whose controller you want to reset.
3. Expand Physical Devices and choose Controllers.

   The Controller Summary page is displayed.

4. Click Reset Controller for the controller you want to reset.

   A confirmation dialog box is displayed.

5. Click OK.

Reviving Virtual Disks and Disk Drives

Caution: Contact My Oracle Support (https://support.oracle.com) before you attempt a revive procedure. This is a volatile operation and should be performed under the direct supervision of a Support representative.

The Sun Storage Common Array Manager software enables you to more closely manage the states of the virtual disks and physical disk drives and recover from failures.

If one or more disk drives in a virtual disk are in the Failed state, you can recover from this failure by reviving the virtual disk. Reviving a virtual disk automatically revives the failed disk drives included in the virtual disk, assuming that the disk drives are still usable.

You should manually revive an individual disk drive only if reviving the virtual disk fails to revive any failed disk drives in the virtual disk. Because reviving a failed drive while IO operations continue on the volumes associated with the virtual disk can cause data validation errors, contact Support Services (https://support.oracle.com) for help in performing this operation.

From the Virtual Disk Details page, you can:

- Revive a virtual disk

  If one or more disk drives in a virtual disk are in the failed state, you can recover from this failure by reviving the virtual disk. Reviving a virtual disk automatically revives the failed disk drives included in the virtual disk.

  Note: Arrays using firmware version 7.x do not have the Revive option.

- Place a virtual disk offline

  Placing a virtual disk offline disables the virtual disk.

  Note: Arrays using firmware version 7.x do not have the Offline option.

- Place a virtual disk online

  Placing a virtual disk online enables the virtual disk.

From the Disk Details page you can:

- Revive the disk drive

  If reviving a virtual disk fails to revive an individual disk drive, you can manually revive that disk drive.

- Reconstruct the disk drive

  You can reconstruct a disk drive only when it meets the following criteria:

  - The disk drive is assigned to a RAID-1, -3, or -5 virtual disk.
  - The disk drive has a Failed or Replaced status and was not automatically revive during a virtual disk revive operation.

- Fail the disk drive

  Failing the disk drive disables the drive.

Page and Field Descriptions

Browser interface pages and fields related to the "Troubleshooting RAID Arrays" section are described in the following subsections:

Job Details - Diagnostic Page

This page displays detailed information about a specific monitoring job, including both current and historical jobs.

TABLE 6-6 describes the buttons and fields on the Job Details - Diagnostics and Support Data Task page.

TABLE 6-6 Job Details - Diagnostics and Support Data Task Page

Field	Description
Host	The host on which the job process was run.
Start Date	The date and time when the job started.
End Date	The date and time when the job was completed.
Status	The current status of the job.
Target	The ID of the target on which the diagnostics were run.
Support Data Task	
Property	Lists the host name, cancel status, start time, last update, status of the collection process, and target device.
Value	The value for each of the listed properties.

Test Setup Page

This page enables you to define setup parameters for the diagnostic test that you selected and to initiate the test.

TABLE 6-7 describes the buttons and fields on the Test Setup page.

TABLE 6-7 Test Setup Page

Field	Description
Context	
Test Name	Name of the diagnostic test to be run.
Monitoring Agent	The name of the server where the monitoring agent is located.
Test Parameters	
Target Controller	The controller to be tested.
Loopback Pattern	Available only for the following tests: Internal Loopback and All Controller Tests. The data pattern to be transmitted during the loopback test.
Channel	Available only for the following tests: Internal Loopback and All Controller Tests. The controller channel to be used during the loopback test.
Password	Password to access the array.
Send Results to Email	Email address to which to send test output, if desired.

Note: The specific parameters displayed on this page are determined by the type of device and type of diagnostic test selected.

Troubleshooting Test List Page

This page enables you to select and run a diagnostic test.

TABLE 6-8 describes the buttons and fields on the Troubleshooting Test List page.

TABLE 6-8 Troubleshooting Test List Page

Field	Description
Run Test	Click to initiate the selected diagnostic test.

TABLE 6-8 Troubleshooting Test List Page

Field	Description
Test Name	The names of the troubleshooting tests that can be run. Options include: • Array Communication Test Tests the management path communication link between the management host and the array. • Controller Read Test The Read Test initiates a read command as it would be sent over an I/O data path. It compares data with a known, specific data pattern, checking for data integrity and redundancy errors. If the read command is unsuccessful or the data compared is not correct, the controller is considered to be in error and is failed. • Controller Write Test A Write Test initiates a write command as it would be sent over an I/O data path (to the Diagnostics region on a specified drive). This Diagnostics region is then read and compared to a specific data pattern. If the write fails or the data compared is not correct, the controller is considered to be in error and is failed and placed offline. • Internal Loopback Test The Internal Loopback Test passes data through each controller's drive-side channel, out onto the loop and then back again. Enough data is transferred to determine error conditions on the channel. If the test fails on any channel, then this status is saved so that it can be returned if all other tests pass. • Remote Peer Communication Check Tests the communication link between two arrays participating in a remote replication relationship. This diagnostic is only available if a remote replication relationship has been established. • All Controller Tests Runs the Controller Read Test, Controller Write Test, and Internal Loopback Test, consecutively.
Test Type	The type of test to run: Out-of-band or In-Band.

Glossary

Definitions obtained from the Storage Networking Industry Association (SNIA) Dictionary are indicated with "(SNIA)" at the end. For the complete SNIA Dictionary, go to www.snia.org/education/dictionary.

agent The component of the system monitoring and diagnostic software that collects health and asset information about the array.

alarm A type of event that requires service action. See also event.

alert A subtype of an event that requires user intervention. The term *actionable event* often describes an alert. See also event.

array Multiple disk drives that function as a single storage device. A high-availability (HA) array configuration has multiple controller and expansion trays of disk drives.

array hot spare A disk that serves as a hot-spare within an array as part of a storage pool; a reserve disk that can be made available to all virtual disks within an array. See also hot-spare.

block The amount of data sent or received by the host per I/O operation; the size of a data unit.

capacity The amount of storage you must allocate to storage elements, including volumes, pools, and virtual disks. Capacity planning should include allocations for volume snapshots and volume copies.

CLI Command-line interface. The SSCS command-line interface is available from the remote CLI client or through an SSCS directory on the Solaris Operating System management software station.

controller tray A tray with an installed redundant RAID controller pair.

control path The route used for communication of system management information, usually an out-of-band connection.

customer LAN See site LAN.

DAS See direct attached storage (DAS).

data host Any host that uses the system for storage. A data host can be connected directly to the array (direct attach storage, or DAS) or can be connected to an external switch that supports multiple data hosts (storage area network, or SAN). See also host.

data path The route taken by a data packet between a data host and the storage device.

direct attached storage (DAS) A storage architecture in which one or two hosts that access data are connected physically to a storage array.

disk A physical drive component that stores data.

event A notification of something that happened on a device. There are many types of events, and each type describes a separate occurrence. See also alarm and alert.

expansion tray A tray that does not have a RAID controller, used to expand the capacity of an array. This type of tray must be attached to a controller tray to function.

extent A set of contiguous blocks with consecutive logical addresses on a physical or virtual disk.

failover and recovery The process of changing the data path automatically to an alternate path.

fault coverage The percentage of faults detected against all possible faults or against all faults of a given type.

FC See Fibre Channel (FC).

Fibre Channel (FC) A set of standards for a serial I/O bus capable of transferring data between two ports at up to 100 megabytes/second, with standards proposals to go to higher speeds. Fibre Channel supports point to point, arbitrated loop, and switched topologies. Fibre Channel was completely developed through industry cooperation, unlike SCSI, which was developed by a vendor and submitted for standardization after the fact. (SNIA)

Fibre Channel switch A networking device that can send packets directly to a port associated with a given network address in a Fibre Channel storage area network (SAN). Fibre Channel switches are used to expand the number of servers that can connect to a particular storage port. Each switch is managed by its own management software.

field-replaceable unit (FRU) An assembly component that is designed to be replaced on site, without the system having to be returned to the manufacturer for repair.

FRU See field-replaceable unit (FRU).

HBA See host bus adapter (HBA).

host As a function of the storage configuration, a representation of a data host that is mapped to initiators and volumes to create a storage domain. See also data host, initiator.

host bus adapter (HBA) An I/O adapter that connects a host I/O bus to a computer's memory system. (SNIA) See also initiator.

host group A group of hosts with common storage characteristics that can be mapped to volumes. See also host.

hot-spare The drive used by a controller to replace a failed disk. See also array hot spare.

in-band traffic System management traffic that uses the data path between a host and a storage device. See also out-of-band traffic.

initiator A system component that initiates an I/O operation over a Fibre Channel (FC) network. If allowed by FC fabric zoning rules, each host connection within the FC network has the ability to initiate transactions with the storage array. Each host in the FC network represents a separate initiator, so if a host is connected to the system through two host bus adapters (HBAs), the system identifies two different initiators (similar to multi-homed, Ethernet-based hosts). In contrast, when multipathing is used in round-robin mode, multiple HBAs are grouped together, and the multipathing software identifies the group of HBAs as a single initiator.

IOPS A measure of transaction speed, representing the number of input and output transactions per second.

LAN Local area network.

logical unit number (LUN) The SCSI identifier for a volume as it is recognized by a particular host. The same volume can be represented by a different LUN to a different host.

LUN See logical unit number (LUN).

MAC Address See media access control (MAC) address.

management host A host serving the configuration, management, and monitoring software for a storage array. The software on the station can be accessed with a browser interface or with a remote scripting command-line interface (CLI) client.

media access control (MAC) address The physical address identifying an Ethernet controller board. The MAC address, also called an Ethernet address, is set at the factory and must be mapped to the IP address of the device.

mirroring A form of storage – also called RAID Level 1, independent copy, and real-time copy – whereby two or more independent, identical copies of data are maintained on separate media. Typical mirroring technologies enable the cloning of data sets to provide redundancy for a storage system.

multipathing A design for redundancy that provides at least two physical paths to a target.

out-of-band traffic System management traffic outside of the primary data path that uses an Ethernet network. See also in-band traffic.

pool See storage pool.

profile See storage profile.

provisioning The process of allocation and assignment of storage to hosts.

RAID An acronym for Redundant Array of Independent Disks, a family of techniques for managing multiple disks to deliver desirable cost, data availability, and performance characteristics to host environments. (SNIA)

remote scripting CLI client A command-line interface (CLI) that enables you to manage the system from a remote management host. The client communicates with the management software through a secure out-of-band interface, HTTPS, and provides the same control and monitoring capability as the browser interface. The client must be installed on a host that has network access to the system.

SAN See storage area network (SAN).

site LAN The local area network at your site. When the system is connected to your LAN, the system can be managed through a browser from any host on the LAN.

snapshot A copy of a volume's data at a specific point in time.

SSCS Sun Storage Command System, the command-line interface (CLI) that can be used to manage the array.

storage area network (SAN) An architecture in which the storage elements are connected to each other and to a server that is the access point for all systems that use the SAN to store data.

storage domain A secure container that holds a subset of the system's total storage resources. Multiple storage domains can be created to securely partition the system's total set of storage resources. This enables you to organize multiple departments or applications into a single storage management infrastructure.

storage pool A container that groups physical disk capacity (abstracted as virtual disks in the browser interface) into a logical pool of available storage capacity. A storage pool's characteristics are defined by a storage profile. You can create

multiple storage pools to segregate storage capacity for use in various types of applications (for example, high throughput and online transaction-processing applications).

storage profile A defined set of storage performance characteristics such as RAID level, segment size, dedicated hot-spare, and virtualization strategy. You can choose a predefined profile suitable for the application that is using the storage, or you can create a custom profile.

storage tray An enclosure containing disks. A tray with dual RAID controllers is called a controller tray; a tray without a controller is called an expansion tray.

stripe size The number of blocks in a stripe. A striped array's stripe size is the stripe depth multiplied by the number of member extents. A parity RAID array's stripe size is the stripe depth multiplied by one less than the number of member extents. (SNIA) See also striping.

striping Short for data striping; also known as RAID Level 0 or RAID 0. A mapping technique in which fixed-size consecutive ranges of virtual disk data addresses are mapped to successive array members in a cyclic pattern. (SNIA).

target The system component that receives a SCSI I/O command. (SNIA)

thin-scripting client See remote scripting CLI client.

tray See storage tray.

virtual disk A set of disk blocks presented to an operating environment as a range of consecutively numbered logical blocks with disk-like storage and I/O semantics. The virtual disk is the disk array object that most closely resembles a physical disk from the operating environment's viewpoint. (SNIA)

volume A logically contiguous range of storage blocks allocated from a single pool and presented by a disk array as a logical unit number (LUN). A volume can span the physical devices that constitute the array, or it can be wholly contained within a single physical disk, depending on its virtualization strategy, size, and the internal array configuration. The array controller makes these details transparent to applications running on the attached server system.

volume snapshot See snapshot.

WWN World Wide Name. A unique 64-bit number assigned by a recognized naming authority such as the Institute of Electrical and Electronics Engineers (IEEE) that identifies a connection (device) or a set of connections to the network. The World Wide Name (WWN) is constructed from the number that identifies the naming authority, the number that identifies the manufacturer, and a unique number for the specific connection.

Index

D

E

M

N

O

P

R

S

T

U

V

W

Z