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About this guide

This guide provides information about using the Storage Management Utility (SMU) to configure and manage storage associated with an array controller that supports iSCSI networking.

Intended audience

This guide is intended for network administrators and storage managers with moderate or advanced knowledge of IP and storage networks.

Prerequisites

- Determine who will install and configure your system.
  A moderate level of knowledge about storage systems, Storage Area Networks (SANs), and IP networks is required to install and manage this storage system.
  If you are not familiar with installing and configuring storage systems or IP networks, HP can install and configure your system. For more information, see “HP installation and configuration assistance” on page 11.
- Record system information on provided checklists in the installation guide or installation overview poster.
- Become familiar with and periodically review the content on the product website.
  - Click Technical Documentation to locate and read the latest documentation, including the quickspecs and the compatibility guide, which discuss important reference information and specifications.
  - Click Software, Firmware & Drivers to learn about recent firmware enhancements and support options.

Related documentation

The following documents describe the MSA1510i:
- HP StorageWorks 1510i Modular Smart Array release notes
- HP StorageWorks 1510i Modular Smart Array installation and configuration roadmap poster
- HP StorageWorks 1510i Modular Smart Array iSCSI concepts and deployment guide
- HP StorageWorks 1510i compatibility guide
- HP StorageWorks 1510i Modular Smart Array installation and user guide
- HP StorageWorks 1510i Modular Smart Array maintenance and service guide
- HP StorageWorks 1510i Modular Smart Array Command Line Interface user guide
- HP StorageWorks Storage Management Utility user guide

These documents are provided on the MSA1510i Support CD v2.0, available on the MSA1510i Support page: http://www.hp.com/support.

In addition to MSA1510i-specific documents, the following guide, available on the SAN Infrastructure website: http://www.hp.com/go/san, includes detailed, helpful information about Fibre Channel and iSCSI networks:
- HP SAN Design reference guide

The following documents and websites provide related information:

HP product information can be found on the HP Documentation website: http://www.docs.hp.com.
MSA product information can be found on the HP Storage website: http://www.hp.com/storage.
Additional related technical information includes:

- Internet Small Computer Systems Interface (iSCSI) rfc 3720: http://www.ietf.org/rfc/rfc3720.txt
- iSCSI Naming and Discovery: https://datatracker.ietf.org/public/pidtracker.cgi
- 802.1Q for Virtual LANs: http://www.ieee802.org/1/pages/802.1Q.html

### Document conventions and symbols

<table>
<thead>
<tr>
<th>Convention</th>
<th>Element</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue text: Table 1</td>
<td>Cross-reference links and e-mail addresses</td>
</tr>
<tr>
<td>Blue, underlined text: <a href="http://www.hp.com">http://www.hp.com</a></td>
<td>Web site addresses</td>
</tr>
<tr>
<td><strong>Bold text</strong></td>
<td>• Keys that are pressed</td>
</tr>
<tr>
<td></td>
<td>• Text typed into a GUI element, such as a box</td>
</tr>
<tr>
<td></td>
<td>• GUI elements that are clicked or selected, such as menu and list items, buttons, tabs, and check boxes</td>
</tr>
<tr>
<td><strong>Italic text</strong></td>
<td>Text emphasis</td>
</tr>
<tr>
<td><strong>Monospace text</strong></td>
<td>• File and directory names</td>
</tr>
<tr>
<td></td>
<td>• System output</td>
</tr>
<tr>
<td></td>
<td>• Code</td>
</tr>
<tr>
<td></td>
<td>• Commands, their arguments, and argument values</td>
</tr>
<tr>
<td><strong>Monospace, italic text</strong></td>
<td>• Code variables</td>
</tr>
<tr>
<td></td>
<td>• Command variables</td>
</tr>
<tr>
<td><strong>Monospace, bold text</strong></td>
<td>Emphasized monospace text</td>
</tr>
</tbody>
</table>

⚠️ **WARNING!**

Indicates that failure to follow directions could result in bodily harm or death.

⚠️ **CAUTION:**

Indicates that failure to follow directions could result in damage to equipment or data.

⚠️ **IMPORTANT:**

Provides clarifying information or specific instructions.

⚠️ **NOTE:**

Provides additional information.

⚠️ **TIP:**

Provides helpful hints and shortcuts.
HP installation and configuration assistance

Storage management and networking knowledge is required to successfully install this product. If you are not familiar with installing and configuring storage array systems, HP can install your system for you. For more information, access our website: http://www.hp.com/go/services. Under the Services Portfolio banner, select Infrastructure Services > Network Storage Services.

Depending on your needs, different levels of assistance are available, such as storage deployment:

- Physical installation
- Virtual disk design and configuration
- Service planning
- Service deployment
- Installation Verification Testing (IVT)
- Customer orientation

HP technical support

Telephone numbers for worldwide technical support are listed on the HP support website: http://www.hp.com/support/.

Collect the following information before calling:

- Technical support registration number (if applicable)
- Product serial numbers
- Product model names and numbers
- Error messages
- Operating system type and revision level
- Detailed questions

For continuous quality improvement, calls may be recorded or monitored.

Subscription service

HP recommends that you register your product at the Subscriber’s Choice for Business website: http://www.hp.com/go/e-updates.

After registering, you will receive e-mail notification of product enhancements, new driver versions, firmware updates, and other product resources.

HP websites

For additional information, see the following HP websites:

- http://www.hp.com
- http://www.hp.com/go/storage
- http://www.hp.com/service_locator
- http://www.hp.com/support/manuals
- http://www.hp.com/support/downloads

Documentation feedback

HP welcomes your feedback.

To make comments and suggestions about product documentation, please send a message to storagedocs.feedback@hp.com. All submissions become the property of HP.
1 Overview

In this section:
• Features and requirements
• Initial configuration methods
• Accessing the SMU
• Changing the management port IP address through the MSA1510i controller display panel
• Best practices

Features and requirements

The Storage Management Utility (SMU):
• Configures and manages system storage.
• Resides on the array controller as part of the array controller firmware.
• Is accessed from a remote server or workstation using a browser.
• Is username and password protected.
• Can be used online while the system is operating.
• Includes an initial configuration wizard, for fast-and-easy configuration in simple environments.
• Includes a main user interface, for more flexible and complete initial configuration and subsequent management tasks.
• Provides configuration suggestions.
• Enables online array capacity expansion, logical drive capacity extension, assignment of spare drives, and RAID or stripe size migration.
• Minimum display settings: 1024 x 768 pixels resolution and 256 colors.
• Supported browser versions: Internet Explorer 6.0 or later.

NOTE:
This document assumes that all network devices are already physically installed and that all required software components are already installed on the servers. See your product installation documents for instructions.
As shown in Figure 1, the interface includes five tabs, each of which is documented in detail in a separate section in this guide.

**Figure 1 SMU display — showing the five tabs**

- **View** — For viewing detailed configuration and status information. (For more information, see “View” on page 19.)
- **Configure** — For initially configuring a system, entering new information, or changing existing settings. (For more information, see “Configure” on page 25.)
- **Wizards** — For initially configuring a simple system. (For more information, see “Wizards” on page 69.)
- **Diagnose** — For generating an XML-formatted diagnostic report. (For more information, see “Diagnose” on page 77.)
- **Update** — For updating MSA controller and module firmware. (For more information see “Update” on page 79.)

**Initial configuration methods**

The SMU provides two methods to initially configure your system:

- The **Wizard tab** — includes the Initial System Configuration Wizard, which is the easiest and simplest method for initially configuring the storage system. You are prompted in a logical sequence for storage, iSCSI, logon, and management settings. The wizard then uses those settings to configure the storage and make it available to the initiator. This configuration method is best for single-server environments needing bulk storage, because one target is created, and is assigned to one initiator. For information about using the wizard, see “Wizards” on page 69.
- The **Configure tab** — offers more flexibility than the wizard when configuring the storage. This configuration method is best for multi-server environments that need to customize the creation of storage LUNs and targets. For information about using the Configure tab, see “Configure” on page 25.
Accessing the SMU

1. Install, connect, and apply power to the storage and other network devices, as detailed in your system user documentation.

2. Obtain and record the IP address assigned to the primary management port (MA0). (Worksheets may be provided with your system installation instructions.)

   To determine the IP address, press the arrow buttons on the front of the array controller and scroll through the messages until the following message is displayed on the controller LCD panel:

   603 Port MA0 IP <address>

   **NOTE:**
   - If the IP address message is not displayed on the LCD panel, an IP address was not assigned to the management port. Check the cable connections, view the module LEDs, and read the system installation, maintenance and service, or other user documents for troubleshooting information.
   - If necessary, you can change the management IP address through the controller LCD panel management menu. For more information, see “Changing the management port IP address through the MSA1510i controller display panel” on page 16.

3. From a server or workstation with access to the storage device, open your Web browser and enter the address obtained in Step 2.

   For example: http://10.10.1.254

   **NOTE:**
   For additional security (at a reduced performance level), access the SMU using the secure mode. For example: https://10.10.1.254

4. Enter the username and password. Default settings are:
   - Username: root
   - Password: root
5. Wait a few moments for the utility to load.

**NOTE:**

When accessing the SMU for the first time, a window is displayed requiring input of a user-defined username and password.

6. One of the following happens:
   - If key components of the system are unconfigured, a prompt to go to the Wizard tab is displayed. (For more information, see “Wizards” on page 69.)
   - If the system is partially configured, the Configure tab is displayed. (For more information, see “Configure” on page 25.)
   - If the system is configured, the View tab is displayed. (For more information, see “Diagnose” on page 77.)

### Changing the management port IP address through the MSA1510i controller display panel

When the MSA1510i is initially installed and powered on, an IP address is automatically assigned to the primary management port (usually MA0). Depending on your network configuration, this default IP address may not be accessible by the network servers.

To change the IP address of the MSA1510i management port to be in the same LAN segment as the network servers, do the following:

1. Access the controller LCD panel management menu. Press the right (>) navigation button on the front of the active controller (usually the front-right controller.) Network Settings should be displayed and blinking.

   LCD panel navigation buttons work as follows:

<table>
<thead>
<tr>
<th>Navigation button</th>
<th>In the menu</th>
<th>Within a menu option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right (&gt;), Up/Down (^/v)</td>
<td>Select a blinking menu option.</td>
<td>When changing IP address settings, move to the next digit.</td>
</tr>
<tr>
<td>Left (&lt;)</td>
<td>Not applicable.</td>
<td>Accept the displayed setting and return to the initial management menu display.</td>
</tr>
</tbody>
</table>
2. Disable DHCP.
   a. With Network Settings displayed and blinking, press > to select it.
   b. Press ^ or v until DHCP Enabled is displayed and blinking, and then press > to select it.
   c. Press ^ or v to change the setting to No.
   d. Press < to accept the new setting and return to the initial management menu display.
3. Change the IP address.
   a. With Network Settings displayed and blinking, press > to select it.
   b. Press ^ or v until IP Address is displayed and blinking, and then press > to select it.
   c. Press ^ or v to scroll through and select the value for each digit of the IP address.
   d. After entering all digits of the new IP address, press < to accept the new setting and return to the initial management menu display.
4. Verify and, if necessary, change the Subnet Mask, Default Gateway, Primary DNS, Secondary DNS, and VLAN ID using procedures similar to those outlined in step 3, but pressing ^ or v to navigate to the desired menu option.
5. After all changes are entered, exit the management menu.
   Press v until Exit is displayed and blinking, and then press >.
   The LCD panel returns to the display mode.
6. Verify that the IP address was entered correctly by pressing ^ or v until the Port #MA0 IP message is displayed.
7. Verify that the server can locate the MSA1510i by opening a command prompt window and using the ping command.

Best practices

- Go to the HP storage website: [http://www.hp.com/storage](http://www.hp.com/storage) for your array controller. Product websites are updated to include the latest:
  - Hardware, firmware, and driver compatibility information.
  - Firmware and/or software.
  - System documentation.
- Use provided installation documents to gather items required for your installation, learn about the installation process, and physically install devices.
- Record information about your system in provided checklists and worksheets. This information is needed when configuring the storage, entering connection information, and setting up multipathing; and for future configuration changes, reference, and troubleshooting purposes.
- Sign up with Subscriber’s Choice to receive e-mail notifications and alerts about your HP devices: [http://www.hp.com/go/e-updates](http://www.hp.com/go/e-updates).
- Separate management traffic from iSCSI storage traffic. Provide separate physical LANs or create Virtual LANs (VLANs) to segment the traffic.
- Ensure that initiators and targets are on the same Layer 2 Ethernet LAN. This guarantees the integrity of the data traffic and maintains high network performance levels.
- Ensure the availability of the storage:
  - Provide redundant power sources—Plug the two power supplies on the device into separate Uninterruptible Power Supplies (UPS) on separate sources of power. If you have only one UPS, maintain separate power paths by plugging one power supply to the UPS on one power source and plug the other power supply to a separate power source.
  - Provide redundant data paths—Include two separate and isolated iSCSI storage networks and the associated hardware (switches, MSA controllers, etc.) and software components.
• MPIO multipathing software, etc.) in the configuration. Configure targets using portals on each controller.

• Create fault-tolerant logical storage units—Create LUNs using fault-tolerant RAID levels and striping methods.

• When assigning system names and aliases, use only the following characters:
  • Uppercase alpha characters (A-Z)
  • Lowercase alpha characters (a-z)
  • Numeric characters (0-9)
  • Special characters (! # = ( ) ’ ; , . and space)

• When accessing the SMU, expand the browser to full screen or a minimum size of 1024 x 768 pixels. Other settings may distort the display or cause items to not display.

• When planning and configuring logical drives:
  • Optimize performance and redundancy by striping the drives in the array across separate storage enclosures on different SCSI buses, especially in mirrored environments using RAID 1+0.
  • Set the drive rebuild priority to high to minimize exposure during a drive failure.
  • Customize the RAID level and striping method to the type of data that will be stored on the logical drive.

**NOTE:**

Depending on the number of physical hard drives included in a storage unit, the SMU may suggest RAID 6 (ADG) as the default RAID level, which offers a high level of fault tolerance and usable disk capacity, but at a significant cost to I/O performance. For comparable fault tolerance but higher performance, consider using RAID 1+0 when fault tolerance is desired and performance is more important than usable capacity. Reserve RAID 6 (ADG) for situations when fault tolerance is desired, but usable capacity is more important than performance.

• After configuring the storage, remember to:
  • Verify that each initiator has been granted access to the target.
  • Control access to the storage through the use of VLANs, CHAP authentication, and ACLs.

• Draw physical and logical diagrams of your network:
  • Hardware/device diagram—Physical layout of the entire network, including device names and cabling.
  • Storage diagram—Hard drive and storage system configuration, including RAID levels.
  • Path/Accessibility diagram—Access information, including which devices are allowed to communicate with each other.
2 View

The Storage Management Utility (SMU) View tab is used to view system information.

Included in this section:

• Page description
• Available tasks

Page description

As shown in Figure 2, the page is divided into 2 main sections:

• System component list—Left side of page
• Task list (and display area)—Right side of page

![Figure 2 View tab—showing the component and task lists](image)

Tabs

Also shown in Figure 2 are the five tabs of the SMU:

• View—For viewing detailed configuration and status information. (For more information, see “View” on page 19.)
• Configure—For initially configuring a system, entering new information, or changing existing settings. (For more information, see “Configure” on page 25.)
• Wizards—For initially configuring a simple system. (For more information, see “Wizards” on page 69.)
• Diagnose—For generating an XML-formatted diagnostic report. (For more information, see “Diagnose” on page 77.)
• Update—For updating MSA controller and module firmware. (For more information see “Update” on page 79.)

Views

As shown in Figure 3, expand the View drop-down box to select a viewing option. Your selection determines which system components are included in the component list:

• All Devices—Displays all system components (Figure 2).
• Devices with Alerts—Displays components for which any type of alert has been generated.
• Devices with Info Alerts—Displays components for which an informational alert has been generated.

![Figure 3 View tab—View drop-down box](image)

**NOTE:**

• In any view, click + or - to expand or contract the items in the system component list.
• As needed, click the scroll bar on the right-side of the page to move through the displayed information.

Available tasks

As shown in Figure 4, the View tab displays detailed system and status information for the selected component.
The following tasks are available in the View tab:

- Viewing status alerts (View All Status Alerts)
- Viewing the event log (View Event Log)
- Refreshing the display (Refresh System)
- Identifying devices (Identify Device)

**Viewing status alerts (View All Status Alerts)**

Figure 5 illustrates some informational status alerts, generated when creating a logical drive.
Figure 5 View tab—View All Status Alerts page

Viewing the event log (View Event Log)

Figure 6 shows an example of a system event log.

Figure 6 View tab—View Event Log page

Refreshing the display (Refresh System)

To refresh the SMU display, select **Refresh System**. The utility scans the configuration, and after a few moments, updates the display.
Identifying devices (Identify Device)

To locate a system component by lighting up its LEDs, select the item from the component list, and then select *Identify Device*.

For example, if this task is selected for a logical drive, the LEDs on the physical hard drives included in that logical drive are illuminated.
3 Configure

The Storage Management Utility (SMU) Configure tab allows for complete system configuration and management. You can configure a new system, configure newly added components to an already-configured system, and make changes to an already-configured system.

Included in this section:
• Page description
• Available tasks
• Sample configuration used in this document
• Fundamental tasks, in initial configuration sequence
• Security tasks
• Additional management and configuration tasks

Page description

As shown in Figure 7, the Configure tab is divided into 2 main sections:
• System component list—Left side of page
• Task list (and input area)—Right side of page

![Figure 7 Configure tab—showing the component list and task list](image)

Tabs

Also shown in Figure 7 are the five SMU tabs:
• View—for viewing detailed configuration and status information. (For more information, see “View” on page 19”).
Configure—For initially configuring a system, entering new information, or changing existing settings. (For more information, see “Configure” on page 25.)

Wizards—For initially configuring a simple system. (For more information, see “Wizards” on page 69.)

Diagnose—For generating an XML-formatted diagnostic report. (For more information, see “Diagnose” on page 77.)

Update—For updating MSA controller and module firmware. (For more information see “Update” on page 79.)

Views

As shown in Figure 8, expand the View as drop-down box to select a viewing option. Your selection determines which system components are shown, as well as their associated tasks:

- Storage with iSCSI view—Displays all system components and their available tasks (Figure 8).
- Storage view—Displays storage-related items only; no targets or initiators are shown.
- iSCSI view—Displays iSCSI-related items only; no arrays, logical drives, or hard drives are shown.

**Figure 8 View as drop-down box**

Also shown in Figure 8, click Show Physical View/Show Logical View to control the display of the configured storage.

**NOTE:**

The Show Physical View/Show Logical View toggle affects the view only when storage components are shown.

- Physical view—Displays a physical representation of the hard drives and configured storage.
- Logical view—Displays a logical representation of the hard drives and configured storage.

**NOTE:**

In any view, click + or - to expand or contract the items in the system component list.
Available tasks

**Figure 9 Configure tab—task listing**

To perform a task in the SMU:

1. Select a system component from the list on the left side of the page.
2. Select a task from the list on the right side of the page.
3. Enter the requested information.

**NOTE:**

After selecting a component from the system list, a unique task list for that component is displayed. **Table 2** lists the possible tasks for each system component.

**NOTE:**

More Information, Identify Device, Refresh System, and View All System Alerts are common tasks and not repeated in **Table 2**.
<table>
<thead>
<tr>
<th>System component</th>
<th>Available tasks</th>
<th>Where documented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create Array</td>
<td>Creating arrays, page 39</td>
<td></td>
</tr>
<tr>
<td>Create iSCSI Target</td>
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<td></td>
</tr>
<tr>
<td>Add iSCSI Initiator</td>
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<td></td>
</tr>
<tr>
<td>Array Accelerator Settings</td>
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</tr>
<tr>
<td>Storage System Settings</td>
<td>Changing global settings (Storage System Settings), page 61</td>
<td></td>
</tr>
<tr>
<td>Reset System</td>
<td>Resetting the system (Reset System), page 66</td>
<td></td>
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<tr>
<td>Clear Configuration</td>
<td>Clearing the configuration (Clear Configuration), page 62</td>
<td></td>
</tr>
<tr>
<td>Canonical Target CHAP Settings</td>
<td>Setting up CHAP authentication, page 53</td>
<td></td>
</tr>
<tr>
<td>iSNS Discovery Settings</td>
<td>Enabling iSNS discovery, page 65</td>
<td></td>
</tr>
<tr>
<td>Add iSNS</td>
<td>Enabling iSNS discovery, page 65</td>
<td></td>
</tr>
<tr>
<td>Redundancy Settings</td>
<td>Disabling auto-path switching (Redundancy Settings), page 64</td>
<td></td>
</tr>
<tr>
<td>Disable Controller</td>
<td>Disabling a controller (Disable Controller), page 64</td>
<td></td>
</tr>
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<td>Management port Settings</td>
<td>Configuring the management port, page 33</td>
<td></td>
</tr>
<tr>
<td>Management Port Login Settings</td>
<td>Not documented</td>
<td></td>
</tr>
<tr>
<td>Set SSL Certificate</td>
<td>Setting the SSL certificate, page 56</td>
<td></td>
</tr>
<tr>
<td>Service Settings</td>
<td>Not documented</td>
<td></td>
</tr>
<tr>
<td>TELNET Service</td>
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<td></td>
</tr>
<tr>
<td>SSH service</td>
<td>Configuring data ports, page 35</td>
<td></td>
</tr>
<tr>
<td>HTTP Service</td>
<td>Disabling data ports (Enable/Disable Port), page 64</td>
<td></td>
</tr>
<tr>
<td>HTTPS Service</td>
<td>Configuring data ports, page 35</td>
<td></td>
</tr>
<tr>
<td>SNMP Service</td>
<td>Deleting a component (Delete), page 63</td>
<td></td>
</tr>
<tr>
<td>Data port</td>
<td>Deleting a component (Delete), page 63</td>
<td></td>
</tr>
<tr>
<td>Create Portal</td>
<td>Configuring data ports, page 35</td>
<td></td>
</tr>
<tr>
<td>Delete IP Address</td>
<td>Deleting a component (Delete), page 63</td>
<td></td>
</tr>
<tr>
<td>Delete Portal</td>
<td>Deleting a component (Delete), page 63</td>
<td></td>
</tr>
<tr>
<td>Create Logical Drive</td>
<td>Creating logical drives, page 41</td>
<td></td>
</tr>
<tr>
<td>Spare Management</td>
<td>Assigning spare drives to an array, page 40</td>
<td></td>
</tr>
<tr>
<td>Delete</td>
<td>Deleting a component (Delete), page 63</td>
<td></td>
</tr>
<tr>
<td>Expand Array</td>
<td>Changing array or logical drive characteristics, page 58</td>
<td></td>
</tr>
<tr>
<td>System component</td>
<td>Available tasks</td>
<td>Where documented</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------------------------------</td>
<td>-------------------------------------------------------</td>
</tr>
<tr>
<td>Array</td>
<td>Create Logical Drive</td>
<td>Creating logical drives, page 41</td>
</tr>
<tr>
<td></td>
<td>Spare Management</td>
<td>Assigning spare drives to an array, page 40</td>
</tr>
<tr>
<td></td>
<td>Delete</td>
<td>Deleting a component (Delete), page 63</td>
</tr>
<tr>
<td></td>
<td>Expand Array</td>
<td>Changing array or logical drive characteristics, page 58</td>
</tr>
<tr>
<td>Logical Drive</td>
<td>Migrate RAID/Stripe size</td>
<td>Changing array or logical drive characteristics, page 58</td>
</tr>
<tr>
<td></td>
<td>Set Preferred Path</td>
<td>Setting the preferred path (Preferred Path), page 67</td>
</tr>
<tr>
<td>Target</td>
<td>Create Portal Group</td>
<td>Creating target portal groups, page 45</td>
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<tr>
<td></td>
<td>Map Logical Drive to Target</td>
<td>Mapping logical drives to the target, page 47</td>
</tr>
<tr>
<td></td>
<td>CHAP Settings</td>
<td>Setting up CHAP authentication, page 53</td>
</tr>
<tr>
<td></td>
<td>Delete Target</td>
<td>Deleting a component (Delete), page 63</td>
</tr>
<tr>
<td></td>
<td>Enable/Disable Access Control</td>
<td>Setting up Access Control Lists, page 51</td>
</tr>
<tr>
<td></td>
<td>Discovery Settings</td>
<td>Enabling iSNS discovery of specific targets (Discovery Settings), page 66</td>
</tr>
<tr>
<td></td>
<td>Set Login Parameters</td>
<td>Changing target login parameters (Set Login Parameters), page 62</td>
</tr>
<tr>
<td>Portal group</td>
<td>Assign Portals</td>
<td>Assigning portals to the portal group, page 46</td>
</tr>
<tr>
<td></td>
<td>Delete Portal Group</td>
<td>Deleting a component (Delete), page 63</td>
</tr>
<tr>
<td>Mapped Logical Drive</td>
<td>Unmap Logical Drive from Target</td>
<td>Not documented</td>
</tr>
<tr>
<td></td>
<td>Update Access Control</td>
<td>Setting up Access Control Lists, page 51</td>
</tr>
<tr>
<td>Initiator</td>
<td>Delete iSCSI Initiator</td>
<td>Deleting a component (Delete), page 63</td>
</tr>
<tr>
<td></td>
<td>CHAP Settings</td>
<td>Setting up CHAP authentication, page 53</td>
</tr>
</tbody>
</table>
Sample configuration used in this document

Illustrations in this document demonstrate the process of configuring a dual-controller MSA1510i storage system, with multiple targets being accessed by multiple initiators. Although each real-world environment and the associated configuration steps will differ from this example, fundamental principles of the configuration steps are the same for all installations. Your configuration may be more or less complex, but the configuration steps will be similar to the steps outlined in this document.

The following diagrams illustrate the sample configuration used throughout this document:

- Sample configuration—Device and cabling diagram
- Sample configuration—physical-to-logical storage diagram
- Sample configuration—Path/accessibility diagram

Sample configuration—Device and cabling diagram

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MSA1510i controller shelf</td>
</tr>
<tr>
<td>2</td>
<td>MSA20 SATA storage enclosure</td>
</tr>
<tr>
<td>3</td>
<td>Primary Ethernet network switch</td>
</tr>
<tr>
<td>4</td>
<td>Redundant Ethernet network switch</td>
</tr>
<tr>
<td>5</td>
<td>Initiator A</td>
</tr>
<tr>
<td>6</td>
<td>Initiator B</td>
</tr>
<tr>
<td>7</td>
<td>Initiator C</td>
</tr>
</tbody>
</table>
Sample configuration—Physical-to-logical storage diagram

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MSA 1510i controller shelf and MSA20 storage enclosure</td>
</tr>
<tr>
<td>2</td>
<td>Array A</td>
</tr>
<tr>
<td>3</td>
<td>Array B</td>
</tr>
<tr>
<td>4</td>
<td>Array C</td>
</tr>
<tr>
<td>5</td>
<td>Logical Drive 1</td>
</tr>
<tr>
<td>6</td>
<td>Logical Drive 2</td>
</tr>
<tr>
<td>7</td>
<td>Logical Drive 3</td>
</tr>
<tr>
<td>8</td>
<td>Mapped Logical Drive 1</td>
</tr>
<tr>
<td>9</td>
<td>Mapped Logical Drive 1</td>
</tr>
<tr>
<td>10</td>
<td>Mapped Logical Drive 1</td>
</tr>
<tr>
<td>11</td>
<td>Target 1</td>
</tr>
<tr>
<td>12</td>
<td>Target 2</td>
</tr>
<tr>
<td>13</td>
<td>Target 3</td>
</tr>
</tbody>
</table>
### Sample configuration—Path/accessibility diagram

<table>
<thead>
<tr>
<th>Port</th>
<th>IP address</th>
<th>Portals</th>
<th>Portal group</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MA0</td>
<td>10.10.10.254</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>2</td>
<td>SA0</td>
<td>10.10.10.10</td>
<td>Portal 1: 3260 Portal 2: 3261</td>
<td>Group: 1 Group: 3</td>
</tr>
<tr>
<td>3</td>
<td>SA0</td>
<td>10.10.10.11</td>
<td>Portal 3: 3260 Portal 4: 3261</td>
<td>Group: 1 Group: 3</td>
</tr>
<tr>
<td>4</td>
<td>SA1</td>
<td>10.10.10.50</td>
<td>Portal 5: 3260 Portal 6: 3261</td>
<td>Group: 5 Group: 5</td>
</tr>
<tr>
<td>5</td>
<td>SA1</td>
<td>10.10.10.51</td>
<td>Portal 7: 3260 Portal 8: 3261</td>
<td>Group: 5 Group: 5</td>
</tr>
<tr>
<td>6</td>
<td>MB0</td>
<td>10.20.10.254</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>7</td>
<td>SB0</td>
<td>10.20.10.10</td>
<td>Portal 9: 3260 Portal 10: 3261</td>
<td>Group: 2 Group: 4</td>
</tr>
<tr>
<td>8</td>
<td>SB0</td>
<td>10.20.10.11</td>
<td>Portal 11: 3260 Portal 12: 3261</td>
<td>Group: 2 Group: 4</td>
</tr>
</tbody>
</table>
Fundamental tasks, in initial configuration sequence

Configuring a new system includes the following tasks, **performed in the following sequence:**

- Configuring management and data ports
- Configuring hard drives
- Creating storage targets
- Adding authorized initiators

Configuring management and data ports

As described in the installation documents, the array connects to the network switch from its Ethernet iSCSI module.

**IMPORTANT:**

In dual-controller configurations, an additional Ethernet iSCSI module is installed in the chassis, providing the redundant path to a separate iSCSI network switch. Ports on both modules must be configured.

When configuring management and data ports, consider the following:

- Isolate management traffic from storage traffic, by assigning IP addresses in different LAN segments.
- Assign one (or more) IP addresses to each port, and then assign one (or more) TCP portals to each IP address.
- Enable/disable the following management services as needed for your environment:
  - TELNET (default: disabled)
  - SSH (default: enabled)
  - HTTP (default: enabled)
  - HTTPS (default: enabled)
  - SNMP (default: enabled)
- Assign IP addresses and TCP portals to the data ports as outlined on your Path/Accessibility Diagram. (When configuring the storage targets, each target is assigned to a specific group of IP portals, controlling access to the storage and the flow of storage traffic.)

**NOTE:**

The maximum supported number of IP addresses and portals may differ, depending on the storage system and the model of its supported array controller. See your system user documents for more information.

Configuring the management port

**IMPORTANT:**

Dual-controller configurations should configure the management port associated with each controller.

- The default management port for controller A is MA0.
- The default management port for controller B is MB0.

1. To clarify the display, expand the **View as** drop-down box and select the iSCSI view.
2. Expand (+) the component list for an installed **MSA1510i controller**.
3. Select the **Management Port** on the controller and view the available tasks.

4. Select **Management Port Settings**.
5. Enter the settings for the management port.

**NOTE:**
- **Port State** must be *Enabled* (default) to use the SMU. If the management port state was disabled, you must use the Command Line Interface (CLI) to re-enable it. (For more information, see the Command Line Interface user guide.)
- Assign a **Host Name** to the storage system (default: chassis serial number). HP recommends changing this to a more helpful user-defined value.
- **Port Name MA0** is the default management port. Although other ports can be configured as the primary management port, HP recommends configuring and using the default.
- To control the path of management traffic to and from the array controller and to add one level of system security, HP recommends assigning a static IP address to the management port that is in a different LAN segment than the data ports. To assign a static IP address, expand the **DHCP Setting** drop-down box and change the setting to **Disabled**. The page expands (shown), showing the currently assigned IP address. Change this to the address you want to use for management traffic. After changing the IP address, you may need to re-connect to the SMU using the newly assigned IP address.
- By default, **VLAN ID** is 0, meaning that traffic flowing from the port to the switch will be untagged. To assign a VLAN for this port to use, enter its value. VLANs are set up on the switch, and are used as one method of controlling access to the storage system.

**IMPORTANT:**
For dual-controller configurations, repeat these steps to configure the management port on the other controller.
- The default management port for controller A is MA0.
- The default management port for controller B is MB0.

### Configuring data ports
Configuring each data port includes two steps:
- Assigning one or more IP addresses to the port *(Step 1).*
- Assigning one or more TCP portals to each IP address *(Step 4).*

**IMPORTANT:**
Configure all data ports you plan to use, including ports on the Ethernet iSCSI module associated with the controller in slot 2, if installed.
1. Select **Data Port > Add IP Address**.

2. Enter settings for the data port.

**NOTE:**
- To control the path of storage traffic to and from the array controller and to add one level of system security, HP recommends assigning an **IP Address** to the data port that is in a different LAN segment than the management port. This IP address can not be changed. To change an IP address assigned to a port, you must add a new IP address and then delete the unneeded entry. When deleting an IP address, all corresponding portals and portal group assignments are also deleted.
- By default, the **VLAN ID** is 0, meaning that traffic flowing from the port to the switch will be untagged. To assign a VLAN for this port to use, enter its value. VLANs are set up on the switch, and are used as one method of controlling access to the storage system.

3. When the display refreshes, expand (+) all components listed for the Data Port and verify that the newly added IP address is shown in the component list.
4. Select **IP Address > Create Portal**.

5. Enter settings for the portal.

   **NOTE:**
   
   For additional security, do not use commonly-known TCP ports.

6. When the display refreshes, verify that the newly configured portal is shown in the component list.

7. As needed for your environment, repeat **Step 4 through Step 6** to assign additional TCP ports to this IP address.

8. Repeat **Step 1 through Step 7** to add additional IP addresses to this data port or to configure the remaining data ports, such as SA1, SB0, and SB1.

**Sample configuration status - after configuring management and data ports**

*Figure 10* illustrates the current configuration.

The following items are configured:

- Management port MA0 and MB0
- Data ports SA0, SA1, SB0, and SB1
  - Each data port is assigned two (2) IP addresses
  - Each IP address is assigned two (2) TCP portals
Figure 10 Sample configuration—after configuring management and data ports

NOTE:
Due to the limited screen size, information for the management and data ports associated with the controller in slot 2 are not shown in Figure 10.

Configuring hard drives
Configuring hard drives includes two steps:

• Creating arrays
• Creating logical drives

NOTE:
For more information on configuring the storage, see “Storage overview” on page 85.
Creating arrays

1. Expand the **View** as drop-down box and select the **Storage with iSCSI** or **Storage only** view.

2. Select **Storage System** > **Create Array**.
3. Select the hard drives to include in the array.

**NOTE:**
- The SMU does not allow hard drives from SATA and SCSI storage enclosures to be included in the same array.
- Hard drives included in an array should be the same size and speed. When drive sizes and speeds are mixed within an array, the usable capacity and the processing ability of the array is reduced to that of the smallest and slowest hard drive.
- For optimum performance of an array, include hard drives from different storage enclosures and connected to different SCSI buses on the array controller.
- Consider reserving some hard drives for use as on-line spares.
- For more information about configuring storage arrays, see “Storage overview” on page 85.

4. When the display refreshes, verify that the newly configured array is shown in the component list.

5. Repeat Step 2 through Step 4 to configure additional arrays from any remaining unused hard drives.

### Assigning spare drives to an array

HP recommends reserving some hard drives in your enclosures to be used as spare drives. Spares are drives that are assigned to one or more arrays, but are not active members of those arrays. If a spare is present and a physical drive in the array fails, the spare automatically replaces the failed drive as a member of the array unit, and the process of rebuilding the information onto the spare automatically begins. The system uses mirrored or parity information from the other member drives to reconstruct information onto the spare drive. After the failed drive is replaced, data on the spare is automatically copied to the replacement drive, and the spare is again available for use as a spare.

1. Select **Array > Spare Management**.
2. Select the hard drive(s) to assign as a spare.

**NOTE:**
- A spare must be the same type (SATA or SCSI) as other drives in the array.
- A spare must be the same size (or larger) and speed (or faster) as other drives in the array.
- A hard drive may be assigned as a spare to more than one array.
- If a spare is assigned to an array, the words *with Spare* are included in the Array description.

3. Repeat Step 1 through Step 2 to assign spares to other configured arrays.

Creating logical drives

1. Select an Array with unused space, and then select **Create Logical Drive**.
2. As needed, expand the drop-down boxes in the task area to change the settings from the suggested defaults.

**NOTE:**
- The SMU suggests defaults for the logical drive, creating one large logical drive from all unused space on the array, with the highest fault tolerance and performance possible for the hard drives included in that array.
- Only Fault Tolerance levels possible for the array are displayed. For example, RAID 5 is not listed if the array has only two physical hard drives.
- The default Stripe Size gives optimum performance in a mixed read/write environment.
  - For read-prominent environments, use a larger stripe size.
  - For write-prominent environments, use a smaller stripe size for RAID 5 or RAID_ADG, and a larger stripe size for RAID 0 or RAID 1+0.
- To build multiple logical drives on the same array, reduce the Size setting from the default to a smaller amount. Additional logical drives can then be built from the remaining unused space.
- Disabling the Array Accelerator for a logical drive reserves use of the accelerator cache for other logical drives in the array. This feature is useful if you want the other logical drives to have the maximum possible performance.

3. When the display refreshes, verify that the configured logical drives are shown in the component list.

4. Repeat Step 1 through Step 3 to create additional logical drives for this array, or to create logical drives for other arrays.

**Configuration status - after configuring hard drives**

*Figure 10* illustrates the current configuration.

The following items are configured:
- Management port MA0 and MB0
- Data ports SA0, SA1, SB0, and SB1
- Physical hard drives, into:
  - Array A—Four (4) 160 GB hard drives, with no assigned spare
    - Logical drive 1—RAID 1+0
  - Array B—Three (3) 250 GB hard drives, with an assigned spare
    - Logical drive 2—RAID 5
  - Array C—Three (3) 250 GB hard drives, with an assigned spare
    - Logical drive 3—RAID 5
Creating storage targets

Configuring each storage target includes several steps:

- Creating the target
- Creating target portal groups
- Assigning portals to the portal group
- Mapping logical drives to the target
- Configuring the redundant controller for a target (dual-controller configurations only)

**NOTE:**

This section illustrates the process of configuring an individual storage target. Repeat all steps in this section for each target that you need to create.

Creating the target

1. Expand the **View as** drop-down box and select the iSCSI view.
2. Select **Storage System** and view the available tasks.

3. Select **Create iSCSI Target**.

4. Enter the requested information for the target.

   **NOTE:**
   - The utility suggests default values for the **Target Name** and **Alias** that adhere to iSCSI standards. To accept the defaults, click **OK**.
   - This step creates the target entity; additional steps build information behind the target.

5. When the display refreshes, verify that the new target is shown in the component list.
Creating target portal groups

1. Select Target > Create Portal Group.

2. Enter the requested information for the portal group.

**NOTE:**
- The utility suggests a default Portal Group Alias. Accept the default or enter a user-defined value.
- This step creates the portal group entity; additional steps build information behind the portal group.

3. When the display refreshes, expand (+) all components listed for the target and verify that the newly added portal group is shown in the component list.
Assigning portals to the portal group

1. Select **Portal Group > Assign Portals**.

2. Expand the **Port Name** drop-down box and select the data port for this portal group to use.

3. Select the portals for this portal group to use.

**NOTE:**
- When assigning portals to a target’s portal group, you are designating the path for traffic to and from that target.
- Only IP addresses and portals associated with the selected data port are displayed.
- This example illustrates selecting two portals (on separate IP addresses) of data port SA0.

4. When the display refreshes, expand (+) all components listed for the portal group and verify that the newly assigned portals are shown in the component list.
Mapping logical drives to the target

1. Select Target > Map Logical Drive to Target.

2. Enter the requested information for the mapped logical drive.

   NOTE:
   - The utility suggests a default value for the Mapped LUN Alias. Accept the default or enter a user-defined, content-descriptive value.
   - The utility suggests a default number to assign to the mapping, beginning with number 1. Accept the default or expand the drop-down box to select a different number. HP recommends accepting the default. The Mapped LUN number is the name presented to the initiator.
   - All available, unmapped logical drives are included in the selection list.
   - One logical drive at a time can be mapped to a target. To map additional logical drives to this target, repeat these steps.

3. When the display refreshes, verify that the mapped logical drive is shown in the component list.

4. To map additional logical drives to this same target, repeat Step 1 through Step 3 in this section.

Configuring the redundant controller for a target (dual-controller configurations only)

IMPORTANT:

Dual-controller configurations must create an additional portal group for each target, using portals on the redundant Ethernet iSCSI module to establish a redundant path. Redundant data ports include SB0, and SB1. For targets assigned to logical port SA0, use logical port SB0 as the redundant path. For targets assigned to logical port SA1, use logical port SB1 as the redundant path.

The following steps are a summary of the steps included in Creating target portal groups and Assigning portals to the portal group, but are for establishing a redundant path:

1. Create a portal group by selecting Target > Create Portal Group. Assign a name to the redundant portal group.
2. Select the newly created Portal Group > Assign Portals. Expand the Port Name drop-down box and select a port on the redundant Ethernet iSCSI module for this target portal group to use. After the portals associated with the selected logical port are displayed, select the TCP portals to use.

Configuration status - after creating storage targets

Figure 12 illustrates the current configuration.

The following items are configured:

- Management port MA0 and MB0
- Data ports SA0, SA1, SB0, and SB1
- Physical hard drives, into arrays and logical drives
- Targets
  - Target 1
  - Target 2
  - Target 3
NOTE:

Figure 12 illustrates the following for Target 1:
• One logical drive (Logical Drive 1) is mapped to this target.
• Primary and redundant paths are defined for this target:
  • Portal Group “pg1” uses two portals on data port SA0 of the primary Ethernet iSCSI module.
  • Portal Group “pg2” uses two portals on data port SB0 of the redundant Ethernet iSCSI module.

Adding authorized initiators

1. Select Storage System > Add iSCSI Initiator.
2. Enter the requested information for the iSCSI initiator.

**NOTE:**

- The **iSCSI Initiator Name** is assigned when defining the initiator on the server, and is usually in the format of “iqn.xxx”. Obtain initiator names from your network administrator or as displayed in the iSCSI initiator software on the server.
- Be sure to enter the **iSCSI Initiator Name** exactly as assigned in the iSCSI initiator software on the server. Include all special characters, including periods, and spaces. If the initiator name is entered incorrectly, the target cannot be presented to the initiator.
- The system suggests a default value for the **iSCSI Initiator Name Alias**. Accept the default or enter a user-defined, descriptive value.
- Expand the **iSCSI Initiator Profile Name** drop-down box to identify the operating system of this initiator.

**Configuration status - after adding initiators**

Figure 13 illustrates a completed configuration:

- Management port MA0 and MB0
- Data ports SA0, SA1, SB0, and SB1
- Physical hard drives, into arrays and logical drives
- Targets
- Initiators
  - Initiator 1
  - Initiator 2
  - Initiator 3
Perform the following tasks to complete the configuration:

- Enter security settings (optional, but recommended). (For more information, see “Security tasks” on page 51.)
- Enter configuration settings in the iSCSI initiator configuration software utility (on the server), including:
  - Adding target portals for the initiator to access.
  - Configuring the target portals. (Be sure to select the option to automatically restore the connection each time the system restarts.)
  - Logging on to establish an active session.

**Security tasks**

Security can include one or all of the following:

- Setting up Access Control Lists
- Setting up CHAP authentication
- Setting the SSL certificate

**Setting up Access Control Lists**

Access control lists (ACLs) provide security at the LUN level. In an ACL, you indicate the initiator(s) that can access specific mapped logical drive units of a target.

**NOTE:**

Repeat all steps in this section for each target for which you want to establish an ACL.

1. From the server, open the iSCSI initiator software and close any active connections to the target. This ensures that there is no I/O activity on the target.
2. Select Target > Enable/Disable Access Control.

3. Expand the ACL State drop-down box, and enable access control.

4. The following warning message is displayed:

5. Confirm that there is no active I/O on the target, and then click **OK**.

**IMPORTANT:**

- To prevent loss of access to the storage, ACLs should not be modified if there is an active session between the initiator and the target. Before enabling ACL for a target, open your iSCSI initiator software and verify that the target status is inactive or disconnected.

- When access control is **disabled** (default), all initiators with access to the array controller can access the storage targets. (If CHAP authentication is set up, only initiators with verified CHAP secrets can access the storage.)

- When access control is **enabled**, access to all mapped logical drives of the target is immediately blocked (Step 2 through Step 3), until ACLs are created for each mapped logical drive (Step 6 through Step 7).
6. Select **Mapped Logical Drive** > **Update Access Control**.

**NOTE:**
Update Access Control is listed as a common task only if Access Control is enabled (Step 2).

7. Select the initiators that can access this mapped logical drive.
8. Repeat Step 6 through Step 7 for each mapped logical drive of the target.
9. If necessary, repeat Step 1 through Step 8 to set up an ACL for a different target.

**Setting up CHAP authentication**

The Challenge Handshake Authentication Protocol (CHAP) is one method of protecting access to the storage. When using CHAP, the same password (also called secret) is entered in both the storage management software and the initiator software.

When an initiator attempts to access the target, the CHAP secrets stored in both software utilities are compared. If the secrets match, access is granted. If the secrets do not match, access is denied.

Three methods of CHAP authentication are available. Choose one method:

- Setting up storage-system target discovery CHAP authentication
- Setting up target-specific initiator-to-target CHAP authentication
- Setting up mutual CHAP authentication

**Setting up storage-system target discovery CHAP authentication**

Creating a CHAP secret that allows discovery of all targets in the storage system requires two steps:

- Assigning a CHAP secret that applies to the storage system (Step 1).
- Entering the same CHAP secret in the iSCSI initiator software (Step 4).
1. In the SMU, select Storage System > Canonical Target CHAP Settings.

2. Expand the CHAP State drop-down box and change the setting to Enabled.

**NOTE:**
If Canonical Target CHAP settings have already been entered, the display is contracted and protected by a gateway check box. To change existing CHAP settings, clear the Use Existing CHAP Settings check box. The page expands, allowing access to the settings.

3. Enter the CHAP Secret in the provided spaces.

4. On the server, open the iSCSI initiator software utility. Navigate through the iSCSI utility and enter the same canonical CHAP secret assigned in the SMU.

**Setting up target-specific initiator-to-target CHAP authentication**

Creating a CHAP secret that is unique for each target in the storage system requires two steps:

- Assigning a CHAP secret to each target (Step 1).
- Entering the same CHAP secret in the iSCSI initiator software (Step 4).
1. In the SMU, select **Target > CHAP Settings**.

2. Expand the **CHAP State** drop-down box and change the setting to **Enabled**.

   **NOTE:**

   If CHAP settings have already been entered for this target, the display is contracted and protected by a gateway check box. To change existing CHAP settings, clear the **Use Existing CHAP Settings** check box. The page expands, allowing access to the settings.

3. Enter the **CHAP Secret**.

4. On the server, open the iSCSI initiator software utility. Navigate through the iSCSI utility and enter the same CHAP secret assigned in the SMU.

**Setting up mutual CHAP authentication**

Setting up mutual CHAP authentication between an initiator and a target requires:

- Entering a target-specific CHAP secret in both the SMU and the iSCSI initiator software utility.
- Entering an initiator-specific CHAP secret in both the SMU and the iSCSI initiator software utility.
- Enabling mutual authentication in the iSCSI initiator software utility.

1. To enter a target-specific CHAP secret in both the SMU and the iSCSI initiator software utility, see “Setting up target-specific initiator-to-target CHAP authentication” on page 54.
2. To enter an initiator-specific CHAP secret in both the SMU and in the iSCSI initiator software utility:
   a. **On the server,** open the iSCSI initiator software utility. Navigate through the iSCSI initiator software utility and either assign a CHAP secret to the initiator or record the existing CHAP secret.
   b. **In the SMU,** select **Initiator > CHAP Settings.** Then, enter the same CHAP secret assigned to the initiator the iSCSI initiator software utility.

3. **On the server,** open the iSCSI initiator software utility. Navigate through the iSCSI initiator software utility to locate and select the option to perform mutual authentication.

### Setting the SSL certificate

A Secure Sockets Layer (SSL) certificate provides browser security, ensuring a secure connection between the array controller and an initiating server, over which any amount of data can be sent securely. SSL works by using a private key to encrypt data transferred over the internet.

The array controller ships with a default certificate already installed, but until a server-specific certificate is installed, a warning message is displayed when accessing the SMU.

SSL certificate implementation on the MSA1510i makes use of PEM formatted files. Microsoft Certificate Services do not directly support the PEM file format, but the publicly available OpenSSL toolset is recommended for generating required keys and certificates or for converting Microsoft private key exports into PEM format. For more information, see the HP Storageworks Modular Smart Array 1510i Advanced Planning and Configuration Guide.

To upload your server-specific SSL certificate:
1. Select **Management Port > Set SSL Certificate**.

2. Expand the SSL Certificate Type drop-down box and select **Upload PEM Certificate**.

3. Enter the requested information.

**Additional management and configuration tasks**

In addition to the tasks already described, the following tasks are also available:

- Adding a route (Add Route)
- Changing array or logical drive characteristics
  - Disabling the array accelerator (Array Accelerator Settings)
  - Expanding an array (Expand Array)
  - Extending a logical drive (Extend Logical Drive)
  - Migrating to a different RAID level or stripe size (Migrate RAID/Stripe Size)
- Changing global settings (Storage System Settings)
- Changing target login parameters (Set Login Parameters)
- Clearing the configuration (Clear Configuration)
- Deleting a component (Delete)
- Disabling auto-path switching (Redundancy Settings)
- Disabling data ports (Enable/Disable Port)
- Disabling a controller (Disable Controller)
- Enabling iSNS discovery
  - Enabling iSNS discovery (iSNS Discovery Settings)
  - Enabling iSNS discovery of specific targets (Discovery Settings)
- Identifying devices (Identify Device)
- Refreshing the display (Refresh System)
- Resetting the system (Reset System)
- Setting the preferred path (Preferred Path)
- Viewing detailed component information (More Information)
- Viewing status alerts (View All Status Alerts)
Adding a route (Add Route)

To add an entry to the route table for this controller:

1. Select a data port from the system component list, and then select the **Add Route** task.

2. Enter the IP information for the route.

Changing array or logical drive characteristics

Changes to existing storage arrays or logical drives include:

- Disabling the array accelerator (Array Accelerator Settings)
- Expanding an array (Expand Array)
- Extending a logical drive (Extend Logical Drive)
- Migrating to a different RAID level or stripe size (Migrate RAID/Stripe Size)

**NOTE:**

To change storage-related settings, expand the View as drop-down box and select the Storage or Storage with iSCSI view.
**IMPORTANT:**

- Completion time of an array expansion, logical drive extension, or logical drive migration varies, depending on the drive speed and type, system array controller settings, and existing storage configuration. (Process times of 36 to 72 hours are common.)
- During an expansion, extension, or migration, access to the data is permitted, but at a reduced performance rate.
- During an expansion, extension, or migration, the risk of data loss if a drive fails is increased.
- Only one expansion, extension, or migration process can take place at a time.
- To verify the progress status of an expansion, extension, or migration:
  - View the icon for the logical drive.
  - View the More Information task for the logical drive.
  - View the Status Alerts messages.

Disabling the array accelerator (Array Accelerator Settings)

By default, the array accelerator is enabled for all logical drives. To choose which logical drives use the array accelerator, select the top-level storage system from the system component list, and then select the **Array Accelerator Settings** task. Then, select which logical drives will use the array accelerator.

**NOTE:**

Disabling the array accelerator for a logical drive reserves use of the cache for other logical drives on the array. This feature is useful if you want the other logical drives to have the maximum possible performance.

Expanding an array (Expand Array)

If unassigned physical hard drives are available or were recently added to a storage enclosure, you can use this task to increase the storage capacity of an existing array.

After expanding an array to include the new hard drive(s), you can then use the additional storage capacity to:
To expand the capacity of an array:

1. Ensure that a known, good backup of the array is available.
2. Verify that the Expand Priority is set to Medium or High. (For more information, see “Changing global settings (Storage System Settings)” on page 61.)
3. Select **Array > Expand Array**.

**NOTE:**
The Expand Array task is available only if unassigned physical hard drives are present in the storage system. To be added to an array, the hard drive must be of similar type (SATA or SCSI), processing ability, and size as the hard drives already included in the array.

4. Select the physical hard drives to add to the array.

### Extending a logical drive (Extend Logical Drive)

If unused space is available in an array, you can use this task to increase the storage capacity of an existing logical drive on that array.

**NOTE:**
The Extend Logical Drive task is listed only if unused space is present in the logical drive's array. To create unused, available space in the array:

- Expand the array. (For more information, see “Expanding an array (Expand Array)” on page 59.)
- Delete a different logical drive on that array to release that space for use. (For more information, see “Deleting a component (Delete)” on page 63.)

To extend the capacity of a logical drive:

1. Ensure that a known, good backup of the array is available.
2. Verify that the Expand Priority is set to Medium or High. (For more information, see “Changing global settings (Storage System Settings)” on page 61.)
3. Select **Logical Drive > Extend Logical Drive**.
4. Enter the new size of the logical drive.

### Migrating to a different RAID level or stripe size (Migrate RAID/Stripe Size)

1. Ensure that a known, good backup of the logical drive is available.
2. Verify that the Rebuild Priority is set to Medium or High. (For more information, see “Changing global settings (Storage System Settings)” on page 61.)
3. Select **Logical Drive > Migrate Logical Drive**.

4. Enter the new settings for the logical drive.

**Changing global settings (Storage System Settings)**

The default global settings are adequate for most environments. If needed, use this option to:

- Change the ratio of memory allocated to read and write operations.
- Change the priority of array expansions relative to normal operations.
- Change the priority of array rebuilds relative to normal operations.

To change the default global settings:

1. Select **Storage System > Storage System Settings**.
2. Enter the new values.

**NOTE:**

- The Cache Ratio determines the amount of memory allocated to read and write operations. For improved performance, you may want to change this ratio to allocate more memory to write operations, as high as 10% read/90% write.

- The **Expand/Rebuild Priority** settings determine whether normal operations are affected by an expansion or rebuild—changing these settings from the defaults may affect system performance:
  - A low priority has a minimal effect on normal operations, because the expansion or rebuild process takes place only when the controller is not busy. However, there is an increased risk of data loss if another physical drive fails before the process is completed.
  - A high priority has a greater effect on normal operations, because the expansion or rebuild process has a higher priority than the normal operations. With more system resources allocated to the expansion or rebuild process, the completion time is reduced, also reducing the risk of data loss if another physical drive fails before the process is completed.

- Before initiating an array expansion or logical drive extension, HP recommends changing the corresponding priority setting to Medium or High.

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### Changing target login parameters (Set Login Parameters)

1. Expand the View as drop-down box and select the iSCSI or Storage with iSCSI view.

2. Select **Target > Set Login Parameters**.

3. Enter the new values.

### Clearing the configuration (Clear Configuration)

Use this option to reset the storage system to its original, unconfigured shipping configuration. Depending on the selected options, some or all of the configuration settings are changed back to the default values, including array, logical drive, target, initiator, and port information.
1. Select **Storage System > Clear Configuration**.

2. Select the configuration components to clear.

**NOTE:**
- Select all—Clears all iSCSI, storage, and management configuration settings.
- iSCSI Configuration—Clears iSCSI configuration settings only.
- Management Configuration—Clears management configuration settings only.
- Storage Configuration—Clears storage configuration settings only.
- When management settings are cleared, any changes to the management port IP address are erased and a new IP address is assigned to the management port. To obtain the new IP address, press the arrow buttons on the front of the array controller and scroll through the LCD messages until the following message is displayed: 603 Port MA0 IP <address>. Record the new IP address, so that you can again access the SMU.

3. A warning message is displayed. Review the selected options and respond appropriately.

**Deleting a component (Delete)**

If necessary, the following components can be deleted:
- Arrays
- Logical drives
- Targets
- Mapped logical drives
- Initiators
- Data port IP addresses
- IP address portals
- Routes
- Target portal groups

To delete a component, select the component from the list, and then select **Delete** from the task list.
NOTE:
Some of the components that can not be deleted while in use include:
• Removing a portal from a portal group
• Deleting a portal group
• Deleting a target

Disabling automatic path switching (Redundancy Settings)

NOTE:
This task is available for dual-controller configurations only.

1. Select **Storage System > Redundancy Settings**.

2. Expand the **Preferred Path Mode** drop-down box and select one of the following options:
   • **Automatic** (default)—Based on I/O load, the system automatically determines and assigns the optimal path (controller ownership) for each LUNs. If a path is manually specified for a LUN with the Set Preferred Path task, it may subsequently be re-assigned by the system.
   • **Manual**—The path for each LUN must be set manually with the Set Preferred Path task.

Disabling data ports (Enable/Disable Port)

By default, all ports on the Ethernet iSCSI module are enabled.

To disable or re-enable a port, select the port in the component list, and then select **Enable/Disable Port**.

Disabling a controller (Disable Controller)

When removing a controller for service, HP recommends first disabling the controller.

To disable a controller, select the controller from the component list, and then select **Disable Controller**.
Enabling iSNS discovery

Enabling iSNS discovery of storage targets includes:

- Enabling iSNS discovery (iSNS Discovery Settings)
- Enabling iSNS discovery of specific targets (Discovery Settings)

Enabling iSNS discovery (iSNS Discovery Settings)

1. Select **Storage System > iSNS Discovery Settings**.

2. Expand the drop-down boxes to enable iSNS discovery and enter other iSNS settings.

**NOTE:**

- If the storage system is in a separate LAN segment than the iSNS server, be sure to change the iSNS **Discovery Mode** to **Manual**.
- After enabling iSNS discovery for the storage system, you must enable iSNS discovery for each target you want discovered through the iSNS process. (For more information, see “Enabling iSNS discovery of specific targets (Discovery Settings)” on page 66.)
Enabling iSNS discovery of specific targets (Discovery Settings)

1. Select Target > Discovery Settings.

2. Expand the drop-down boxes to Enable SLP and/or iSNS Discovery.

Identifying devices (Identify Device)

To locate a system component by lighting up its LEDs, select the item from the component list, and then select Identify Device.

For example, if this task is selected for a logical drive, the LEDs on the physical hard drives included in that logical drive are illuminated.

Refreshing the display (Refresh System)

Use this option to update the SMU display.

To refresh the SMU display, select Refresh System. The utility scans the configuration and, after a few moments, updates the display.

Resetting the system (Reset System)

Use this option to remotely reset (power cycle) the array controller.

To reset the array controller, select Storage System > Reset System. The following warning message is displayed.
NOTE:
This task is available for dual-controller configurations only.

To manually (explicitly) set controller ownership of a LUN:

1. Select an already-configured logical drive from the system component list, and then select the Preferred Path task.

2. Expand the Preferred Path drop-down box and select a controller.

IMPORTANT:
If the Redundancy Setting mode is set to “Automatic”, path ownership may automatically switch from one controller to the other, depending on the processing load, as the system attempts to balance the processing load between the two controllers. To permanently set the path for a LUN, the Redundancy Setting mode must be set to “Manual”. For more information, see “Disabling auto-path switching (Redundancy Settings)” on page 64.

Viewing detailed component information (More Information)

To view detailed information about a system component, select the desired component, and then select More Information. The following image illustrates sample information displayed for a target.
NOTE:
Make note of the icon displayed next to each system component. Icons provide at-a-glance status of each component. (For more information about status icons, see “Icon descriptions” on page 91.)

Viewing status alerts (View All Status Alerts)

Available in both the Configure and View tabs, View All Status Alerts shows the following alerts:

- Informational
- Degraded
- Critical

The following image illustrates the informational status alerts generated during the configuration of a logical drive.
The Initial System Configuration Wizard is the easiest and simplest method to initially configure your system. You are prompted in a logical sequence for storage, iSCSI, logon, and management settings. The wizard then uses those settings to configure the storage as an iSCSI target and make it available to the iSCSI initiator.

**NOTE:**

This configuration method is best for single-server environments needing bulk storage:
- One IP address is assigned to each data port.
- One target is created.
- One initiator is identified.

For more control over an initial configuration or to make changes to an existing configuration, use the SMU Configure tab. (See “Configure” on page 25.)

To use the wizard:
1. Access the SMU. (For more information, see “Accessing the SMU” on page 15.)
2. When prompted, click OK to use the wizard.

**NOTE:**
- If the Configure tab is displayed instead of the prompt, click the Wizards tab to access the wizard.
- If the View tab is displayed instead of the prompt, the system is already configured and the wizard is not available. Click the Configure tab to enter additions or changes to the existing configuration.
- Portions of the Initial System Configuration Wizard are available in the following circumstances:
  - If the system is completely unconfigured, all pages of the wizard are available.
  - If IP addresses have not been assigned to the data ports, targets have not been created, or initiators have not been added, the iSCSI Configuration page is available.
  - If IP addresses have not been assigned to the redundant data ports, the Redundant iSCSI Configuration page is available.
  - If there are unassigned physical hard drives or unused space in an array and iSCSI settings have not been entered, the Storage Configuration page is available in addition to the iSCSI Configuration page.
3. In the initial Welcome page, expand the drop-down box on the left side of the page to display the steps included in the wizard.

4. When prompted, click **Next**.
5. In the Storage Configuration page, enter configuration settings for the logical drive.

NOTE:
- The wizard suggests a Fault Tolerance (RAID) level, unique to each installation, based on the detected number of storage enclosures, enclosure type (SATA or SCSI), number of available hard drives, drive generation, speed, and size. To select a different RAID level, expand the Fault Tolerance drop-down box.
- Depending on your hardware configuration and selected RAID level, the Assign Spare option may not be displayed.
6. In the iSCSI Configuration page, enter values for one of the data ports.

**NOTE:**

- By default, the wizard recommends configuring **Data Port** SA0. HP recommends accepting the default.
- Assign an **IP Address** to the data port.
- VLANs are set up on the switch and are used as one method of controlling access to the storage. If using VLANs, enter the **VLAN ID** to use (0 = not used).
- The wizard suggests a default **iSCSI Target Name** and **iSCSI Target Alias**. Accept the default or enter user-defined values.
- Be sure to enter the **iSCSI Initiator Name** exactly as assigned in the iSCSI initiator software utility (on the server). Include all special characters, including periods and spaces. If the Initiator Name is entered incorrectly, the target cannot be presented to the initiator.
- In dual-controller configurations, the Redundant iSCSI Configuration page is displayed, to enter settings for a data port on the redundant module.
- To configure the remaining data ports, complete the Initial System Configuration Wizard process, and then use tasks available in the Configure tab. (For more information, see “Configuring management and data ports” on page 33.)
7. In the Logon Settings page, specify if you want to change access information.

![Logon Settings page screenshot]

**NOTE:**

To change the logon username and password, clear **Use Existing Administrator ID and Password**. The Logon Settings page expands, with options to change the Admin ID and Password.
In the Management Settings window, enter settings for the management port.

**NOTE:**
- **Port State** must be *Enabled* (default) to use the SMU. To re-enable SMU management, you must use a Command Line Interface (CLI) command. For more information, see the Command Line Interface user guide.
- Assign a **Host Name** to the storage system. (Default: chassis serial number)
- By default, the wizard suggests configuring **Logical Port Name MA0** as the primary management port. HP recommends accepting the default.
- To control the path of management traffic to and from the array controller, and to add one level of system security, HP recommends assigning a static IP address to the management port *that is in a different subnet than the data ports*. To assign a static IP address, expand the **DHCP Setting** drop-down box and change the setting to Disabled. The page expands (shown), showing the currently assigned IP address. Change this to the address you want to use for management traffic. After changing the IP address, you may need to re-connect to the SMU, using the newly assigned IP address.
- **VLANs** are set up on the switch and are used as one method of controlling access to the storage. If using VLANs, enter the **VLAN ID** to use (0 = not used).
9. After completing all steps of the wizard, a final confirmation window is displayed.

- Click **Finish** to apply the configuration settings.
- Click **Back** to change settings.
- Click **Cancel** to exit the wizard.

10. Wait for the utility to apply your settings.

11. After all settings have been applied, you may need to change the IP address of your management client device to be in the same subnet as the address assigned to the management port.

12. Access the ACU again, and navigate through the Configure and View tabs to familiarize yourself with the interface, your initial configuration, and available options.

**NOTE:**
Wizards are available for basic configuration tasks only. Use the **Manage** and **Configure** tabs to view and change your configuration. (For more information, see “Configure” on page 25 or “Diagnose” on page 77.)

**IMPORTANT:**
Perform the following tasks to complete the configuration:

- Enter security settings (optional, but recommended). (For more information, see “Security tasks” on page 51.)
- Enter configuration settings in the iSCSI initiator configuration software utility (on the server), including:
  - Adding target portals for the initiator to access.
  - Configuring the target portals. (Be sure to select the option to automatically restore the connection each time the system restarts.)
  - Logging on to establish an active session.
The Storage Management Utility (SMU) Diagnose tab is used to generate diagnostic information about the array controller.

1. Click **Generate Report**.
2. After a few moments, the report is displayed in a separate window.

3. As needed, use the options available in the report window menu bar to edit or save the diagnostic information to a file.
6 Update

Updating system firmware (Flash Firmware)

Available tasks

As shown in Figure 14, the Update tab includes two options:

- Updating MSA firmware
- Updating hard drive firmware

Figure 14 Update tab—task listing

Prerequisites

Before updating system firmware, make note of the following:

- When determining which MSA controller firmware version to use, review the requirements and information in the Compatibility Matrix(es), release notes, and other MSA announcements.
- Because firmware updates require least one restart of the MSA array and its attached storage enclosures, update system firmware only during a scheduled maintenance window.
- Before updating system firmware, stop all host traffic to the array controller.
- Before updating system firmware, make sure that a recent, known good backup of all data on the MSA array is available.
- Before updating system firmware, make sure that a copy of the configuration, including the iSCSI IP addressing and portal information, along with the hard drive, LUN, and target information is available.
• If it has been more than six months since you restarted your MSA storage system, HP recommends that you power-cycle the MSA (power off, and then power on) before updating the firmware to ensure that you are working with a fresh system.

• For newly installed MSA, do not perform a firmware update until controller batteries are fully charged.

• For existing MSA, do not perform a firmware update until you have confirmed that the “host mode” or “profile” for each connection is correctly set. The host mode identifies the operating system of each connection to the storage. Do not use the “default” setting. If the host mode is not properly set, hosts may lose access to the storage or experience other difficulties after the update. Depending on your operating system environment or user preference, the host mode is set through the “connection” commands of the CLI or through the “ACL” settings of the SMU. For more information, see the CLI or SMU user documents.

• In dual controller MSA1510i configurations, you MUST log off all redundant paths to the MSA array prior to beginning a firmware update. The update will not succeed if redundant paths are detected by the MPIO/DSM and may require multiple reboots to recover back to the original firmware version. There could also be potential loss of connection of the Internet Explorer to the management port if there are redundant paths during the flash update cycle.

• In dual controller MSA1510i configurations, only one of the two MSA controllers is updated directly. The second MSA controller is updated (cloned) when the MSA is power-cycled near the end of the updating procedure.

• Depending on the storage enclosure model attached to the MSA array (SATA or SCSI), you may be able to update enclosure firmware or hard drive firmware through the MSA utility.

• After the update is complete, be sure to check the status of the MSA for unexpected issues. After power-cycling the MSA array, verify the status of the connections, defined profile types, redundancy settings, and storage configuration.

• After the update is complete, power cycle the MSA and all of its attached hard drive storage enclosures to activate the new firmware.

**IMPORTANT:**
If you encounter any problems during the firmware update process, stop and contact HP technical support. See “HP technical support” on page 11 for support contact information.

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**Updating MSA firmware**

1. Determine which version firmware is currently installed on the MSA by using one of the following methods:
   - With the array controller powered on, press the **arrow** buttons on the front of the controller until the following message is displayed:
     
     **00 Array Controller Firmware ver <version>**.

   - From the SMU, select **View MSA 1510i Controller**. Then, view the Device Information in the right pane of the screen for the Firmware Version.
2. Obtain the latest firmware files and save to a temporary location on the host:
   a. Go to the MSA1510i Support page: http://www.hp.com/support
   b. Select your language.
   c. Select your operating system.
      The display is updated to include a list of available downloads for the specified operating system.
   d. If you are not yet registered, under the Subscribe to driver and support alerts banner, click Sign up now to receive e-mail notifications about MSA firmware or hardware, driver and support alerts, advisories, and notifications. This alert notification system is a one-way broadcasting method used to distribute important notices about HP devices.
   e. Click the title description of the download option to display important information about the update.
      • Click the Description tab for a brief overview about the download.
      • Click the Release Notes tab for detailed information about the download, including version information, compatibility information, a summary of changes, important notes, service considerations, and installation precautions.
   
   **IMPORTANT:**
   Be sure to review the online release notes and readme files for last-minute notifications about the update.

   f. After reviewing the release notes for update, click Download and follow the on-screen instructions to save the download bundle to a temporary directory on the server.
   
   **NOTE:**
   For downloaded ISO images, create a CD from the downloaded ISO file using a CD burning tool with the ability to burn a CD from an ISO file. Do not simply copy the ISO file to a blank CD.

3. Schedule a maintenance window for the update.
4. Ensure that there is a valid, recent backup of the system.
5. Stop all host traffic to the MSA array.
6. If the MSA has not been restarted in the last six months, power cycle the array.
7. From within the SMU, select **Update > Controller > Flash Firmware**.

8. Under the Flash Firmware banner, click **Browse** and navigate to the location of the previously-obtained firmware file, and then click **OK**.

9. Wait for a completion message to display.
   For example, the following messages are displayed on the MSA controller LCD panel:
   
   MSA1510i updates:  
   - 307 FIRMWARE FLASH DONE  
   - 313 FIRMWARE FLASH DONE ON BOX <n>
   
   MSA20 updates:  
   (Each attached storage enclosure is updated one at a time, in sequential box number order.)

**NOTE:**
Do not interfere with or cancel the download process. Interrupting the download process might corrupt the firmware.

10. Restart the MSA and its attached storage enclosures storage system by doing the following (newly downloaded firmware cannot be accessed until the MSA is restarted):
   
   a. Press and hold down the MSA Power on/Standby button for approximately five seconds to place the MSA in Standby mode.
   
   b. Power off all storage enclosures attached to the MSA.
   
   c. Wait approximately two minutes to ensure that the hard disk drives in the enclosures stop rotating.
   
   d. Restart all storage enclosures attached to the MSA.
   
   e. Wait approximately four minutes to allow the enclosures to complete their startup routines.
   
   f. Press and release the MSA Power on/Standby button to restart the MSA.
   
   g. Wait (up to eight minutes) for the STARTUP COMPLETE message to display on the MSA controller LCD panel.
11. View the messages displayed on the array controller LCD panel during startup to confirm that the firmware was installed successfully and that the array controller restarts successfully.

**NOTE:**

In dual-controller configurations, firmware on the two controllers is compared each time the MSA chassis is restarted. If the versions are mismatched, the system prompts to clone the firmware on the controller with the latest version over to the controller with the earlier version firmware. (For the system to operate in a dual-controller mode, firmware on the controllers must match.)

The following message is displayed on the LCD panel of the controller with the earlier firmware:

07 CLONE Firmware ? ‘<’ = NO, ‘>’ = YES

Press the > button on the LCD panel to clone the firmware. During the cloning process, informational messages are displayed on the controller LCD panels. When the cloning process is complete, the just-updated controller automatically restarts.

---

**Updating hard drive firmware**

SCSI hard drive firmware updates are performed using files on the ProLiant Firmware Maintenance CD and are required only when the following message is displayed on the MSA controller LCD panel:

85 BAD DRIVE Firmware BOX <n> BAY <n>

**CAUTION:**

Before downloading new firmware, make note of the following:

- Update system firmware during a scheduled maintenance window.
- Stop all host traffic to the array controller during the updating process.
- Make sure that a recent, known good back up of all data on the MSA array is available before updating system firmware.
- Make sure that a copy of the configuration, including the iSCSI IP addressing and portal information, along with the hard drive, LUN, and target information is available before updating system firmware.
- If it has been more than six months since you restarted your MSA storage system, HP recommends that you power-cycle the MSA (power off, and then power on) before updating the firmware to ensure that you are working with a fresh system.
- After the update is complete, power cycle the MSA and all of its attached hard drive storage enclosures to activate the new firmware.
- For newly installed MSA, do not perform a firmware update until the controller batteries are fully charged.

1. Obtain the ISO image for the latest ProLiant Firmware Maintenance CD from the following website: http://www.hp.com/support/proliantstorage. Then, burn the image onto a CD using a standard CD-ROM burning utility. Do not simply copy the ISO file to a blank CD.

**NOTE:**

If the latest Firmware Maintenance CD does not include the latest-release drive firmware contained in a Smart Component, the CD can be used in combination with the latest individual Smart Component package to perform the update.

2. Insert the CD into the CD-ROM drive of the server.

3. Using the navigation window, locate the inventory file on the CD and copy it to a temporary location on the host. The filename may be similar to InventoryResultsLinux.xml.
4. Open a browser and access the SMU.
5. Select **Update > Storage System > Flash Firmware.**

6. Under the **Upload Inventory Firmware XML File** banner, click **Browse**, navigate to the location of the previously-obtained XML firmware file, select an updating option, and then click **OK**.

7. Wait for the MSA1510i to process the XML file and update the display with a list of all Smart Components that need updating.

8. In the updated display, select a Smart Component from the list.

9. Under the **Upload Smart Component File** banner, click **Browse**, navigate to the location of the Smart Component firmware file on the CD, and then click **OK**. The system processes the Smart Component and updates all hard drives, based on the list generated in Step 6. As the hard drives are updated, progress information is displayed on the screen.
A Storage overview

- Arrays and logical drives
- Fault-tolerance levels
- Comparison of RAID Methods
- Choosing a RAID level

Arrays and logical drives

The capacity and performance of a single physical hard drive is adequate for home users. However, business users demand higher storage capacities, higher data transfer rates, and greater protection against data loss when a hard drive fails.

Connecting extra physical drives to a system increases the total storage capacity (Figure 15), but has no effect on the efficiency of read/write operations. Data is still transferred to only one physical drive at a time.

**Figure 15 Multiple physical drives (D1, D2, and D3) in a system**

An array controller combines several physical drives into one or more virtual units called logical drives, which have superior performance, capacity, and/or fault tolerant features than separate physical drives. The read/write heads of all included physical drives are active simultaneously, reducing the total time required for data transfer.

**Figure 16 Multiple physical drives (D1, D2, and D3) configured into one logical drive (L1)**

Because the read/write heads are active simultaneously, the same amount of data is written to each drive during any given time interval. Each unit of data is called a block, and adjacent blocks form a set of data stripes across all physical drives in that logical drive (Figure 17).
Figure 17 Data striping (S1-S4) and data blocks (B1-B12) on multiple physical drives (D1, D2, D3)

For data in the logical drive to be readable, the data block sequence must be the same in every stripe. This sequencing process is performed by the array controller, which sends the data blocks to the drive write heads in the correct order.

A natural consequence of the striping process is that each physical drive in a given logical drive will contain the same amount of usable space. If one physical drive has a larger capacity than other physical drives in the same logical drive, the extra capacity is wasted, because it cannot be used by the logical drive.

The group of physical drives containing the logical drive is called a drive array (or just array). Because all physical drives in an array are commonly configured into just one logical drive, the term array is also often used as a synonym for logical drive. However, an array can contain several logical drives, each of a different size (Figure 18).

Figure 18 Two arrays (A1, A2) containing five logical drives (L1 through L5) spread across five physical drives (D1 through D5)

Each logical drive in an array is distributed across all of the physical drives within the array. A logical drive can also extend across more than one storage enclosure attached to the array system.

Drive failure, although rare, is potentially catastrophic. For example, in Figure 18, failure of any one physical drive in an array causes every logical drive in the array to suffer irretrievable data loss.

To protect against data loss due to physical drive failure, logical drives are usually configured with fault tolerance.

Fault-tolerance levels

To protect against data loss due to physical drive failure, logical drives are usually configured with fault tolerance. The following configuration types are available:

- RAID 0—no fault tolerance
- RAID 1+0—drive mirroring
- RAID 5—distributed data guarding
- RAID 6—advanced data guarding

For any configuration except RAID 0, further protection against data loss can be achieved by assigning a drive as an online spare. This drive contains no data and is connected to the same controller as the array. When any other physical drive in the array fails, the controller automatically rebuilds information
that was originally on the failed drive to the online spare. The system is quickly restored to full RAID-level
data protection. (In the unlikely event that another drive in the array fails while data is being rewritten to
the spare, the logical drive will still fail.)

A spare is assigned to an array and is automatically assigned to all logical drives in the same array.
You do not need to assign a separate spare to each array; you can configure one hard drive to be
the spare for several arrays.

RAID 0—no fault tolerance

This configuration (Figure 17) provides no protection against data loss when a drive fails. However, it is
useful for rapid storage of large amounts of non-critical data (for printing or image editing, for example),
or when cost is the most important consideration.

Table 3 RAID 0 features

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest performance method for writes.</td>
<td>All data on the logical drive is lost if a physical drive fails.</td>
</tr>
<tr>
<td>Lowest cost per unit of stored data.</td>
<td>Cannot use a spare.</td>
</tr>
<tr>
<td>All drive capacity is used to store data (none needed for fault tolerance).</td>
<td>Can only preserve data by backing it up to external storage media.</td>
</tr>
</tbody>
</table>

RAID 1+0—drive mirroring

In this configuration, data on a physical hard drive is duplicated to a second hard drive.

**NOTE:**

When only two hard drives are included in the array, this fault-tolerance method is called RAID 1. When
more than two hard drives are included in the array, this fault-tolerance method is called RAID 1+0.
(RAID_1 is not supported on the MSA1510i storage system.)

![Figure 19 RAID 1 array, with two physical hard drives (D1, D2)](image)

When the array has more than two physical drives, drives are mirrored in pairs (Figure 20).
Figure 20 RAID 1+0 array, with eight physical hard drives (D1 through D8)

In each mirrored pair, the physical drive that is not busy answering other requests answers any read request sent to the array. (This behavior is called load balancing.) If a physical drive fails, the remaining drive in the mirrored pair can still provide all the necessary data. Several drives in the array can fail without incurring data loss, as long as no two failed drives belong to the same mirrored pair.

RAID 1+0 is useful when high performance and data protection are more important than the cost of physical drives.

Table 4 RAID 1, RAID 1+0 features

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest read and write performance of any fault-tolerant configuration.</td>
<td>Expensive (half of the drives are used for fault tolerance).</td>
</tr>
<tr>
<td>No loss of data as long as no failed drive is mirrored to another failed drive.</td>
<td>Only half of total drive capacity usable for data storage.</td>
</tr>
</tbody>
</table>

RAID 5—distributed data guarding

In this method, a block of parity data is calculated for each stripe from the data that is in all other blocks within that stripe. The blocks of parity data are distributed across every physical drive within the logical drive (Figure 21). When a physical drive fails, data that was on the failed drive can be calculated from the data on the remaining drives and the parity data. This recovered data is written to the assigned spare or to a replacement drive in a process called a rebuild.

Figure 21 RAID 5 array, with three physical hard drives (D1, D2, D3) showing distributed parity information (P_{x,y})

This configuration is useful when cost, performance, and data availability are equally important.
Table 5 RAID 5 features

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>No loss of data if one physical drive fails.</td>
<td>Loss of data if a second drive fails before data from the first failed drive is rebuilt.</td>
</tr>
<tr>
<td>More usable drive capacity than RAID 1+0, because parity information requires the storage space equivalent to one physical drive.</td>
<td></td>
</tr>
</tbody>
</table>

RAID 6—advanced data guarding

RAID 6 (also called RAID ADG) is similar to RAID 5, because both methods generate and store parity information to protect against data loss caused by drive failure. With RAID 6, however, two different sets of parity data are distributed across the physical drives, allowing data to be preserved even if two drives fail. Each set of parity data uses up a capacity equivalent to that of one of the constituent drives, as shown in Figure 22.

Figure 22 RAID 6 (ADG) array, with four physical hard drives (D1, D2, D3, D4) showing distributed parity information (Px,y)(Qx,y)

This method is most useful when data loss is unacceptable, but cost is also an important factor. The probability that data loss will occur when arrays are configured with RAID 6 (ADG) is less than when they are configured with RAID 5.

Table 6 RAID 6 (ADG) features

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>High read performance.</td>
<td>Relatively low write performance (lower than RAID 5), because of the need to create two sets of parity data.</td>
</tr>
<tr>
<td>High data availability—Any two drives can fail without loss of critical data.</td>
<td></td>
</tr>
<tr>
<td>More drive capacity is usable than with RAID 1+0—Parity information requires only the storage equivalent to two physical drives.</td>
<td></td>
</tr>
</tbody>
</table>

Comparison of RAID Methods

Table 7 summarizes important features of the different RAID levels.
### Table 7 Summary of RAID methods

<table>
<thead>
<tr>
<th></th>
<th>RAID 0</th>
<th>RAID 1+0</th>
<th>RAID 5</th>
<th>RAID 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative name</td>
<td>Striping</td>
<td>Mirroring</td>
<td>Distributed Data Guarding (DDG)</td>
<td>Advanced Data Guarding (ADG)</td>
</tr>
<tr>
<td>Usable drive space*</td>
<td>100%</td>
<td>50%</td>
<td>67% to 93%</td>
<td>50% to 96%</td>
</tr>
<tr>
<td>Usable drive space formula</td>
<td>n</td>
<td>n/2</td>
<td>(n-1)/n</td>
<td>(n-2)/n</td>
</tr>
<tr>
<td>Minimum number of physical drives</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Tolerates physical drive failure?</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Tolerates simultaneous failure of more than one physical drive?</td>
<td>No</td>
<td>Only if no two failed drives are in a mirrored pair</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Read performance</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Write performance</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Relative cost</td>
<td>Low</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
</tbody>
</table>

*Values for usable drive space are calculated with these assumptions:
- All physical drives in the array have the same capacity.
- Online spares are not used.
- No more than 14 physical drives are used per array for RAID 5.
- No more than 56 drives are used with RAID 6.

### Choosing a RAID level

Use Table 8 to help you determine the best RAID level for your environment.

### Table 8 Choosing a RAID level

<table>
<thead>
<tr>
<th>Most important characteristic</th>
<th>Also important</th>
<th>Suggested RAID level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault tolerance</td>
<td>Cost effectiveness</td>
<td>RAID 6</td>
</tr>
<tr>
<td></td>
<td>I/O performance</td>
<td>RAID 1+0</td>
</tr>
<tr>
<td>Cost effectiveness</td>
<td>Fault tolerance</td>
<td>RAID 6*</td>
</tr>
<tr>
<td></td>
<td>I/O performance</td>
<td>RAID 5 (RAID 0 if fault tolerance is not required)</td>
</tr>
<tr>
<td>I/O performance</td>
<td>Cost effectiveness</td>
<td>RAID 5 (RAID 0 if fault tolerance is not required)</td>
</tr>
<tr>
<td></td>
<td>Fault tolerance</td>
<td>RAID 1+0</td>
</tr>
</tbody>
</table>
## Table 9 describes SMU icons.

### Table 9 SMU icons

<table>
<thead>
<tr>
<th>Icon</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Icon]</td>
<td>Top-level storage system</td>
</tr>
<tr>
<td>![Icon]</td>
<td>Controller—Active</td>
</tr>
<tr>
<td>![Icon]</td>
<td>Controller—Standby</td>
</tr>
<tr>
<td>![Icon]</td>
<td>Management or data port—Disabled</td>
</tr>
<tr>
<td>![Icon]</td>
<td>Management or data port—Enabled</td>
</tr>
<tr>
<td>![Icon]</td>
<td>IP address</td>
</tr>
<tr>
<td>![Icon]</td>
<td>Portal</td>
</tr>
<tr>
<td>![Icon]</td>
<td>Connection</td>
</tr>
<tr>
<td>![Icon]</td>
<td>Session</td>
</tr>
<tr>
<td>![Icon]</td>
<td>Route</td>
</tr>
<tr>
<td>![Icon]</td>
<td>Target</td>
</tr>
<tr>
<td>![Icon]</td>
<td>Mapped logical drive</td>
</tr>
<tr>
<td>![Icon]</td>
<td>Portal group</td>
</tr>
<tr>
<td>Icon</td>
<td>Meaning</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
</tr>
<tr>
<td><img src="image" alt="Initiator Icon" /></td>
<td>Initiator</td>
</tr>
<tr>
<td><img src="image" alt="Logical Drive Icon" /></td>
<td>Logical drive</td>
</tr>
<tr>
<td><img src="image" alt="Logical Drive - Being Expanded Icon" /></td>
<td>Logical drive—Being expanded (animated icon)</td>
</tr>
<tr>
<td><img src="image" alt="Logical Drive - Being Rebuilt Icon" /></td>
<td>Logical drive—Being rebuilt (animated icon)</td>
</tr>
<tr>
<td><img src="image" alt="SATA Array Icon" /></td>
<td>SATA array</td>
</tr>
<tr>
<td><img src="image" alt="SATA Hard Drive Icon" /></td>
<td>SATA hard drive</td>
</tr>
<tr>
<td><img src="image" alt="SATA Hard Drive - Spare Icon" /></td>
<td>SATA hard drive—Spare</td>
</tr>
<tr>
<td><img src="image" alt="SATA Hard Drive - Active Spare Icon" /></td>
<td>SATA hard drive—Active spare (animated icon)</td>
</tr>
<tr>
<td><img src="image" alt="SATA Hard Drive - Being Rebuilt Icon" /></td>
<td>SATA hard drive—Being rebuilt (animated icon)</td>
</tr>
<tr>
<td><img src="image" alt="SATA Hard Drive - Active Spare - Being Rebuilt Icon" /></td>
<td>SATA hard drive—Active spare—Being rebuilt (animated icon)</td>
</tr>
<tr>
<td><img src="image" alt="SCSI Array Icon" /></td>
<td>SCSI array</td>
</tr>
<tr>
<td><img src="image" alt="SCSI Hard Drive Icon" /></td>
<td>SCSI hard drive</td>
</tr>
<tr>
<td><img src="image" alt="SCSI Hard Drive - Spare Drive Icon" /></td>
<td>SCSI hard drive—Spare drive</td>
</tr>
<tr>
<td><img src="image" alt="SCSI Hard Drive - Active Spare Icon" /></td>
<td>SCSI hard drive—Active spare (animated icon)</td>
</tr>
<tr>
<td><img src="image" alt="SCSI Hard Drive - Being Rebuilt Icon" /></td>
<td>SCSI hard drive—Being rebuilt (animated icon)</td>
</tr>
<tr>
<td><img src="image" alt="SCSI Hard Drive - Active Spare - Being Rebuilt Icon" /></td>
<td>SCSI hard drive—Active spare—Being rebuilt (animated icon)</td>
</tr>
<tr>
<td><img src="image" alt="Smart Component Icon" /></td>
<td>Smart component</td>
</tr>
<tr>
<td>Icon</td>
<td>Meaning</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
</tr>
<tr>
<td>✗</td>
<td>Status—Critical</td>
</tr>
<tr>
<td>⚠</td>
<td>Status—Degraded</td>
</tr>
<tr>
<td>✔</td>
<td>Status—Okay</td>
</tr>
<tr>
<td>🔄</td>
<td>Status - Pause/standby</td>
</tr>
<tr>
<td>?</td>
<td>Help</td>
</tr>
<tr>
<td>📘</td>
<td>More information is available for this component. View the status alerts.</td>
</tr>
</tbody>
</table>
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