

HP Direct-Connect External SAS Storage for HP BladeSystem Solutions Deployment Guide

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Revision History

Edition	Date	Description
First	December 2008	Initial release. Described all solution devices, including the MSA2000 G1 shared SAS external storage enclosure.
Second	June 2009	Added the MSA2000 G2 shared SAS external storage enclosure. Added the MDS600 zoned SAS external storage enclosure.
Third	December 2009	Added examples of newly supported configurations.

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Support and other resources

Contacting HP

Before you contact HP

Be sure to have the following information available before you call or contact HP:

- Technical support registration number (if applicable)
- Product serial number
- Product model name and number
- Product identification number
- Applicable error message
- Add-on boards or hardware
- Third-party hardware or software
- Operating system type and revision level

HP contact information

For the name of the nearest HP authorized reseller:

- See the Contact HP worldwide (in English) website <http://welcome.hp.com/country/us/en/www-contact.html>.

For HP technical support:

- In the United States, for contact options see the Contact HP United States website http://welcome.hp.com/country/us/en/contact_us.html. To contact HP by phone:
 - Call 1-800-HP-INVENT (1-800-474-6836). This service is available 24 hours a day, 7 days a week. For continuous quality improvement, calls may be recorded or monitored.
 - If you have purchased a Care Pack (service upgrade), call 1-800-633-3600. For more information about Care Packs, refer to the HP website <http://www.hp.com/hps>.

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 email notification of product enhancements, new driver versions, firmware updates, and other product resources.

Document conventions and symbols

Convention	Element
Blue text: Document conventions and symbols	Cross-reference links and e-mail addresses
Blue, underlined text: http://www.hp.com	Website addresses
Bold text	<ul style="list-style-type: none">• Keys that are pressed• Text typed into a GUI element, such as a box• GUI elements that are clicked or selected, such as menu and list items, buttons, tabs, and check boxes
<i>Italic</i> text	Text emphasis
Monospace text	<ul style="list-style-type: none">• File and directory names• System output• Code• Commands, their arguments, and argument values
<i>Monospace, italic</i> text	<ul style="list-style-type: none">• Code variables• Command variables
Monospace, bold text	Emphasized monospace text

 **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.

Customer self repair

HP customer self repair (CSR) programs allow you to repair your StorageWorks product. If a CSR part needs replacing, HP ships the part directly to you so that you can install it at your convenience. Some parts do not qualify for CSR. Your HP-authorized service provider will determine whether a repair can be accomplished by CSR.

For more information about CSR, contact your local service provider, or see the CSR website <http://www.hp.com/go/selfrepair>.

Rack stability

Rack stability protects personnel and equipment.

WARNING!

To reduce the risk of personal injury or damage to equipment:

- Extend leveling jacks to the floor.
 - Ensure that the full weight of the rack rests on the leveling jacks.
 - Install stabilizing feet on the rack.
 - In multiple-rack installations, fasten racks together securely.
 - Extend only one rack component at a time. Racks can become unstable if more than one component is extended.
-

Part I. Solution devices and concepts

The following chapters describe supported solution devices and concepts:

- [Introduction](#), page 11
- [Device information](#), page 17
- [High availability information](#), page 41
- [Zoning information](#), page 43
- [Installation overview and best practices](#), page 45
- [Solution management tools](#), page 55
- [Device worksheets](#), page 65

1 Introduction

This document provides guidelines, instructions, and examples for attaching external SAS storage enclosures to an HP BladeSystem c-Class enclosure. These deployment guidelines and configuration examples will help when deploying a solution centered around a BladeSystem c-Class enclosure with server blades, SAS mezzanines and interconnect devices, and external SAS storage enclosures. To round out the solution, MSL Tape Libraries and Tape Autoloaders are also included.



Topics discussed in this guide

This guide includes the following topics:

- General descriptions and primary features of devices in a BladeSystem solution with external SAS storage enclosures
- Links to essential installation, setup, and user instructions for each device
- Information about high availability and performance
- Information about different zoning techniques and scenarios
- Summary of the fundamental steps required to successfully deploy a BladeSystem solution with external SAS storage enclosures
- Configuration and cabling examples
- Worksheets for recording system information

NOTE:

Detailed physical installation and setup instructions are not provided in this document. For detailed hardware and software installation and configuration instructions, see user documents for individual devices. The purpose of this document is to provide installation and configuration guidelines and examples.

Devices referred to in this deployment guide

The following hardware components may be included in a BladeSystem solution with external SAS storage enclosures:

- HP BladeSystem c-Class c3000 and c7000 Enclosures
- HP BladeSystem c-Class ProLiant Server Blades
- HP BladeSystem c-Class SAS P700m Mezzanine cards
- HP BladeSystem c-Class SAS BL Switches
- HP StorageWorks 600 Modular Disk System drive enclosures
- HP StorageWorks 2000sa or 2000sa G2 Modular Smart Array controller and drive enclosures
- HP StorageWorks MSL Tape Libraries and 1/8 G2 Tape Autoloader

Documents referred to in this deployment guide

BladeSystem enclosures and devices:

- *HP BladeSystem c-Class Solution Overview Setup Poster*
- *HP BladeSystem c3000/c7000 Enclosure Quick Setup Instructions*
- *HP BladeSystem c3000/c7000 Enclosure Setup and Installation Guide*
- *HP BladeSystem Onboard Administrator User Guide*
- *HP StorageWorks ProLiant Server Blade Installation Instructions*
- *HP ProLiant Server Blade User Guide*
- *HP Smart Array P700m Controller Installation Overview*
- *HP Smart Array P700m Controller for HP ProLiant Servers User Guide*
- *HP StorageWorks 3Gb SAS BL Switch Installation Instructions*

MDS600 storage enclosures:

- *HP StorageWorks 600 Modular Disk System Setup Poster*
- *HP StorageWorks 600 Modular Disk System User Guide*
- *HP StorageWorks 600 Modular Disk System Maintenance and Service Guide*

MSA2000sa storage enclosures:

- *HP StorageWorks 2000 Modular Smart Array Racking Instructions*
- *HP StorageWorks 2000 Modular Smart Array Family Installation Road Map*
- *HP StorageWorks 2000sa Modular Smart Array Supported Cable Configurations*
- *HP StorageWorks 2012sa Modular Smart Array User Guide*
- *HP StorageWorks 2000 Modular Smart Array Family Reference Guide*
- *HP StorageWorks 2000 Family Modular Smart Array CLI Reference Guide*
- *HP StorageWorks 2000 Family Modular Smart Array Firmware Upgrade Instructions*

MSA2000sa G2 storage enclosures:

- *HP StorageWorks 2000 Modular Smart Array racking instructions*
- *HP StorageWorks 2000 Modular Smart Array Family installation road map*
- *HP StorageWorks MSA2000 G2 installation instructions*
- *HP StorageWorks 2000 G2 Modular Smart Array cable configuration guide*
- *HP StorageWorks 2000sa G2 Modular Smart Array User Guide*
- *HP StorageWorks 2000 G2 Modular Smart Array Reference Guide*
- *HP StorageWorks 2000 G2 Modular Smart Array CLI Reference Guide*
- *HP StorageWorks 2000 Family Modular Smart Array firmware upgrade instructions*

These and additional documents for devices in this solution are available on the HP Manuals website <http://www.hp.com/support/manuals> and on the device websites.

How to obtain detailed device information

For detailed installation, configuration, user, and reference information about the HP BladeSystem enclosure and its supported devices, note the types of information you can obtain from HP websites.

Available tasks in device websites

Some of the tasks you can perform in a device website include the following:

- In the initial display, read overview information and announcements about the device.
- In the grey selection box at the right of the page, click one of the **QuickSpecs** options to view detailed device and network specifications.
- In the grey selection box at the right of the page, click **Support & Documents** to access the Business Support Center page for the device. From this page, you can access a collection of Task and Resource links. Some of the links include:
 - **Download drivers and software**
 - **Setup, install, and configure** (information)
 - **Manuals** (to access user documents associated with the device)
 - **Sign up for driver and support alerts** (strongly recommended)
 - **Customer advisories**
 - **Customer notices**

Available tasks in the BladeSystem Technical Resources website

Some of the tasks you can perform in the BladeSystem documentation page (<http://www.hp.com/go/bladeSystem/documentation>) include the following:

- In the initial display, access and read conceptual documents and architectural overviews of the HP BladeSystem environment.
- In the **Install Your Solution** tab, select a device from the displayed list to access the following links for that device:
 - **QuickSpecs**
 - **Customer Advisories**
 - **Support and Documents**
 - **Quick Install Instructions** (the poster shipped with the device)
 - **User Guide** (the primary Installation and Setup or User guide for the device)

List of helpful HP websites

HP support: <http://www.hp.com/support>

HP storage: <http://www.hp.com/go/storage>

HP BladeSystem: <http://www.hp.com/go/bladeSystem>

Direct Connect SAS Storage for HP BladeSystem: www.hp.com/go/directconnect

HP BladeSystem technical resources (user documents, white papers, and support documents) <http://www.hp.com/go/bladeSystem/documentation>

HP BladeSystem components: <http://h18004.www1.hp.com/products/blades/components/c-class-components.html>

HP BladeSystem interconnect devices: <http://h18004.www1.hp.com/products/blades/components/c-class-interconnects.html>

HP BladeSystem adapters and mezzanines: <http://h18004.www1.hp.com/products/blades/components/c-class-adapters.html>

HP MDS600: <http://www.hp.com/go/mds600>

HP MSA2000sa: <http://www.hp.com/go/msa2000sa> (under **Previous Generation**)

HP MSA2000sa G2: <http://www.hp.com/go/msa2000sa>

Tape Storage & Media website: <http://www.hp.com/go/tape> (under **Business Class Libraries** or **Tape Autoloaders**)

Getting started

To help you successfully deploy this solution in your environment, be sure to do the following:

- Locate a workstation with a CD-ROM drive and access to the Internet, for reading component-specific user documents from the CD or HP website associated with the component.
- Prepare the site for the power and cooling needs of the solution and its components. (See the user documents for your c-Class BladeSystem Enclosure.)
- Use the worksheets in this guide to record important information about your solution and its components. Device and system information recorded in these worksheets may be needed when initially installing and configuring the solution, and will be helpful for troubleshooting purposes. Because the number of devices differ for each deployment, print or copy pages as needed. (“[Device worksheets](#)” on page 65).
- Identify all of the components you plan to deploy in the solution, whether newly arrived and in boxes or already installed and in use.
- Review the QuickSpecs for the mezzanine, switch, and storage enclosures to make sure that your planned configuration, including number of servers, is supported.
- Plan to update firmware on all devices in the solution; devices in this solution may require a firmware update. Prepare for and include this step when installing the devices.

2 Device information

Overview information is provided for the following solution devices:

- [HP BladeSystem c-Class Enclosures](#), page 17
- [HP BladeSystem c-Class Server Blades](#), page 20
- [HP P700m SAS Mezzanine card](#), page 22
- [HP StorageWorks 3Gb SAS BL Switch](#), page 24
- [HP StorageWorks 600 Modular Disk System](#), page 27
- [HP StorageWorks 2000sa Modular Smart Array](#), page 30
- [HP StorageWorks MSL2024, MSL4048, and MSL8096 Tape Libraries and 1/8 G2 Tape Auto-loader](#), page 37
- [Rack and power](#), page 39

HP BladeSystem c-Class Enclosures

The HP BladeSystem c-Class enclosure serves as the host for a variety of common form factor components. The architecture uses scalable device bays (for server or storage blades) and interconnect bays (for interconnect modules providing fabric connectivity) that help to scale up or scale out the BladeSystem infrastructure.

Each HP BladeSystem c-Class Enclosure includes redundant power supply and cooling fan modules, plus the Onboard Administrator module and Insight Display diagnostic LCD panel for setup and maintenance. Redundant components and a nonstop mid-plane keep everything up and running at top performance. In addition, HP BladeSystem c-Class enclosures use thermal logic technology to save on power and cooling.

Insight Display wizards, Onboard Administrator software, and Virtual Connect architecture allow you to set up and maintain the system, and facilitate adding, replacing, and recovering servers and other components with ease.

HP offers two c-Class enclosure models to match the needs of small and large environments: the c3000 and c7000.

- [HP BladeSystem c3000 enclosure](#)
- [HP BladeSystem c7000 enclosure](#)

For more information about c-Class enclosures, see the HP BladeSystem enclosures website: <http://h18004.www1.hp.com/products/ blades/components/enclosures/c-class/index.html>.

HP BladeSystem c3000 enclosure

The HP BladeSystem c3000 is built uniquely for small spaces without requiring special power and cooling capabilities. It provides eight device bays and four interconnect bays in a 6U rack-mount or tower-mount configuration.



For more information

Device website: <http://h18004.www1.hp.com/products/blades/components/enclosures/c-class/c3000/>

BladeSystem Technical Resources website: <http://www.hp.com/go/bladeSystem/documentation>

Be sure to read the following documents, shipped with the enclosure:

- *HP BladeSystem c-Class Solution Overview Setup Poster*—Provides an overview of the complete installation process of an HP BladeSystem c-Class solution.
- *HP BladeSystem c3000 Enclosure Quick Setup Instructions*—Includes brief physical installation instructions for the enclosure.
- *BladeSystem c3000 Enclosure Rack Template*—Provides a physical template for helping mount the enclosure in a rack.

For more detailed information about the enclosure, see the following documents, available on HP websites:

- *HP BladeSystem c3000 Enclosure Setup and Installation Guide*—Includes detailed hardware description, installation, and user information
- *HP BladeSystem Onboard Administrator User Guide*—Includes information on using Onboard Administrator.
- *HP BladeSystem c-Class Enclosure Troubleshooting Guide*—Provides procedures and solutions for troubleshooting an HP BladeSystem c-Class enclosure, from using the Insight Display to more complex component-level troubleshooting.

HP BladeSystem c7000 enclosure

The HP BladeSystem c7000 enclosure is ideal for larger data centers with more dynamic data center environments. It provides 16 device bays and 8 interconnect bays in a 10U rack-mount configuration.



For more information

Device website: <http://h18004.www1.hp.com/products/blades/components/enclosures/c-class/c7000/>

BladeSystem Technical Resources website: <http://www.hp.com/go/bladeSystem/documentation>

Be sure to read the following documents, shipped with the enclosure:

- *HP BladeSystem c-Class Solution Overview Setup Poster*—Provides an overview of the complete installation process of an HP BladeSystem c-Class solution.
- *HP BladeSystem c7000 Enclosure Quick Setup Instructions*—Includes brief physical installation instructions of the enclosure.
- *BladeSystem c7000 Enclosure Rack Template*—Provides a physical template for helping mount the enclosure in a rack.

For more detailed information about the enclosure, see the following documents, available on HP websites:

- *HP BladeSystem c7000 Enclosure Setup and Installation Guide*—Includes detailed hardware description, installation, and user information
- *HP BladeSystem Onboard Administrator User Guide*—Includes information on using Onboard Administrator.
- *HP BladeSystem c-Class Enclosure Troubleshooting Guide*—Provides procedures and solutions for troubleshooting an HP BladeSystem c-Class enclosure, from using the Insight Display to more complex component-level troubleshooting.

HP BladeSystem c-Class Server Blades

An HP c-Class Server blade is a fully-function server that slides into an HP BladeSystem c-Class Enclosure, in contrast to a server that is mounted in a rack. The great advantage of blade architecture is the easy addition of more server blades to your environment.

The HP BladeSystem c-Class Enclosures support server blade models that are built in standardized form factors, referred to as half-height (4U) or full-height (8U). Double-density (also referred to as double-density) server blades are available, with two servers housed in the same form factor as a half-height server blade.

ProLiant Server Blades

HP ProLiant c-Class server blades share the same features and design standards of traditional rack-mounted ProLiant servers. A variety of server blade models is available, each with different features, such as using different processors, number of processors included, memory types, and maximum amount of supported memory.

To learn more about available server blade models and their features, see the HP BladeSystem c-Class ProLiant Server Blades website: <http://h18004.www1.hp.com/products/blades/components/c-class-bladeservers.html>.



Example half-height server blade

Example full-height server blade

Example double-density server blade

For more information

Device website: <http://h18004.www1.hp.com/products/blades/components/c-class-bladeservers.html>

BladeSystem Technical Resources website: <http://www.hp.com/go/bladeSystem/documentation>

Be sure to read the following documents, shipped with the server blade and BladeSystem enclosure:

- *HP StorageWorks ProLiant Server Blade Installation Instructions*—Includes physical installation instructions.
- *HP BladeSystem c-Class Solution Overview Setup Poster*—Provides an overview of the complete installation process of an HP BladeSystem c-Class solution.

For more detailed information about the server blade, see the following documents, available on HP websites:

- *HP ProLiant Server Blade User Guide*—Includes detailed hardware description and user information

Important tips

- Compatibility dependencies exist among components. See the QuickSpecs for your existing or potential components to confirm compatibility. QuickSpecs are available for each component on the HP BladeSystem website: <http://www.hp.com/go/bladeSystem>.
- The number of processors, DIMM slots, adapter and mezzanine slots, and other features differ for server blade models.
- The maximum number of servers allowed to access an MSA2000sa is 32, whether housed in one or two c-Class enclosures. The type of server blade is not relevant; the maximum is 32.
- Double-density server blades have unique requirements compared to other server blades, including:
 - Two P700m mezzanine cards must be installed on the double-density server blade; one for each server node.
 - When a c7000 enclosure is populated with double-density server blades, four 3Gb SAS BL Switches must be installed in the enclosure.
 - “A-side” servers (1A-16A) are automatically routed through switches installed in interconnect bays 5 and 6.
 - “B-side” servers (1B-16B) are automatically routed through switches installed in interconnect bays 7 and 8.

HP P700m SAS Mezzanine card

The HP P700m SAS mezzanine card is HP's first PCI-Express SAS Smart Array card that supports external shared storage for c-Class enclosures. One P700m is installed on each HP ProLiant server blade. (Two are installed on double-density server blades; one on each server node.)

Key features of P700m offerings include:

- Low cost
- Full feature options
- 3Gb SAS connections through the c-Class enclosure high speed mid-plane to the switch
- High availability, with four physical ports, each of which consists of two SAS links (x2), resulting in 4 (x2) ports.
- High performance, with data bandwidth up to 600 MB/s per port (300 MB/s per SAS link)
- HP Smart Array Server Software, including SmartStart and HP Systems Insight Manager (SIM)

Two models of the P700m mezzanine card are available: the 256 MB cache model is a low-cost mezzanine card that satisfies the basic requirements for an HP c-Class external SAS storage solution, and the 512 MB cache model that has enhanced features, including battery backed cache options that offers additional flexibility.



For more information

Device website: <http://h18004.www1.hp.com/products/blades/components/c-class-adapters.html>

BladeSystem Technical Resources website: <http://www.hp.com/go/bladessystem/documentation>

Be sure to read the following documents, shipped with the mezzanine card and BladeSystem enclosure:

- *HP Smart Array P700m Controller Installation Overview*—Includes physical installation instructions.
- *HP BladeSystem c-Class Solution Overview Setup Poster*—Provides an overview of the complete installation process of an HP BladeSystem c-Class solution.

For more detailed information about the mezzanine card, see the following documents, available on HP websites:

- *HP Smart Array P700m Controller for HP ProLiant Servers User Guide*—Includes detailed hardware description and user information

Important tips

- In zoned solutions such as those using the MDS600 storage enclosure, the 512 MB model P700m SAS mezzanine card is required.
- The same model P700m (256 MB cache or 512 cache) must be installed on all servers housed in the same BladeSystem c-Class enclosure.
- Only one P700m is supported per server blade node. On double-density server blades, two P700m are supported; one for each server node. Installing more than one P700m per server blade node will result in an unsupported configuration.
- In c3000 BladeSystem enclosure environments:
 - For half-height server blades, the P700m must be installed in mezzanine slot 2.
 - For full-height server blades, the P700m can be installed in mezzanine slot 1, 2, or 3, with 2 being the preferred location.
 - For double-density server blades, a P700m must be installed in each mezzanine slot (total of two; one for each server node).
- In c7000 BladeSystem enclosure environments:
 - For half-height server blades, the P700m can be installed in mezzanine slot 1 or 2, with 2 being the preferred location.
 - For full-height server blades, the P700m can be installed in mezzanine slot 1, 2, or 3, with 3 being the preferred location.
 - For double-density server blades, a P700m must be installed in each mezzanine slot (total of two; one for each server node).
- The mezzanine slot in which you install the P700m determines the bays in which you must install the SAS switches, because each mezzanine card slot maps to a specific interconnect device bay of the BladeSystem c-Class enclosure. For more information, see [“HP StorageWorks 3Gb SAS BL Switch”](#) on page 24 and the BladeSystem c-Class enclosure user documents.
- Be sure to upgrade to the latest firmware version before use.
- HP Smart Array Server Software is supported for use with the P700m and its servers, but it is important to note that the MSA2000 family does not use the Smart Array storage device management software tools – ACU, ADU, and Storage Event Notification Service. The MSA2000 family of controller enclosures use MSA2000-specific storage management software. For more information about the MSA, see [“HP StorageWorks 2000sa Modular Smart Array”](#) on page 30.

HP StorageWorks 3Gb SAS BL Switch

The HP StorageWorks 3Gb SAS BL Switch (SAS BL switch) is HP's first c-Class embedded SAS switch designed to provide external storage for HP c-Class server blades.



Key features of the 3Gb SAS BL Switch include:

- 3Gb SAS links through the BladeSystem c-Class enclosure high speed mid-plane to the server bays
- Sixteen internal SAS connections to BladeSystem c-Class server bays (x2 links)
- Eight external SAS ports for connections to HP external SAS storage enclosures (x4 links)
- High performance, with data bandwidth up to 1200MB/s per external SAS port (300 MB/s per link; 300MB/s x 4 links =1200 MB/s per port)
- High availability support
- Dual domain support
- Zoning support
- HP Virtual SAS Manager Software, for switch management and zoning tasks.

The 3Gb SAS BL Switch is a single-wide form factor and consumes one BladeSystem c-Class enclosure interconnect bay. High-availability configurations use two 3Gb SAS BL Switches installed in the same interconnect bay row.

To achieve proper connections, the interconnect bay in which you install the switch module must match up to the mezzanine slot in which the P700m card is installed. Connections between the P700m mezzanine cards on the server blades and the SAS switches in the interconnect bays are through independent traces (mappings) on the BladeSystem c-Class enclosure midplane.

For BladeSystem c3000 and c7000 enclosures, the SAS BL switch can be installed in the following interconnect bays:

BladeSystem enclosure model	Supported interconnect bays
c3000	3 and 4
c7000	3 and 4, or 5 and 6, or 7 and 8

For detailed information on port mappings for the c3000 and c7000 enclosures, see the *HP BladeSystem Onboard Administrator User Guide*, and c3000 or c7000 user documents.

As with other BladeSystem devices, the 3Gb SAS BL Switch can be managed through the Onboard Administrator web interface. In addition, the Virtual SAS Manager application provides switch-specific tasks, such as creating and assigning zone groups and updating switch firmware. For more information about configuring and managing the switch using VSM, see ["Zoning information"](#) on page 43 and ["Solution management tools"](#) on page 55.

For more information

Device website: http://h18006.www1.hp.com/products/storageworks/3gbsas_switch/index.html

BladeSystem Technical Resources website: <http://www.hp.com/go/bladeSystem/documentation>

Be sure to read the following documents, shipped with the switch and BladeSystem enclosure:

- *HP StorageWorks 3Gb SAS BL Switch Installation Instructions*—Includes physical installation instructions.
- *HP BladeSystem c-Class Solution Overview Setup Poster*—Provides an overview of the complete installation process of an HP BladeSystem c-Class solution.

For more detailed information about the switch, see the following documents, available on HP websites:

- *HP StorageWorks 3Gb SAS BL Switch User Guide*—Includes detailed hardware descriptions and user information
- *HP Virtual SAS Manager User Guide*—Provides detailed information about and instructions on how to configure zone groups on the 3Gb SAS BL Switch to control access to external SAS storage enclosures.

Important tips

- When installing switches in BladeSystem c-Class enclosure interconnect bays, make sure that the bays map to the mezzanine slots of the desired server blade.
- Be sure to upgrade to the latest firmware version before use.
- The following types of firmware are available for the 3Gb SAS BL Switch; choose the firmware type that is best for your environment:
 - Firmware versions earlier than 2.0.0.0—Single zone support. This firmware version is supported for use only on shared SAS storage enclosures, such as the MSA2000sa, and with tape devices such as the MSL G3 tape libraries.
By default, all server blade bays have access to all storage connected to the switch. These settings are pre-configured and cannot be altered. To restrict access to the storage, use features included in your storage management software.
 - Firmware versions 2.0.0.0 and later—Multi-zone support. Supported for use in all environments. By default, for server bays to access storage, zone groups must be created. Zone groups provide user-defined isolation within the switch.
- When connecting devices to the 3Gb SAS BL Switch, be sure to follow HP recommended best practices and note the following:
 - Performance may be impacted if cabling recommendations are not implemented.
 - Maximum supported length and type of SAS cable is dependant on the type of external tape device or storage enclosure. For more information, see the QuickSpecs for the tape device or storage enclosure.
 - For improved performance and availability, deploy a dual-domain configuration instead of single-domain.
 - For best performance, connect two cables from the switch to each storage enclosure I/O module or controller. This additional cable offers additional performance: one cable provides a x4 connection; two cables provide a x8 (wide-port) connection.

For more information about single domain, dual domain, and wide-port cabling, see “[Deployment examples](#)” on page 85.

- When the c7000 enclosure is populated with double-density server blades, four switches must be installed in BladeSystem c-Class interconnect bays 5, 6, 7, and 8.
 - Switches in interconnect bays 5 and 6 map to the “a” server nodes in device bays 1–16. (Referred to as servers 1a–16a.)
 - Switches in interconnect bays 7 and 8 map to the “b” server nodes in device bays 1–16. (Referred to as servers 1b–16b.)

HP StorageWorks 600 Modular Disk System

The HP StorageWorks 600 Modular Disk System (MDS600) enclosure is a Serial Attach SCSI (SAS) disk drive storage enclosure. The MDS600 supports 3.5" SAS or Serial ATA (SATA) disk drives and attaches to HP c7000 or c3000 BladeSystem enclosures via the 3Gb SAS BL Switch. The MDS600 has two, 35-drive drawers for a total of 70 disk drives.



Key features of the MDS600 include:

- 5U design, with seventy (70) 3.5-inch hot-pluggable SAS or SATA drive bays.
- Choice of high performance enterprise class dual-port SAS drives or low cost, high capacity archival class single-port SATA drives.
- Four power supplies for maximum redundancy and fault-tolerance.
- Drive bay zoning support (when attached to a 3Gb SAS BL Switch in a BladeSystem c-Class enclosure).

In single domain environments with SATA disk drives: Include one I/O module in each storage enclosure drawer.



In dual domain environments with dual-port SAS disk drives: Include two I/O modules in each storage enclosure drawer.



 **NOTE:**

- Drive bay zoning is performed using the Virtual SAS Manager (VSM) utility which is integrated in the 3Gb SAS BL Switch firmware. For more information about the VSM, see “[Solution management tools](#)” on page 55.
 - Disk drive configuration tasks are performed using the HP Array Configuration Utility (ACU). For managing and monitoring MDS600 storage enclosures, use HP Systems Insight Manager (HP SIM). For more information about these applications, see “[Solution management tools](#)” on page 55.
-

For more information

Device website: <http://www.hp.com/go/mds600>

BladeSystem Technical Resources website: <http://www.hp.com/go/bladesystem/documentation>

Be sure to read the following documents, shipped with the storage and BladeSystem enclosure:

- *HP StorageWorks 600 Modular Disk System Setup Poster*
- *HP BladeSystem c-Class Solution Overview Setup Poster*—Provides an overview of the complete installation process of an HP BladeSystem c-Class solution.

For more detailed information about the switch, see the following documents, available on HP websites:

- *HP StorageWorks 600 Modular Disk System User Guide*
- *HP StorageWorks 600 Modular Disk System Maintenance and Service Guide*
- *HP Virtual SAS Manager user guide*—Provides detailed information about and instructions how to configure zone groups on the 3Gb SAS BL Switch to control access to external SAS storage enclosures.

Important tips

- Be sure to upgrade to the latest firmware version before use.
- MDS600 storage is configured and managed in the following sequence, using different applications:
 - Create drive-bay zone groups and assign the zone groups to BladeSystem c-Class enclosure server bays using HP Virtual SAS Manager (VSM). For more information about VSM, see “[HP Virtual SAS Manager](#)” on page 58.
 - Configure drives in the zone group into arrays and LUNs using the HP Array Configuration Utility (ACU). For more information about the ACU, see “[HP Array Configuration Utility](#)” on page 61.
 - Manage the MDS600 using HP Systems Insight Manager (SIM). For more information about SIM, see “[HP Systems Insight Manager](#)” on page 62.
- When racking the MDS600, consider its weight and size:
 - Weight: An unpopulated MDS600 weighs 72.57K (160lb)
 - Size: 5U
- When racking the MDS600, an additional support brace may be required.

For more information about MDS600 rack supports, see the MDS600 QuickSpecs, available on the MDS600 website.

- When connecting power cords, consider the following:
 - The MDS600 storage enclosure, BladeSystem c-Class enclosure, and other devices in the rack all consume power. Make sure that sufficient power input is available.
 - Each MDS600 storage enclosure ships with two pairs of unique power cords
 - The offset power cord option kit (AF502B) is available for use with the MDS600 storage enclosure. This fanout cable provides one input connector and four output connectors and can be used to supply power to multiple power supply modules in one or two MDS600.
- When connecting the MDS600 storage enclosure to the 3Gb SAS BL Switch, be sure to follow HP recommended best practices. For more information about cabling devices to the switch, see the user documents for each device. Note the following:
 - Performance may be impacted if cabling recommendations are not implemented.
 - Maximum supported length of SAS cables is 2m.
 - For improved performance and availability, deploy a dual-domain configuration instead of single-domain.
 - For optimal performance, connect two cables from the switch to each MDS600 I/O module. This additional cable offers additional performance: one cable provides a x4 connection; two cables provide a x8 (wide-port) connection.

For more information about single domain, dual domain, and wide-port cabling, see [“Deployment examples”](#) on page 85.

HP StorageWorks 2000sa Modular Smart Array

The HP StorageWorks 2000sa Modular Smart Array (MSA2000sa) is modular, reliable, affordable, and easy-to-manage external shared SAS storage enclosure. MSA2000 storage enclosures provide twelve drive bays able to accommodate 3.5-inch enterprise-class dual-port SAS disk drives or archival-class single-port SATA disk drives.

There are two types of MSA storage enclosures:

- Controller enclosures
- Drive enclosures

NOTE:

The following images show dual-controller and dual-I/O module MSAs. Single-domain models are also available.

Controller enclosures include controllers modules, for connecting to the SAS switch.



Drive enclosures include I/O modules, for connecting to the MSA2000sa controller enclosure, providing additional storage capacity. Up to three drive enclosures can cascade behind an MSA2000sa controller enclosure.



NOTE:

MSA2000 is a family name for a collection of MSA models.

- MSA2000sa refers to the 12 drive bay, 3.5-inch disk drive SAS controller enclosure.
 - MSA2012sa refers to the SAS controller module installed in the controller enclosure.
 - MSA2000 refers to the 12 drive bay, 3.5-inch disk drive drive enclosure that can connect to the MSA2000sa controller enclosure for additional storage capacity.
-

Key features of the MSA2000 family include:

- Space-efficient 2U design, with 12 hot-pluggable hard drive bays.
- Easy to manage and service, with embedded software tools and hot-plug, redundant hardware components.
- Dual controllers in the MSA2000sa controller enclosure and dual I/O modules in cascaded MSA2000 drive enclosures provide multiple paths for high availability connectivity. (Single controller and single I/O module enclosures are available, but do not provide the multiple paths or allow for path failover.)

- Ability to grow as storage demands increase; increase up to 21.6 TB SAS or 48 TB SATA. The MSA2000sa controller enclosure can support up to 3 cascaded drive enclosures.
- Support for up to 255 volumes with sizes up to 16 TB.
- Choice of high performance enterprise class dual-port SAS drives or low cost, high capacity archival class single-port SATA drives.

Configuration, management, and monitoring tasks are performed using the Storage Management Utility (SMU) or Command Line Interface (CLI), both of which are embedded in MSA2000 family array controller firmware. For more information about these software utilities, see “[Solution management tools](#)” on page 55. Functionality of the two user interfaces is similar, but presented in different screen formats. HP recommends becoming familiar with and primarily using one of the two interfaces.

For more information

Device website: <http://www.hp.com/go/msa2000sa> (under **Previous Generation**)

Be sure to read the following documents that are printed and shipped with the MSA2000sa:

- *HP StorageWorks 2000 Modular Smart Array racking instructions*—Includes physical installation instructions.
- *HP StorageWorks 2000 Modular Smart Array Family installation road map*—Includes an overview of installation and configuration steps.

For detailed information about the storage enclosure and its utilities, see the following documents, available on HP websites:

- *HP StorageWorks 2000sa Modular Smart Array supported cable configurations*—Includes sample illustrations of different supported configurations and their cabling.
- *HP StorageWorks 2012sa Modular Smart Array user guide*—Includes hardware description, configuration, and user information that is unique to the MSA2012sa model.
- *HP StorageWorks 2000 Modular Smart Array family reference guide*—Includes detailed hardware descriptions, configuration, and user information that applies to all MSA2000 models. The SMU is detailed.
- *HP StorageWorks 2000 Family Modular Smart Array CLI reference guide*—Includes instructions for using the CLI. All commands are detailed.
- *HP StorageWorks 2000 Family Modular Smart Array firmware upgrade instructions*—Includes information and instructions for updating firmware on MSA2000sa controllers.
- *HP StorageWorks 2000 Modular Smart Array troubleshooting guide*—Includes troubleshooting information.

Important tips

- Be sure to upgrade the MSA2000sa controllers to the latest firmware version *before* connecting to the switch.
- For high availability, two controllers must be installed in each MSA2000sa controller enclosure, and two I/O modules must be installed in each MSA2000 drive enclosure.
- When cabling the MSA2000sa controller enclosure, MSA2000 drive enclosures, and 3Gb SAS BL Switches, be sure to follow HP recommended best practices. For more information about cabling the devices, see the user documents for the devices. Suggested references include the *HP StorageWorks 2000sa Modular Smart Array supported cable configurations*, *HP StorageWorks 2012sa Modular Smart Array user guide*, and *HP StorageWorks 3Gb SAS BL Switch user guide*. For sample cabling illustrations see “[Deployment examples](#)” on page 85.
- Maximum supported length of SAS cables is 4m.

- The controller and its disk drives are configured using the Storage Management Utility (SMU) or Command Line Interface (CLI).
 - For information about configuring storage in the SMU, see the *HP StorageWorks 2000 Family Modular Smart Array reference guide*.
 - For information about configuring storage in the CLI, see the *HP StorageWorks 2000 Family Modular Smart Array CLI reference guide*.
- (Optional but strongly recommended) Map each MSA2000sa storage volume to ports on the server blades. (This is called explicit mapping. Other HP utilities use a similar concept termed Selective Storage Presentation (SSP) or Access Control Lists (ACL).)

When you set up explicit maps, you specify for each volume, the hosts that can access it. If a new server is installed in the BladeSystem c-Class enclosure, storage volumes will not be visible to that server until explicitly mapped.

When you do *not* set up explicit maps for each volume, all server blades with P700m controllers that are contained in the same SAS zone can access the storage. If a new server is installed in the BladeSystem c-Class enclosure, the storage volumes will be immediately visible to that server.

- For information about mapping volumes using the SMU, see “Managing Host Access to Volumes” in the *HP StorageWorks 2000 Family Modular Smart Array reference guide*.
 - For information about mapping volumes using the CLI, see the “Map volume” section in the *HP StorageWorks 2000 Family Modular Smart Array CLI reference guide*.
- When mapping, be sure to choose all MSA2000sa controller ports (A0, A1, B0, and B1), to guarantee access in the event of a controller, port, or cable failure. During a failover, if access is granted to all MSA2000sa controller ports, I/O will fail over to ports on the surviving controller.

HP StorageWorks 2000sa G2 Modular Smart Array

The HP StorageWorks 2000sa G2 Modular Smart Array (MSA2000sa G2) is 3Gb SAS, external shared storage that helps users easily transition from direct attached to centralized storage. It allows departmental and small to medium businesses grow capacity as demands increase up to 29.7 TB SAS or 60 TB SATA. With up to 511 LUNs and LUN sizes up to 16 TB, the MSA2000sa G2 provides maximum configuration flexibility.

The MSA2000sa G2 allows mixing of enterprise-class, dual-port SAS drives and archival-class single-port SATA drives, and supports both Large Form Factor and Small Form Factor drives. The optional HP StorageWorks 2000 Modular Smart Array Snapshot Software offers increased data protection. The MSA2000sa G2 can be configured with a single controller for a low initial price with future expansion, or with dual controller for situations that require higher availability and performance for the most demanding entry-level situations.

There are two types of MSA storage enclosures:

- Controller enclosures
- Drive enclosures

 **NOTE:**

The following images show dual-controller and dual-I/O module MSAs. Single domain models are also available.

Controller enclosures include controller modules, for connecting to the SAS switch. Two MSA2000sa G2 models are available:

MSA2012sa G2 includes 12 drive bays for 3.5 inch disk drives

MSA2024sa G2 includes 24 drive bays for 2.5 inch disk drives



Drive enclosures include I/O modules, for connecting to the MSA2000sa G2 controller enclosure, providing additional storage capacity. Up to four drive enclosures can cascade behind an MSA2000sa G2 controller enclosure, as long as the total number of drives does not exceed 99 (including the drives in the controller enclosure). Two MSA2000sa G2 models are available:

MSA2000 includes 12 drive bays for 3.5 inch disk drives



MSA70 includes 24 drive bays for 2.5 inch disk drives



NOTE:

MSA2000 G2 is a family name for a collection of second-generation MSA2000 models.

- MSA2012sa G2 refers to the 12 drive bay, 3.5-inch drive SAS controller enclosure.
- MSA2024sa G2 refers to the 24 drive bay, 2.5-inch drive SAS controller enclosure.
- MSA2300sa G2 refers to the SAS controller that can be used in either G2 controller enclosure.
- MSA2000 refers to the drive enclosure that can connect to the MSA2012sa or MSA2024sa controller enclosure for additional storage capacity.

Key benefits of the MSA2000sa G2 family include:

- MSA2000sa G2 products manage growing storage requirements across multiple HP ProLiant servers for users who need a centralized dedicated storage solution for applications. Shared storage allows for controlled, cost-effective growth and increased protection of data.
- Its ease of management allows a department or small company to effectively handle growing storage requirements with a minimum of complexity.
- MSA2000sa G2 products extend the benefits of shared storage resources to first time implementers on a tight budget.
- Depending on the model chosen, the modular design allows the user to start relatively small but supports future growth to hundreds of users and up to 27 TB of LFF SAS or 60 TB of LFF SATA storage, or 29.7 TB of SFF SAS or 24.7 TB of SFF SATA storage.
- The optional controller-based snapshot and clone capability as part of the MSA2000 family allows the smaller departmental user or company to implement functionality once only available to much larger firms with high-cost arrays.

Key features of the MSA2000 G2 family include:

- Space-efficient 2U design, with hot-pluggable hard drive bays.
- Highly efficient consolidation and sharing of storage geared to departmental and small-to-medium business requirements.
- Cost efficient plus high-availability choices.
- Flexibility in drives: Large Form Factor 3.5-inch or HP ProLiant Small Form Factor 2.5-inch drives.
- Enterprise-class SAS or archival-class SATA drives as need and budget dictates.
- Dual-port SAS drives for enterprise needs.
- Large capacity single-port SATA drives for low cost archival storage.
- Ability to mix SAS and SATA drives within the same storage enclosure.
- Choice of single- or dual-controller enclosure models
- Choice of single I/O or high-availability dual I/O drive enclosure models.

Configuration, management, and monitoring tasks are performed using the Storage Management Utility (SMU) or Command Line Interface (CLI), both of which are embedded in MSA2000-family array controller firmware. For more information about these software utilities, see “[Solution management tools](#)” on page 55. Functionality of the two user interfaces is similar, but presented in different console formats. HP recommends becoming familiar with and primarily using one of the two interfaces.

For more information

Device website: <http://www.hp.com/go/msa2000sa>

Be sure to read the following documents that are printed and shipped with the MSA2000sa G2:

- *HP StorageWorks 2000 Modular Smart Array racking instructions*—Includes physical installation instructions.
- *HP StorageWorks 2000 Modular Smart Array Family installation road map*—Includes an overview of installation and configuration steps.

For detailed information about the storage enclosure and its utilities, see the following documents, available on HP websites:

- *HP StorageWorks 2000sa G2 Modular Smart Array supported cable configurations*—Includes sample illustrations of different supported configurations and their cabling.
- *HP StorageWorks 2012sa G2 Modular Smart Array user guide*—Includes hardware description, configuration, and user information that is unique to the MSA2012sa model.
- *HP StorageWorks 2000 G2 Modular Smart Array reference guide*—Includes detailed hardware description, configuration, and user information that applies to all MSA2000 models. The SMU is detailed.
- *HP StorageWorks 2000 G2 Family Modular Smart Array CLI reference guide*—Includes instructions for using the CLI. All commands are detailed.
- *HP StorageWorks 2000 Family Modular Smart Array firmware upgrade instructions*—Includes information and instructions for updating firmware on MSA controller modules.
- *HP StorageWorks 2000 Modular Smart Array troubleshooting guide*—Includes troubleshooting information.

Important tips

- Be sure to upgrade the MSA2000sa G2 controllers to the latest firmware version *before* connecting to the switch.
- For high availability, two controllers must be installed in each MSA2000sa G2 controller enclosure, and two I/O modules must be installed in each drive enclosure.
- When cabling the MSA2000sa G2 controller enclosure, MSA2000 and MSA70 drive enclosures, and 3Gb SAS BL Switches, be sure to follow HP recommended best practices to provide a highly available solution. For more information about cabling the devices, see the user documents for the devices. Suggested references include the *HP StorageWorks 2000sa G2 Modular Smart Array supported cable configurations*, *HP StorageWorks 2000sa G2 Modular Smart Array user guide*, and *HP StorageWorks 3Gb SAS BL Switch user guide*. For sample cabling illustrations see “[Deployment examples](#)” on page 85.
- To connect MSA2000 drive enclosures to the MSA2000sa G2 controller enclosure or MSA70 drive enclosure, a Mini-SAS to SAS cable must be purchased. For more information, see the MSA2000 QuickSpecs or *HP StorageWorks 2000sa Modular Smart Array supported cable configurations*.
- Maximum supported length of SAS cables is 4m.

- The controller and its storage are configured using the Storage Management Utility (SMU) or Command Line Interface (CLI).
 - For information about configuring storage in the SMU, see the *HP StorageWorks 2000 G2 Modular Smart Array reference guide*.
 - For information about configuring storage in the CLI, see the *HP StorageWorks 2000 G2 Modular Smart Array CLI reference guide*.
- (Optional but strongly recommended) Map each MSA2000sa storage volume to ports on the server blades. This is called explicit mapping. Other HP utilities use a similar concept termed Selective Storage Presentation (SSP) or Access Control Lists (ACL).

When you set up explicit maps, you specify for each volume, the hosts that can access it. If a new server is installed in the c-Class enclosure, storage volumes will not be visible to that server until explicitly mapped.

When you do *not* set up explicit maps for each volume, all server blades with P700m controllers that are contained in the same SAS zone can access the storage. If a new server is installed in the BladeSystem c-Class enclosure, the storage volumes will be immediately visible to that server.

 - For information about mapping volumes using the SMU, see “Managing Host Access to Volumes” in the *HP StorageWorks 2000 G2 Modular Smart Array reference guide*.
 - For information about mapping volumes using the CLI, see the “Map volume” section in the *HP StorageWorks 2000 G2 Modular Smart Array CLI reference guide*.
- When mapping, be sure to choose all MSA2000sa G2 controller ports (A1, A2, A3, A4, B1, B2, B3, and B4), to guarantee access in the event of a controller, port, or cable failure. During a failover, if access is granted to all MSA2000sa G2 controller ports, I/O will fail over to ports on the surviving controller.

HP StorageWorks MSL2024, MSL4048, and MSL8096 Tape Libraries and 1/8 G2 Tape Autoloader

The HP StorageWorks MSL2024, MSL4048, and MSL8096 Tape Libraries and 1/8 G2 Tape Autoloader provide compact, high-capacity, low-cost solutions for simple, unattended data backup. The Libraries house 12 tape cartridges for each 1U of height, with easy access to tape cartridges via removable magazines and one or more mailslots. The Autoloader houses up to eight tape cartridges in a compact 1U form factor with easy access to tape cartridges via two removable magazines and a configurable mailslot. The MSL2024, MSL4048, and MSL8096 Libraries can be partitioned into multiple logical libraries for optimal configuration flexibility in a shared storage environment.

The Libraries and Autoloader are compatible with most operating systems. Tape backup requires either direct support from the operating system or a compatible backup application to take full advantage of the many features. To verify compatibility review the Design Guide, or for white papers and examples, go to <http://www.hp.com/go/ebs>. The SAS Libraries and Autoloader support LTO Ultrium tape drives.



For more information

HP Automation website: <http://www.hp.com/go/automation>

HP Enterprise Backup Solutions website: <http://www.hp.com/go/ebs>

HP Library and Tape Tools website: <http://www.hp.com/support/tapetools>

Be sure to read the following documents that are included on the documentation CD shipped with the Library or Autoloader:

- *HP StorageWorks MSL2024 Tape Library getting started, HP StorageWorks MSL4048 Tape Library getting started, HP StorageWorks MSL8096 Tape Library getting started, or HP StorageWorks 1/8 G2 Tape Autoloader getting started*—Includes overview information about the tape library and its installation and configuration procedures.
- *HP StorageWorks MSL2024, MSL4048, and MSL8096 Tape Libraries user and service guide and HP StorageWorks 1/8 G2 Tape Autoloader user and service guide*—Includes detailed hardware reference, maintenance, and service information.

Important tips

- Connectivity differs depending on the firmware version installed on the BL switch:
 - Firmware versions earlier than 2.0.0: All servers containing a c-Class SAS Mezzanine card are automatically connected to all tape libraries. This is not configurable.

- Firmware versions 2.0.0 or later: Switch-port zone groups must be created and assigned to server bays to grant access to the tape library.

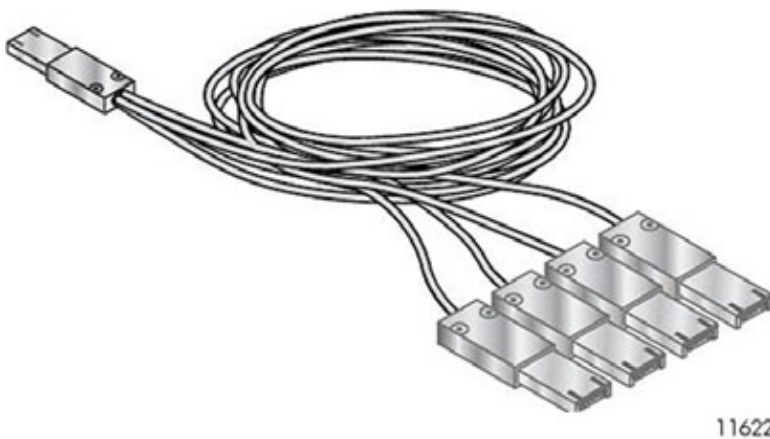
For more information about configuration guidelines, see the EBS Design Guide.

- SAS tape libraries must be connected to a port on a SAS BLswitch (they cannot be connected to a SAS port on an MSA or MDS storage enclosure).
- Each SAS tape drive has a single SAS port. Redundancy is not supported, so the host end of the fanout cable will be connected to only one port on one SAS BL switch. Either SAS BL switch in the BladeSystem c-Class enclosure may be used. The corresponding switch port on the other SAS BL switch may be left open or connected to other tape devices.
- To use all four channels of the 3Gb SAS BL Switch port, use a SAS fanout cable, which has one mini-SAS connector on the switch end and four mini-SAS connectors on the tape drive end.

The available SAS fanout cables approved for use with the tape library or autoloader and the SAS BL switch include:

- AN975A – 2m External Mini-SAS to 4X1 Mini-SAS Cable Kit
- AN976A – 4m External Mini-SAS to 4X1 Mini-SAS Cable Kit

The following illustration is a representation of a fanout cable.



Rack and power

HP helps companies manage power and cooling costs. HP provides a variety of hardware and software, enabling optimal deployment of HP servers and storage, and smarter control over power, cooling and access.

For more information

For additional information see the following HP websites:

HP Infrastructure products website: <http://h18004.www1.hp.com/products/servers/platforms/rackandpower.html> (Server racks, power, and infrastructure options)

HP power protection and management website: <http://h18004.www1.hp.com/products/servers/proliantstorage/power-protection/index.html> (Power distribution racks, uninterruptible power supplies (UPS), Power distribution units (PDU), rack and power management software)

HP BladeSystem Power Sizer website: <http://h71019.www7.hp.com/ActiveAnswers/cache/347628-0-0-0-121.html> (Power consumption and heat load estimations)

3 High availability information

HP External SAS BladeSystem Solutions provide high availability, offering c-Class BladeSystem users full connectivity to External SAS storage by using the following redundant hardware components:

- Two controllers in each MSA2000sa controller enclosure
- Two I/O modules in each MDS600 storage enclosure drawer (four per MDS600 storage enclosure)
- Two 3Gb SAS BL Switches in each BladeSystem c-Class enclosure (four when using double-density server blades in the c7000 enclosure)
- One dual-ported P700m mezzanine card (four links configured as two (2X) SAS ports) in each server
- Dual-ported SAS hard drives in the MSA2000sa controller enclosures and drive enclosures
- Redundant power supplies and fans in the BladeSystem c-Class enclosures and MSA storage enclosures.

Using redundant components ensures high availability. If any component in the path between the server and the storage fails, management software will automatically fail over all I/O to the alternate path.

Although single-controller MSA2000sa controller enclosures and single I/O module MDS600 drawers are supported for use in single-domain environments, the dual-controller/dual I/O module models are required in high availability environments. With two controllers in the controller enclosure, or two I/O modules in the MDS600 drawer, high availability is ensured if one of the controllers/I/O modules fails. During a failover event, all processing is performed by the remaining controller/I/O module, with no interruption to the flow of data.

When configuring the storage, the storage enclosures offer a variety of RAID levels, allowing a user-selected level of performance and fault tolerance. For more information about RAID levels and configuring the MSA2000sa storage, see the *HP StorageWorks MSA2000sa Configuration Best Practices White Paper* at <http://www.hp.com/go/msa2000sa> (under Resource Library). For more information about RAID levels and configuring the MDS600 storage, see the *Configuring Arrays on Smart Array Controllers Reference Guide*, at <http://h18000.www1.hp.com/products/servers/proliantstorage/software-management/acumatrix/>.

Although not included in the scope of this document, clustering is supported in BladeSystem environments, providing another level of fault tolerance. For more information about clustering support for the MSA2000sa, see the QuickSpecs on the MSA2000sa website: <http://www.hp.com/go/msa>. For more information about clustering support for the MDS600, see the QuickSpecs on the MDS600 website: <http://www.hp.com/go/mds600>.

4 Zoning information

HP Virtual SAS Manager (VSM) is the software application used to configure the switch, and create and manage hardware-based zone groups. These zone groups allocate resources for device load balancing purposes and for selectively allowing access to data. For planning purposes, zone groups and assignments can be pre-configured, even if servers or disk drives are not yet installed in BladeSystem c-Class enclosure device bays or storage enclosure drive bays.

 **NOTE:**

While zoning is created and managed through the VSM, the storage is configured, formatted, and partitioned using software utilities such as the HP Array Configuration Utility (ACU), HP Storage Management Utility (SMU), and Microsoft Disk Manager.

You can create two types of zone groups:

- Drive bay zone groups—Groups together disk drive bays, which can be chosen from one or more MDS600 storage enclosures or MDS600 storage enclosure drawers. Server bays assigned this type of zone group have access to the disk drive bays included in the zone group as if they are directly connected to those servers. Zoned storage environments such as those using the MDS600 use drive bay zoning.
- Switch port zone groups—Groups together one or more SAS ports on the switch. Server bays assigned this type of zone group have access to the controller enclosures or tape devices connected to the ports included in the zone. Tape environments and shared storage environments such as those using the MSA2000sa use switch port zoning. All tape drives in a tape device will be accessible to any server that has access to the zone group. All LUNs in the controller enclosure will be accessible to the assigned servers, unless controlled through the storage management utility for the controller enclosure.

Key zoning configuration steps include:

- Enabling/disabling Multi-initiator mode.
- Creating zone groups (switch-port based or drive-bay based).
- Assigning zone groups to servers.
- Capturing the configuration for safekeeping. HP strongly recommends this step, especially in single-domain configurations.

 **NOTE:**

For VSM firmware versions earlier than 2.0.0.0, no configuration tasks are available.

 **IMPORTANT:**

When assigning zone groups to server bays, make sure to assign storage connected to switch ports associated with the server bays. For more information, see [“Zoning requirements”](#) on page 44.

For more information on zoning, see the *HP Virtual SAS Manager user guide*, available on the 3Gb SAS BL Switch page of the HP Manuals website <http://www.hp.com/support/manuals>.

Zoning requirements

When connecting external SAS storage enclosures to an HP StorageWorks 3Gb SAS BL Switch, use the guidelines from the following table to zone the storage to server blades. Failure to follow these guidelines will result in an unsupported configuration.

For more information on zoning, see the *HP Virtual SAS Manager user guide*, available on the BladeSystem Interconnects page of the HP Manuals website: <http://www.hp.com/support/manuals>.

Use the following table to determine which external storage enclosure to use when zoning storage to server bays. For example, the table shows that storage for half-height server blades installed in device bays 1-8 of a c7000 enclosure must be zoned from enclosures attached to ports 1, 2, 3, or 4 on the 3Gb SAS BL Switch.

c-Class enclosure model	Server blade type	P700m mezzanine slot	c-Class device bay	Zone storage from enclosures connected to these 3Gb SAS BL Switch ports
c7000	Half height	Any	1-8	1-4
			9-16	5-8
	Full height	1 or 2	Any	1-4
			3	5-8
	Double density (BL2x220c)	Any	1-8	1-4
			9-16	5-8
c3000	Half height	2	Any	1-4
	Full height	2	Any	1-4
		3	Any	5-8
	Double density (BL2x220c)	1 "A-side"	Any	1-4
		2 "B-side"	Any	5-8

NOTE:

Only one P700m is supported per server blade node. On double-density server blades, two P700m are supported; one for each server node. Installing more than one P700m per server blade node will result in an unsupported configuration.

5 Installation overview and best practices

This section provides an overview of the steps required to install a BladeSystem enclosure with external SAS storage; details are not included in the scope of this document. For details, see the setup and installation instructions provided with each device. User documents for devices in this solution are available on the HP Manuals website <http://www.hp.com/support/manuals> and on the device websites:

BladeSystem Technical Resources website: <http://www.hp.com/go/bladesystem/documentation> (under the **Install Your Solution** tab)

MDS600 website: <http://www.hp.com/go/mds600> (under **Support for your device > Manuals**)

MSA2000sa website: <http://www.hp.com/go/msa2000sa> (under **Previous Generation > Support for your device > Manuals**)

MSA2000sa G2 website: <http://www.hp.com/go/msa2000sa> (under **Support for your device > Manuals**)

Tape Storage & Media website: <http://www.hp.com/go/tape> (under **Business Class Libraries** or **Tape Autoloaders**)

 **NOTE:**

- While installing this solution, record device and system information in “[Device worksheets](#)” on page 65. This information is used in later installation or configuration steps, and will be helpful for troubleshooting and support purposes.
 - In this installation overview, the use of MSA2000sa refers to both the MSA2000sa and the MSA2000sa G2. Installation tasks for the MSA2000sa and MSA2000sa G2 are identical.
-

Key installation steps

Key task	Link
Set up the rack.	Step 1 , page 47
Install mezzanine cards on the server blades.	Step 3 , page 47
Install BladeSystem c-Class enclosure and its servers, interconnect devices, and other components. Install operating system updates and patches, and, if necessary, update firmware on the HP mezzanines and interconnect devices.	Step 4 , page 47 and Step 5 , page 48
For each server that will boot locally (not use the storage enclosure as a boot device), install the operating system.	Step 6 , page 48
Install MDS600 storage enclosures. If necessary, update the firmware.	Step 7 , page 48
Install MSA2000sa controller enclosures and MSA drive enclosures. If necessary, update the firmware.	Step 8 , page 49
Configure zoning on the switch.	Step 9 , page 50
Configure the MDS600 and storage.	Step 11 , page 50
Configure the MSA2000sa controllers and storage.	Step 12 , page 51

Installation steps

1. Set up the rack and its power distribution units (PDUs).
2. If applicable, install the Tape Library or Autoloader.
3. Install a mezzanine card on each server blade. Make sure to install the mezzanine card in a slot that will correspond to planned interconnect bays of the switches. (*HP P700m Installation Instructions* and *HP P700m User Guide*)

Record the slot number in which you installed the mezzanine card on the provided spaces in "[Server \(and mezzanine\) worksheet](#)" on page 67.

4. Install the BladeSystem c-Class enclosure and the blade devices.
 - a. Rack the BladeSystem enclosure. (*HP BladeSystem c-Class Solution Overview Setup Poster*)
 - b. Install the following devices in the BladeSystem enclosure:
 - Server blades with mezzanine cards attached
 - Power supplies
 - Fans
 - Onboard Administrator modules
 - 3Gb SAS BL Switches

Make sure to install the switches in interconnect bays that correspond with the slots in which the mezzanine cards were installed in the servers.
 - c. Connect the Onboard Administrator cables and power cords.

If the MSA2000sa is already racked, do not connect SAS cables between the switches and the MSA2000sa controller enclosure at this time. Connect them only after ensuring that the latest available firmware is installed on the MSA2000sa controllers.
 - d. Apply power to the rack and turn on the AC circuit breakers for the BladeSystem enclosure.

Power is automatically applied to or removed from the devices as power is applied or removed from the BladeSystem enclosure. As the devices power on, they automatically perform a series of Power-On Self-Tests. (POST)

Confirm successful startup of the BladeSystem enclosure and its components. View the OA module display, the Insight Display, and device LEDs to monitor the progress of the Power-On Self-Tests. For details, see the Onboard Administrator user guide and user documents for the devices.
 - e. Complete the HP BladeSystem Insight Display installation wizard. (*HP BladeSystem c3000/c7000 Enclosure Quick Setup Instructions*)

When the BladeSystem enclosure is powered up for the first time, the Insight Display launches an installation wizard to guide you through the configuration process. After configuring the BladeSystem enclosure, the Insight Display verifies that there are no installation or configuration errors.
 - f. Complete the Onboard Administrator First Time Setup Wizard. (*HP BladeSystem Onboard Administrator user guide*).
 - g. Record important system information about each device in the BladeSystem c-Class enclosure in the spaces provided in "[Solution summary worksheet](#)" on page 66 "[Server \(and mezzanine\) worksheet](#)" on page 67, and "[Interconnect worksheet](#)" on page 68. To obtain this information, open Onboard Administrator and view information for each device in the BladeSystem enclosure.

5. Upgrade firmware on the BladeSystem enclosure, mezzanine cards, and switches to the latest versions.
 - a. For each device, determine the currently-installed firmware version, and record in the provided spaces in “[Device worksheets](#)” on page 65. This information is displayed in Onboard Administrator in the Rack Firmware page.
 - b. For each device, determine if there is a more recent version of firmware available. The latest available firmware version is listed and available for download on the HP website for each device. Alternatively, firmware can also be downloaded from the Business Support Center at <http://www.hp.com/support>.
 - c. As needed, upgrade the firmware on the devices.
 - BladeSystem c-Class enclosures: Updated via Onboard Administrator
 - P700m mezzanine cards: Updated via a SmartComponent
 - 3Gb SAS BL switches: Updated via Virtual SAS Manager

6. For each server that will boot locally (*not use the storage enclosure as a boot device*), install the operating system. (*HP ProLiant Server Blade User Guide*) If not included in your solution, proceed to the next step.

If the storage enclosure will be used at the boot device, the operating system must not be installed at this time.

7. Install the MDS600 storage enclosures. If not included in your solution, proceed to the next step.
For each MDS600 storage enclosure, record important device information. (“[MDS600 storage enclosure worksheet](#)” on page 69)

For detailed instructions on installing MDS600 storage enclosures, see “Setup” in the *HP StorageWorks 600 Modular Disk System User Guide*.

- a. Prepare for a firmware update. The MDS600 firmware uses a Smart Component, which are available on the Firmware Maintenance CD. A more recent version of a particular component might be available on the support page of the HP website (<http://www.hp.com/support>). Obtain the latest firmware and upgrade instructions from the MDS600 website: <http://www.hp.com/go/mds600>.

- b. Rack the MDS600 storage enclosure.

- c. Insert disk drives in the MDS600 storage enclosure drawers.

- d. Connect SAS cables from the MDS600 I/O modules to the switch.

Be sure to follow provided guidelines of a fault-tolerant cabling configuration to provide a highly available solution.

For more information about cabling storage enclosures to the switch, see “[Deployment examples](#)” on page 85.

- e. Connect the power cords.

- f. Apply power to the MDS600 storage enclosures.

Confirm successful startup of the MDS600 storage enclosure. View the LEDs on the front and rear of each MDS600 to monitor the progress of the POST. For more information about MDS600 LED patterns, see “Component identification” in the *HP StorageWorks 600 Modular Disk System User Guide*.

- g. If needed, upgrade the firmware on the MDS600 I/O modules, using the firmware and instructions obtained in Step a.

8. Install the MSA2000sa controller enclosures and MSA drive enclosures. If not included in your solution, proceed to the next step.

For each MSA2000sa controller enclosure and MSA drive enclosure, record important device information. (“MSA2000sa controller enclosure worksheet” on page 70)

For detailed instructions on installing MSA controller and drive enclosures, see “Installing and Cabling Enclosures” in the user guide for your MSA2000sa model.

- a. Prepare for a firmware update. Obtain the latest controller firmware and upgrade instructions from the MSA2000sa website: <http://www.hp.com/go/msa>.
- b. Rack the MSA2000sa controller enclosure and any MSA drive enclosures.
- c. Insert disk drives in the MSA storage enclosures.
- d. Connect MSA drive enclosures to the MSA2000sa controller enclosure. Be sure to follow provided guidelines of a fault-tolerant cabling configuration to provide a highly available solution. For more information about cabling cascaded MSA drive enclosures, see “Deployment examples” on page 85.

Do not connect SAS cables between the MSA controller enclosure and the switch at this time. Connect them only after ensuring that the latest available firmware is installed on the MSA2000sa controllers.

- e. Connect the Ethernet cables and power cords.
- f. Apply power to the MSA storage enclosures.
 - Power on any cascaded drive enclosures and allow them to complete its POST. Make sure that the drive enclosures complete their startup routines before powering on the controller enclosure. If the controller enclosure is powered on prematurely, it may not properly discover the attached storage.
 - Power on the controller enclosure and allow it to complete POST.
 - Confirm successful startup of the MSA enclosures and their hard drives. View the LEDs on the front and rear of each MSA to monitor the progress of the POST. For more information about MSA LED patterns, see “Hardware Components and LEDs” in the user guide for your MSA2000sa model.
- g. If needed, upgrade the firmware on the MSA2000sa controllers, using the firmware and instructions obtained in Step a.
- h. Install required MSA-specific drivers and software, such as the multipathing Device Specific Module, on each server that will access the MSA2000sa. (“Host System Requirements” in the user guide for your MSA2000sa model and MSA2000sa QuickSpecs)
- i. Connect SAS cables from the MSA2000sa controller enclosure to the switch. If cascaded MSA drive enclosures are also included, connect SAS cables from the MSA I/O modules to the MSA2000sa controllers. Connect the MSA2000sa controller enclosure to the switch only *after* upgrading the controller firmware to the latest version.

Be sure to follow provided guidelines of a fault-tolerant cabling configuration to provide a highly available solution.

For more information about cabling storage enclosures to the switch, see “Deployment examples” on page 85.

9. Configure zone groups and assign to the servers.
 - a. Set the Multi-initiator mode.
 - b. Create the zone groups.
 - c. For each server bay, assign zone groups to grant the server access to the storage, following the requirements outlined in [“Zoning requirements”](#) on page 44.

Zoned SAS and Shared SAS storage enclosures use different types of zoning. For more information on the VSM, see its online help and the *HP Virtual SAS Manager user guide*.

10. Force the servers to discover the storage by restarting all servers that need to access the storage. If supported by your operating system, use a management utility to scan for new hardware. Be sure to view device and status information to confirm that they were properly discovered.
11. Configure the MDS600 storage enclosure. If not included in your solution, proceed to the next step.
 - a. Obtain and record the WWID of each MDS600 I/O module in the provided spaces in [“MDS600 storage enclosure worksheet”](#) on page 69.
 - b. Obtain and record the SAS WWN of all P700m ports on all server blades that will access the MDS600 storage in the provided spaces in [“Server \(and mezzanine\) worksheet”](#) on page 67. These WWN are used in the ACU when granting hosts access to the storage.

The WWNs of all P700m ports connected to each 3Gb SAS BL switch are displayed as “Device ID” on the Switch Port Mapping page in Onboard Administrator. (*HP Onboard Administrator user guide*)

- c. From each server assigned a drive-bay zone group, create arrays and LUNs using the ACU or ACU CLI. (“ACU” in the *Configuring Arrays on HP Smart Array Controllers Reference Guide*)

If the MDS600 is being used as the boot device for server blades, create the required volumes on the MDS600. (*Booting from shared storage with direct connect SAS storage for HP BladeSystem and HP StorageWorks MSA2012sa on the MSA2000sa website*)

- d. (Recommended) Enable Selective Storage Presentation (SSP) for each LUN and select the host controller that needs access. (“Selective Storage Presentation” in the *Configuring Arrays on HP Smart Array Controllers Reference Guide*)

High availability configurations require at least two mappings per volume to each server.

12. Configure the MSA. (“Configuring a System for the First Time” in the user guide for your MSA2000sa model) If not included in your solution, proceed to the next step.
 - a. Obtain and record the IP address of each MSA2000sa controller in the provided spaces in “[MSA2000sa controller enclosure worksheet](#)” on page 70. This IP address is used when accessing the Storage Management Utility (SMU) or Command Line Interface (CLI) to configure the MSA. (“Obtaining IP Values for Your Storage System” in the user guide for your MSA2000sa model)
 - b. Obtain and record the SAS WWN of all P700m ports on all server blades that will access the MSA2000sa storage in the provided spaces in “[Server \(and mezzanine\) worksheet](#)” on page 67. These WWN are used in the SMU or CLI when granting hosts access to the storage.

The WWNs of all P700m ports connected to each 3Gb SAS BL switch are displayed as “Device ID” on the Switch Port Mapping page in Onboard Administrator. (*HP Onboard Administrator user guide*)
 - c. Create Vdisks and volumes using the SMU or CLI. (“Creating Virtual Disks” in the user guide for your MSA2000sa model)

If the MSA is being used as the boot device for server blades, create the required volumes on the MSA. (*Booting from shared storage with direct connect SAS storage for HP BladeSystem and HP StorageWorks MSA2000sa* on the MSA2000sa website)
 - d. (Recommended) Map each MSA volume to the servers that need access. (“Mapping a Volume to a Host” in the user guide for your MSA2000sa model)

For each MSA volume:

 - Create a mapping to all WWNs of the server that needs access.
 - Open access to the volume through all SAS ports on the MSA2000sa controller.

High availability configurations require at least two mappings per volume to each server.
13. The basic steps of installing the External SAS storage for HP BladeSystem solution are complete. Additional configuration steps may include:
 - If the MSA is used as a boot device for server blades, configure the server blades properly and then install the operating system. (*Booting from shared storage with direct connect SAS storage for HP BladeSystem and HP StorageWorks MSA2012sa* on the MSA2000sa website)
 - Complete network setup.
 - Install software applications.
 - Set up and configure clusters.
 - Confirm multipathing software setup and configuration.
 - Connect SAS cables from the switch to the Tape Library or Autoloader. For more information about cabling Tape Libraries and Autoloaders, see “[Tape library—basic cabling](#)” on page 107.

Installation notes and best practices

BladeSystem c-Class enclosure installation notes and best practices

- The BladeSystem c-Class enclosure can be installed in a rack or rack-free environment.
- Before installing components in the BladeSystem c-Class enclosure, be sure to review enclosure bay numbering.
- Before installing components in the BladeSystem c-Class enclosure, be sure understand which mezzanine slots on which servers map to which interconnect bay.

Server blade installation notes and best practices

- Before installing the server blades in the BladeSystem c-Class enclosure, be sure to install the Mezzanine cards on the server blades.

P700m mezzanine card installation notes and best practices

- The choice of mezzanine slot in which the P700m is installed determines the bays in which you must install the SAS switches, because each mezzanine card slot maps to a specific interconnect device bay of the BladeSystem c-Class enclosure.
 - When installing on a half-height server blade, the P700m can be installed in mezzanine slot 1 or 2, with 2 being the preferred location. (In the c3000, mezzanine slot 1 is not supported.)
 - When installing on a full-height server blade, the P700m can be installed in mezzanine slot 1, 2, or 3, with 3 being the preferred location. (In the c3000, mezzanine slot 2 is the preferred location.)
 - When installing on a double-density server blade, a P700m must be installed in each mezzanine slot. (Two total; one for each server node.)
- New HP ProLiant server blades auto-configure when they are powered up for the first time. For more information about the Auto configuration process, see the server-specific setup and installation guide or the HP ROM-Based Setup Utility User Guide. These guides are available on the server Documentation CD.
- Do not power up the server until the hardware configuration is satisfactory and remember to check the HP P700m website for the latest firmware version and upgrade.

3Gb SAS BL Switch installation notes and best practices

- When selecting interconnect bays for the switches, make sure that the selected bays map to the mezzanine slots of the desired server blade.

MDS600 storage enclosure installation notes and best practices

- The MDS600 storage enclosure will be the heaviest item in the rack. Make sure that the MDS600 is installed at the bottom of the rack. For example, if connecting six MDS600 to one BladeSystem c-Class enclosure, install four MDS600 enclosures in the bottom of the rack, install the c-Class enclosure just above the midpoint of the rack, and install the remaining two MDS600 enclosures at the top of the rack. Plan the rack installation carefully because it is difficult to change the location of components after they are installed.
- When installing disk drives, populate the drive bays from the rear to the front of the drawer, starting with the highest device bay ID number.

- Use blanks to fill unpopulated drive bays. Gaps between components cause changes in airflow through the device. Using blanks ensures proper airflow.

MSA2000sa family storage enclosure installation notes and best practices

- You can supply a nickname for the SAS WWN to be able to easily identify the host in the host list.
 - For the MSA2000sa, see `set host-wwn-name` in the *HP StorageWorks 2000 Family Modular Smart Array CLI reference guide* or “Managing the Global Host List on a SAS System” in the *HP StorageWorks 2000 Family Modular Smart Array reference guide*.
 - For the MSA2000sa G2, see `set host-name` in the *HP StorageWorks 2000 G2 Family Modular Smart Array CLI reference guide* or “Managing the Global Host List on a SAS System” in the *HP StorageWorks 2000 G2 Family Modular Smart Array reference guide*.
- If creating multiple volumes, consider using multiple Vdisks to improve performance.
- Decide whether to use explicit mapping to control which hosts can access a volume. For more information, see “Managing Host Access to Volumes” in the *HP StorageWorks 2000 Family Modular Smart Array reference guide*.

6 Solution management tools

The following software tools are used to configure, manage, and monitor devices in this solution:

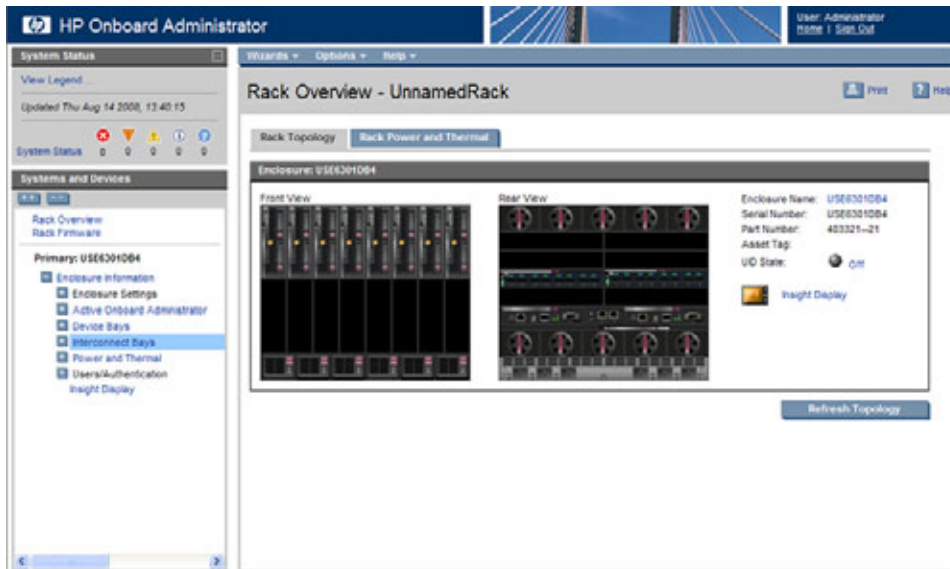
- [HP Onboard Administrator](#)—for managing and monitoring the c-Class enclosure and all of its devices.
- [HP Virtual SAS Manager](#)—for managing and monitoring the 3Gb SAS BL Switch.
- [MSA2000-family Storage Management Utility](#) and [MSA2000-family Command Line Interface](#)—for configuring MSA2000-family array controllers and its storage.
- [HP Array Configuration Utility](#)—for configuring storage on MDS600 storage enclosures.
- [HP Systems Insight Manager](#)—for monitoring storage enclosures, such as the MSA2000sa and MDS600.
- [MSL Tape Libraries and 1/8 G2 Tape Autoloader remote management interface](#)—for configuring tape libraries and autoloaders.
- [MSL Tape Libraries and 1/8 G2 Tape Autoloader operator control panel](#)—for configuring tape libraries and autoloaders.

HP Onboard Administrator

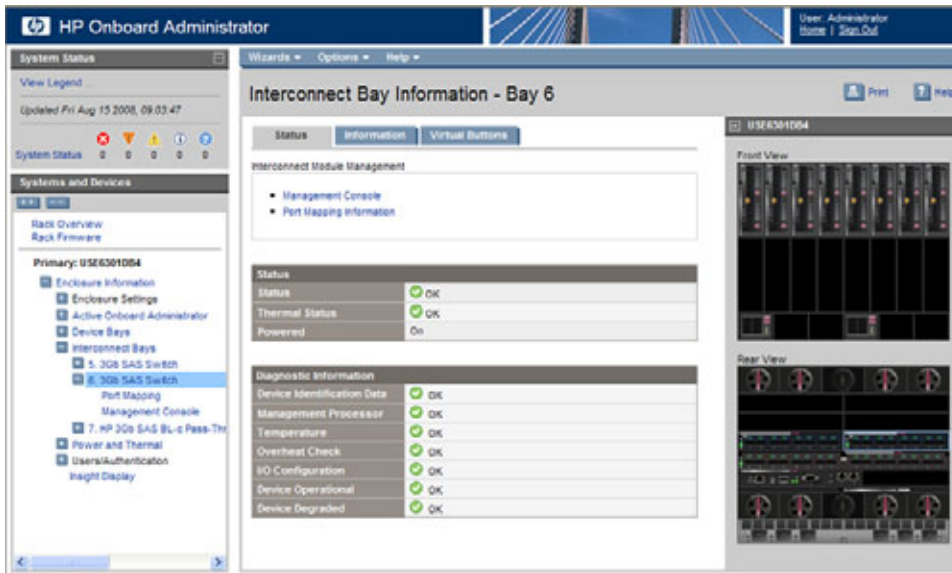
HP BladeSystem Onboard Administrator (OA) is the enclosure management processor, subsystem, and firmware base used to support the HP BladeSystem c-Class enclosures and the managed devices contained within the enclosure.

OA provides a single point from which to perform basic management tasks on server blades or switches within the c-Class enclosure. Using hardwired knowledge, OA performs initial configuration steps for the enclosure, allows for run-time management and configuration of the enclosure components, and informs you of problems within the enclosure through e-mail, SNMP, or the Insight Display. For more information about using OA, see the *HP BladeSystem Onboard Administrator User Guide*.

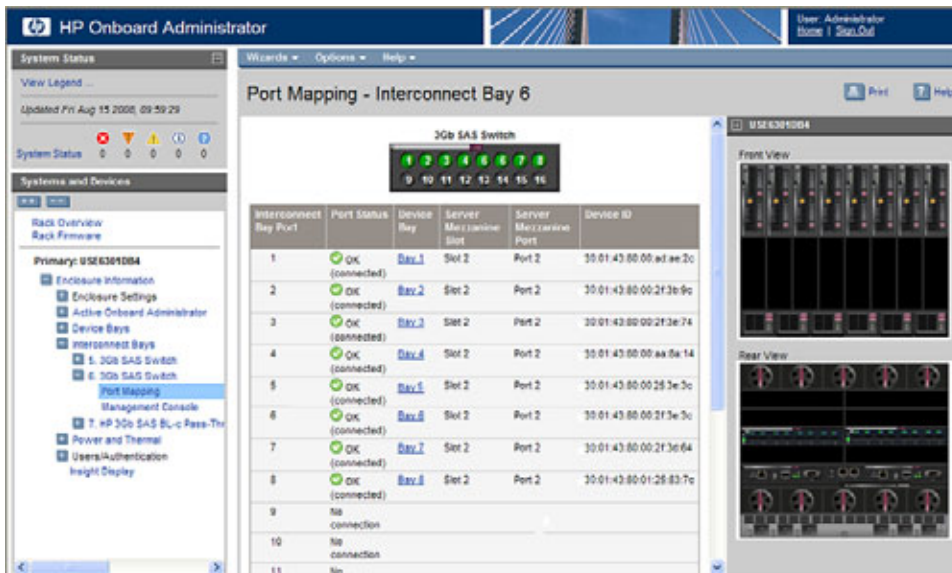
The following image shows the Rack Topology view of the front and rear of a c7000 enclosure, with the primary navigation tree on the left-side of the display. As shown in this example, half-height server blades are installed in device bays 1–8, and the two SAS BL switches are installed in interconnect bays 5 and 6.



As shown in the following image, selecting an item in the navigation tree displays management and monitoring tasks for the selected device. For example, when a 3Gb SAS BL Switch installed in interconnect bay 6 is selected in the navigation tree, additional information about the device is displayed, with tabs at the top of the display providing additional functions.



As shown in the following image, when determining the WWN of the P700m mezzanine ports, expand the navigation tree for a 3Gb SAS BL Switch and then click Port Mapping. For the selected switch, the display shows each port of the switch, the server blade it is mapped to, and the WWN of the P700m mezzanine port.



HP Virtual SAS Manager

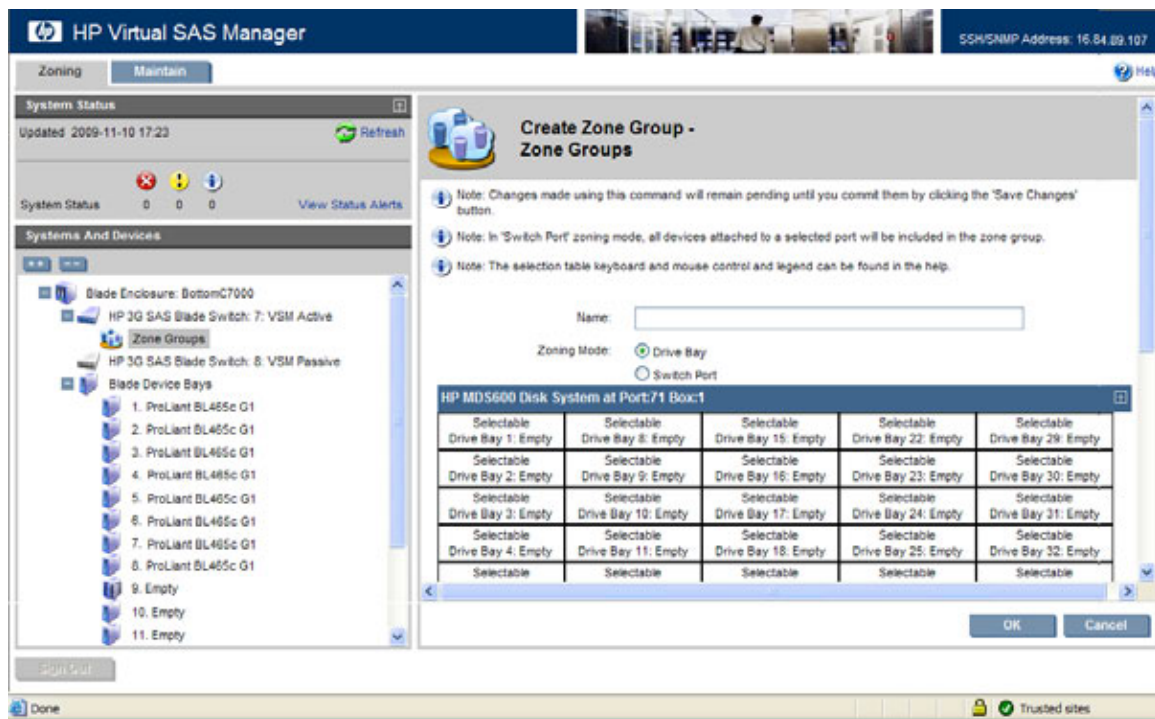
HP Virtual SAS Manager (VSM) resides in the 3Gb SAS BL Switch firmware and is the software application used to create hardware-based zone groups to control access to external SAS storage. Servers in the c-Class enclosure are then granted access to these zone groups, allowing them to access the storage.

Available in both a graphical user interface (GUI) and a command line interface (CLI), VSM offers the following key tasks:

- Enter switch parameters
- Create zone groups
- Assign zone groups to servers
- Reset the switch
- Update firmware

For information on the VSM, see its online help and the *HP Virtual SAS Manager user guide*, available on the 3Gb SAS BL Switch page of the HP Manuals website <http://www.hp.com/support/manuals>.

The following image shows an example page of the VSM.



! IMPORTANT:

Storage is configured, formatted, and partitioned using software utilities such as the HP Array Configuration Utility (ACU), HP Storage Management Utility (SMU), and Microsoft Disk Manager. Configuration tools differ for each storage enclosure and operating system environment. For more information, see the QuickSpecs for the storage enclosure.

MSA2000-family Storage Management Utility

The Storage Management Utility (SMU) offers a graphical user interface (GUI) for configuring, managing, and monitoring the MSA2000-family storage systems. The SMU is accessed through a browser by entering the IP address of the MSA2000 management port.

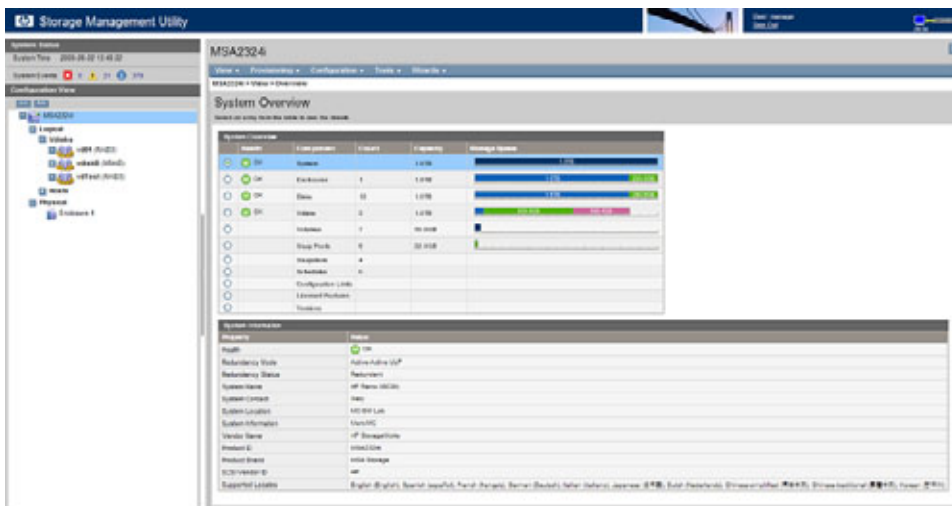
Through the SMU, you can manage the following physical and logical storage components: controller enclosures, drive enclosures, MSA2000 controllers, power-and-cooling modules, hard drives, virtual disks (Vdisks), volumes, volume-to-host mappings, master volumes, snap pools, and snapshots.

The SMU includes monitoring and diagnostic features that enhance the reliability, availability, and serviceability of the storage system. You can configure the transmission of event notifications (alerts), which can be sent to the screen or to e-mail addresses, and Simple Network Management Protocol (SNMP) traps, which can be sent to an SNMP application. Events are also recorded in an event log on the storage system from which they can be viewed.

In dual-controller systems, you can access all SMU functions from either controller. If one controller becomes unavailable, you can continue to monitor and manage the storage system from the partner controller.

For more information about using the SMU, see the reference guide for your MSA2000 model, available on the MSA2000 website at <http://www.hp.com/go/msa2000>.

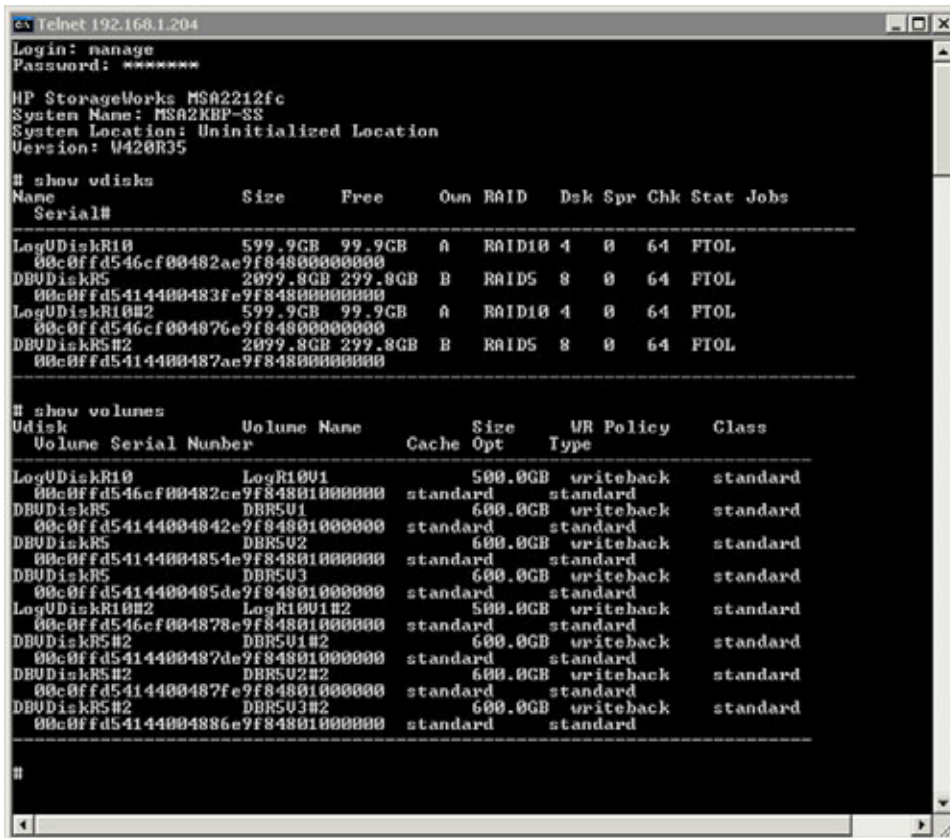
The following image shows a status summary view, with information about the MSA2000sa G2 and its Vdisks, including hardware and storage system status messages.



MSA2000-family Command Line Interface

The embedded CLI offers a command level method of configuring, managing, and monitoring the MSA2000-family array and its storage. You can enter individual commands or command scripts. The CLI is accessed locally through a terminal emulator running on a management host connected to the serial port on the MSA2000 controller or remotely through a Secure Shell application (SSH), Telnet, or terminal emulator running on a management host connected through a LAN to the Ethernet port on the MSA2000 controller. For more information about using the CLI, see the *HP StorageWorks 2000 Family Modular Smart Array CLI reference guide*.

The following image shows a CLI display for the `show vdisks` and `show volumes` command.



```

Telnet 192.168.1.204
Login: manage
Password: *****

HP StorageWorks MSA2212fc
System Name: MSA2KBP-SS
System Location: Uninitialized Location
Version: W420R35

# show vdisks
Name                               Size      Free      Own RAID  Dsk Spr  Chk Stat  Jobs
Serial#
-----
LogUDiskR10                         599.9GB  99.9GB   a  RAID10  4   0   64 FTOL
00c0ffd546cf00482ae9f84801000000
DBUDiskR5                           299.9GB  299.8GB  B  RAID5   8   0   64 FTOL
00c0ffd5414400483fe9f84801000000
LogUDiskR10#2                       599.9GB  99.9GB   a  RAID10  4   0   64 FTOL
00c0ffd546cf004876e9f84801000000
DBUDiskR5#2                          299.9GB  299.8GB  B  RAID5   8   0   64 FTOL
00c0ffd5414400487ae9f84801000000

# show volumes
Udisk                               Volume Name      Size      UR Policy  Class
Volume Serial Number              Cache Opt      Type
-----
LogUDiskR10                         LogR10U1         500.0GB  writeback  standard
00c0ffd546cf00482ce9f84801000000  standard
DBUDiskR5                           DBRSU1          600.0GB  writeback  standard
00c0ffd54144004842e9f84801000000  standard
DBUDiskR5                           DBRSU2          600.0GB  writeback  standard
00c0ffd54144004854e9f84801000000  standard
DBUDiskR5                           DBRSU3          600.0GB  writeback  standard
00c0ffd5414400485de9f84801000000  standard
LogUDiskR10#2                       LogR10U1#2      500.0GB  writeback  standard
00c0ffd546cf004878e9f84801000000  standard
DBUDiskR5#2                          DBRSU1#2        600.0GB  writeback  standard
00c0ffd5414400487de9f84801000000  standard
DBUDiskR5#2                          DBRSU2#2        600.0GB  writeback  standard
00c0ffd5414400487fe9f84801000000  standard
DBUDiskR5#2                          DBRSU3#2        600.0GB  writeback  standard
00c0ffd54144004886e9f84801000000  standard
#

```

HP Array Configuration Utility

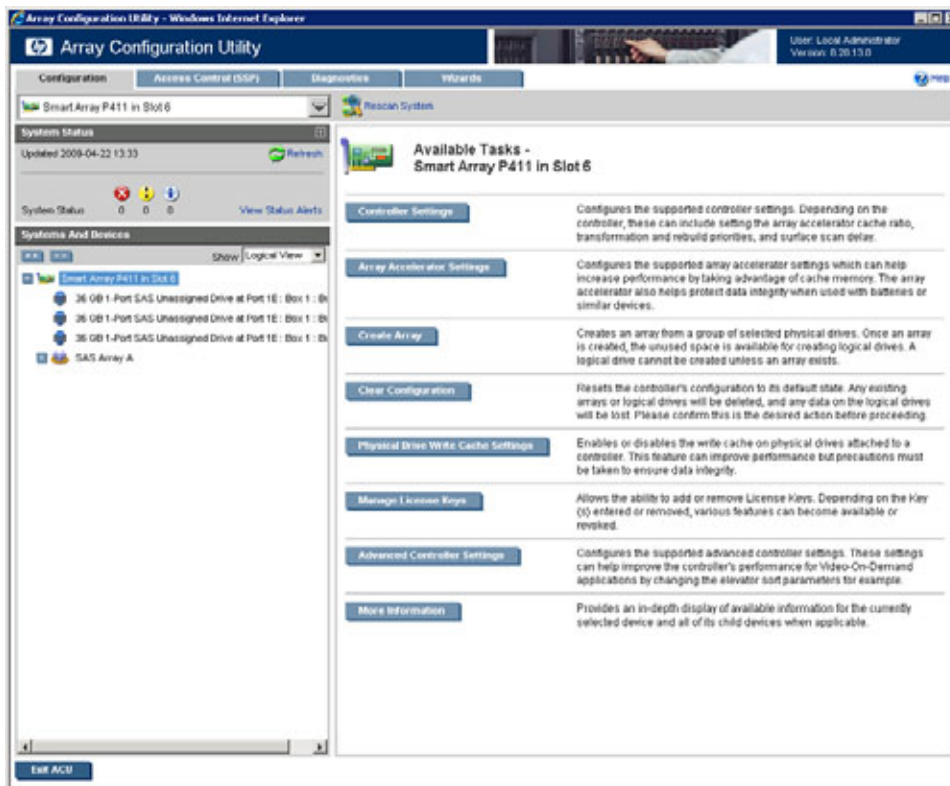
The Array Configuration Utility (ACU) is a server-based, browser-accessed tool used to configure a controller and its storage. The ACU is supported for use in Windows, Linux, and NetWare environments and can run locally from the server or remotely through HP Systems Insight Manager (HP SIM).

The ACU:

- Is available in both a graphical user interface and a command line interface.
- Allows the setting of access rights to MSA storage by hosts.
- Supports local or remote access.

NOTE:

When creating arrays using the graphical user interface, the ACU provides easy-to-use configuration wizards and suggested settings. Consider these defaults (especially the RAID level and rebuild priority) and make sure that they are acceptable according to your plans.



For information about using the ACU, see the ACU section of the Configuring Arrays on HP Smart Array Controllers Reference Guide. This guide is available on the Support page of the ACU website: <http://h18000.www1.hp.com/products/servers/proliantstorage/software-management/acumatrix/>

HP Systems Insight Manager

HP Systems Insight Manager (SIM) is the foundation for the HP unified server-storage management strategy. SIM is a hardware-level management product that provides basic management features through a single management view. SIM provides device management capabilities that consolidate and integrate management data from HP and third-party devices. SIM reports hardware fault conditions (both failure and pre-failure) and collects data for reporting and graphing. SIM also provides base-level management of HP clients, printers, and selected storage.

HP recommends using HP SIM to monitor the performance of your systems.

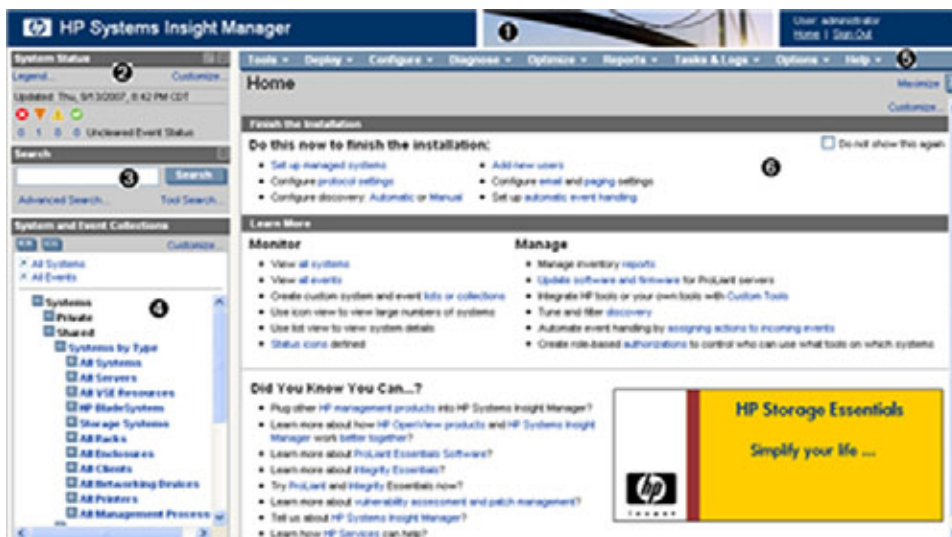
NOTE:

You must install and use SIM to benefit from the Pre-Failure Warranty for processors, SAS, SCSI, and SATA hard drives, and memory modules.

Key SIM benefits include:

- System discovery and identification
- Fault management and event handling
- Inventory data collection
- Data collection and inventory reports on system devices

For more information, see the SIM website <http://www.hp.com/go/hpsim>.



MSL Tape Libraries and 1/8 G2 Tape Autoloader remote management interface

With the remote management interface (RMI), you can monitor, configure, and operate most Library or Autoloader functions from a web browser. The RMI is accessed through a browser by entering the IP address of the Library or Autoloader.

When possible, use the RMI as the primary Library or Autoloader interface because the web interface provides access to additional features, includes online help, and is easier to use than the front panel. However, the RMI is not required to use the product, except to configure SNMP, IPv6, and logical libraries. The only tasks that cannot be performed from the RMI are: opening the mailslot, initiating the wellness test, saving and restoring files, and downloading firmware via a USB flash drive.

Before using the RMI, you must configure the device's network and set the administrator password with the operator control panel (OCP).



TIP:

Check the Help screens in the RMI for additional information. The help pages are updated with most firmware updates and often contain technical details that are not contained in the documentation. To access RMI help, click Help on the right side of the Web page banner.

For more information about the RMI, see the *HP StorageWorks MSL2024, MSL4048, and MSL8096 Tape Library user and service guide* or the *HP StorageWorks 1/8 G2 Tape Autoloader user and service guide*.

As shown in the following image, the System Status pane on the left side of the page shows the current device and drive status. The System Status pane for the MSL4048 and MSL8096 also shows the power supply status. Use the tabs in the main window to view the different screens. Some screens require the administrator password.

The screenshot displays the HP Command View MSL web interface. The top navigation bar includes the HP logo, the text "Command View MSL", and a user account dropdown menu showing "Account: User" and "Logout Help". Below the navigation bar are tabs for "Identity", "Status", "Configuration", "Operations", and "Support". The "Status" tab is selected, and sub-tabs for "Library", "Drive", "Inventory", and "Security" are visible. The "Library" sub-tab is active, showing a "Library Status" pane with the following data:

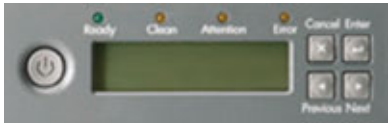
Library Status #8 20:01:36 Library Time	
Status	Ready
Cartridge In Transport	None
Odometer	6940
Total Power On Time	68d 23h 46min
Robotic Status	Ready
Internal Temperature	29.5 °C
Power Supply Status	1 Online
Media Removal	Abused
Level 1 - Left Magazine	Present
Level 1 - Right Magazine	Present
Level 2 - Left Magazine	Present
Level 2 - Right Magazine	Present

Below the Library Status pane is a "Refresh" button. On the left side of the interface, the "System Status" pane is visible, showing the following information:

System Status	
Updated: Monday, 12/1/2008 13:06:21	
Library Name	TomLab4UA
Status	Ready
Drive 1 Status	Ready
Drive 2 Status	Ready
Drive 3 Status	Ready
Drive 4 Status	Ready
Slots (Free/Total)	33/48
Mailslot	Disabled
Library Time	12-01-08 20:05
Power Supply Status	1 Online

MSL Tape Libraries and 1/8 G2 Tape Autoloader operator control panel

The operator control panel (OCP) has a power button, four LEDs, an LCD screen, and control keys. With the OCP, you can monitor, configure, and operate most library or Autoloader functions from the front panel. Use the control buttons to scroll through the menu. For more information about the OCP, see the *HP StorageWorks MSL2024, MSL4048, and MSL8096 Tape Library user and service guide* or the *HP StorageWorks 1/8 G2 Tape Autoloader user and service guide*.



MSL2024 and 1/8 G2 Tape Autoloader OCP



MSL4048 and MSL8096 OCP

7 Device worksheets

Use the following worksheets to record important reference information about your devices. Because the number of devices differ for each installation, print or copy pages as needed.

- [Solution summary worksheet](#)
- [Server \(and mezzanine\) worksheet](#)
- [Interconnect worksheet](#)
- [MDS600 storage enclosure worksheet](#)
- [MSA2000sa controller enclosure worksheet](#)
- [MSA2000 drive enclosure worksheets](#)
- [Tape and Autoloader worksheet](#)

 **NOTE:**

Device and system information recorded in these worksheets is used when initially installing and configuring the solution, and will be helpful for troubleshooting purposes. Print or copy pages of this section as needed.

Solution summary worksheet

Use the following spaces to record big-picture information about your solution. This information might be required or obtained during initial setup and configuration, and is helpful for future configuration changes and troubleshooting.

Component	Quantity of	
Rack		Model:
		Rack name:
Power Distribution Units (PDUs)		
HP c-Class BladeSystem Enclosure		
HP c-Class Onboard Administrator module		
HP c-Class BladeSystem Server Blades		
HP c-Class BladeSystem SAS mezzanine cards		<i>P700m</i>
HP c-Class BladeSystem SAS interconnect devices		<i>3Gb SAS BL Switch</i>
External SAS shared storage controller enclosure		
Tape or Autoloader		
SAS cables		
Hard drives		
SAS fanout cable		

Server (and mezzanine) worksheet

Server blade model:	
Serial number:	
Server name:	
OS version/service pack:	
Installed in enclosure device bay number:	
Onboard Administrator IP address:	
Mezzanine slot used by P700m:	
P700m serial number	
P700m firmware version (must be the same on all mezzanines):	
P700m WWN	Accessing switch in interconnect bay #

Interconnect worksheet

❗ **IMPORTANT:**

Multi-path configurations need two switches.

Model: 3Gb SAS BL Switch
Serial number:
Switch name:
Firmware version (must be the same on all switches):
Installed in enclosure interconnect bay number:
Model: 3Gb SAS BL Switch
Serial number:
Switch name:
Firmware version (must be the same on both switches):
Installed in enclosure interconnect bay number:

MDS600 storage enclosure worksheet

Model: MDS600 storage enclosure
Chassis serial number:
Device name:
Firmware version (must be the same on all I/O modules):
I/O module 1 WWID:
I/O module 2 WWID:
I/O module 3 WWID:
I/O module 4 WWID:
ACU login information:
Hard drive types and sizes:

MSA2000sa controller enclosure worksheet

Model: <i>MSA2000sa controller enclosure</i>
MSA controller model:
Chassis serial number:
Device name:
Hard drive type and size:
Firmware version (must be the same on both controllers):
Controller A Management port IP address:
Controller A, Port 0 WWN:
Controller A, Port 1 WWN:
Controller B Management port IP address:
Controller B, Port 0 WWN:
Controller B, Port 1 WWN:
SMU login information:

MSA2000 drive enclosure worksheets

Model: MSA2000 drive enclosure
Chassis serial number:
Device name:
Enclosure firmware version:
Hard drive type and size:
Model: MSA2000 drive enclosure
Chassis serial number:
Device name:
Enclosure firmware version:
Hard drive type and size:
Model: MSA2000 drive enclosure
Chassis serial number:
Device name:
Enclosure firmware version:
Hard drive type and size:
Model: MSA2000 drive enclosure
Chassis serial number:
Device name:
Enclosure firmware version:
Hard drive type and size:

MSA70 drive enclosure worksheets

Model: MSA70 drive enclosure
Chassis serial number:
Device name:
Enclosure firmware version:
Hard drive type and size:
Model: MSA70 drive enclosure
Chassis serial number:
Device name:
Enclosure firmware version:
Hard drive type and size:
Model: MSA70 drive enclosure
Chassis serial number:
Device name:
Enclosure firmware version:
Hard drive type and size:
Model: MSA70 drive enclosure
Chassis serial number:
Device name:
Enclosure firmware version:
Hard drive type and size:

Tape and Autoloader worksheet

Model:
Chassis serial number:
Device name:
Firmware version:

Part II. Deployment examples

The following chapters describe example deployments:

- [Introduction](#), page 77
- [Switch and storage enclosure port information](#), page 79
- [Deployment examples](#), page 85

The following example configurations are illustrated:

- [Zoned storage—single domain, standard cabling](#), page 86
- [Zoned storage—single domain, wide-port cabling](#), page 87
- [Zoned storage—single domain, wide-port cabling, max performance with SATA disk drives](#), page 88
- [Zoned storage—dual domain, standard cabling](#), page 90
- [Zoned storage—dual domain, wide-port cabling](#), page 91
- [Zoned storage—with two c-Class enclosures](#), page 92
- [Zoned storage—maximum capacity](#), page 93
- [Shared storage—single controller, standard cabling](#), page 97
- [Shared storage—dual controller, standard cabling](#), page 98
- [Shared storage—dual controller, optimal cabling](#), page 99
- [G2 shared storage—dual controller, optimal cabling](#), page 100
- [Shared storage—with cascaded drive enclosures](#), page 101
- [G2 Shared storage—with two c-Class enclosures](#), page 102
- [Shared storage—with double-density servers](#), page 104
- [Shared storage—maximum capacity](#), page 103
- [Zoned and Shared storage—to the same c-Class enclosure](#), page 106
- [Tape library—basic cabling](#), page 107

8 Introduction

Examples in this section illustrate a few of the supported deployments when connecting external SAS storage enclosures to the c-Class BladeSystem. The focus of these examples is on hardware options, requirements, and SAS cabling. Most examples are of dual-domain, high-availability configurations, so that if any component along the path fails, traffic will fail over to the alternate path.

- Most configurations discussed and illustrated in this document provide high availability to the storage enclosures:
 - Standard high-availability cabling provides two cable paths to the external storage; one to the primary switch and the other one to the paired switch in the same interconnect row of BladeSystem c-Class enclosure.
 - Optimal and wide-port high-availability cabling provide four cable paths to the external storage. The additional paths in optimal and wide-port cabling configurations provide additional availability and offer improved performance.
- Because configuration and cabling principles are the same for MSA2000sa and MSA2000sa G2 controller enclosures, examples of shared storage show either the MSA2000sa or MSA2000sa G2 controller enclosure. Examples are not duplicated for each MSA model.
- In the provided illustrations, colors are used to highlight and differentiate the cable paths from the 3Gb SAS BL switches to the storage enclosures. The choice of colors do not represent the actual color of the cable, but were chosen to help color-impaired readers better differentiate the paths.
 - Blue cables: Connections to the primary (left) switch in the BladeSystem c-Class enclosure. (Interconnect bays 3, 5, or 7)
 - Green cables: Connections to the paired switch in the same row of the BladeSystem c-Class enclosure. (Interconnect bays 4, 6, or 8)

The following standards are maintained in the sample configurations:

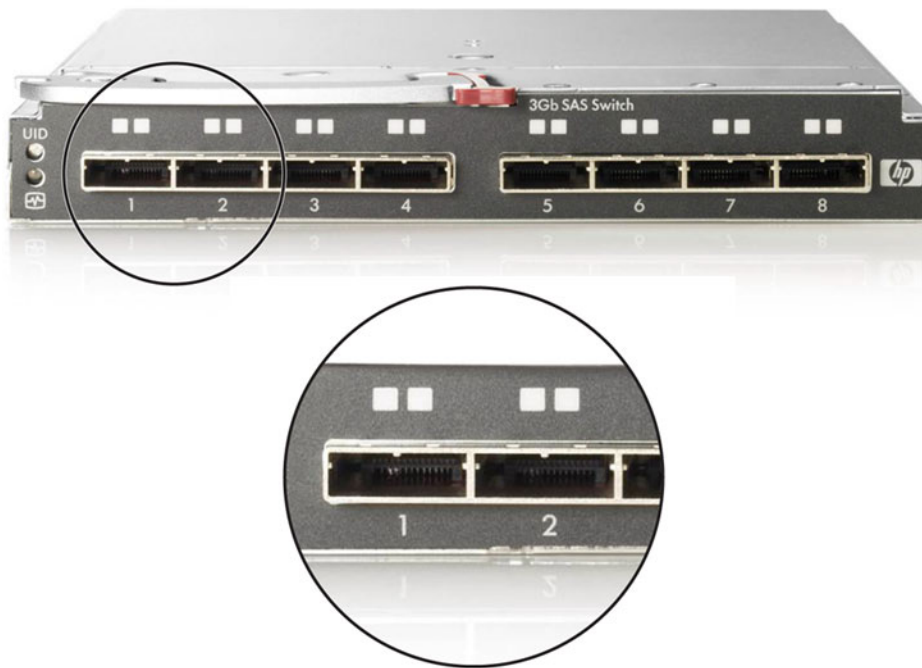
Device	Single domain	Dual domain
SAS switches:	<p>Depending on the type of server blade used, one or two switches are installed in the c-Class enclosure, providing a single path between the server blades and the switches.</p> <p>When using full-height or half-height server blades, one switch is required.</p> <p>When using double-density server blades in the c7000 enclosure, two switches are required, installed in different interconnect rows, for example, in interconnect bays 5 and 7.</p>	<p>Depending on the type of server blade used, two or four switches are installed in the c-Class enclosure, providing dual paths between the server blades and the switches.</p> <p>When using full-height or half-height server blades, two switches are required, installed in adjacent interconnect bays, for example, in interconnect bays 5 and 6.</p> <p>When using double-density server blades in the c7000 enclosure, four switches are required, installed in different interconnect rows, for example, in interconnect bays 5, 6, 7, and 8.</p>
MSA2000sa SAS controller modules:	<p>One controller is installed in MSA2000sa controller enclosures, providing a single path between the switch and the MSA2000sa.</p>	<p>Two controllers are installed in MSA2000sa controller enclosures, providing an alternate path between the switches and the MSA2000sa.</p>
MDS600 SAS I/O modules:	<p>Two I/O modules are installed in the MDS600 storage enclosure, providing a single path between the switch and the single-port SATA disk drives in each MDS600 enclosure drawer.</p>	<p>Four I/O modules are installed in the MDS600 storage enclosure, providing alternate paths between the switches and the dual-port SAS disk drives in each MDS600 enclosure drawer.</p>
Cabling:	<p>A single cable is connected between the switch and the storage enclosure. If ports on the switch and the storage enclosure are available, connect an additional cable between the devices, for improved performance.</p>	<p>Two cables are connected between the switch and the storage enclosure: one from the primary controller or I/O module and one from the secondary controller or I/O module. If ports on the switch and the storage enclosure are available, connect an additional cable between the devices, for improved performance.</p>
Zoning:	<p>When creating and assigning zone groups to server bays, assign server bays 1–8 to zone groups associated with storage connected to switch ports 1, 2, 3, or 4. Assign server bays 9–16 to zone groups associated with storage connected to switch ports 5, 6, 7, or 8. For more information, see “Zoning requirements” on page 44.</p>	

9 Device SAS port information

3Gb SAS BL Switch port information

As shown in the following illustration:

- **SAS ports:** 8, from left to right on the front of the switch. Labeled 1–8. Use these SAS ports to connect external SAS storage enclosures and tape devices.



When cabling external storage enclosures to the switch, note the following:

- Storage enclosures connected to switch ports 1–4 are reserved for use by server bays 1–8 in the BladeSystem c-Class enclosure.
- Storage enclosures connected to switch ports 5–8 are reserved for use by server bays 9–16 in the BladeSystem c-Class enclosure.
- For optimal performance, connect two cables from the switch to each storage enclosure I/O module or controller. This additional cable offers additional performance: one cable provides a x4 connection; two cables provide a x8 (wide-port) connection.

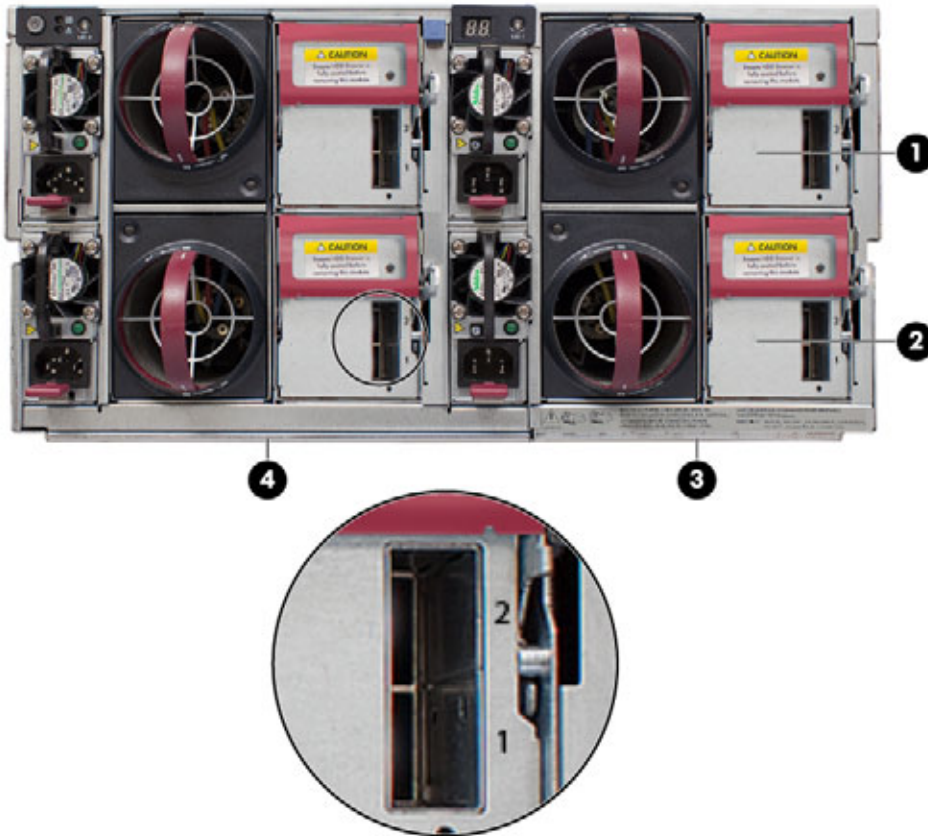
When creating and assigning zone groups to server bays, note the following:

- Assign server bays 1–8 zone groups associated with storage enclosures connected to switch ports 1, 2, 3, or 4.
- Assign server bays 9–16 zone groups associated with storage enclosures connected to switch ports 5, 6, 7, or 8.

MDS600 storage enclosure port information

As shown in the following illustration:

- **SAS port 1:** the bottom port on each I/O module. Use this SAS port for the first connection to the host (through the SAS Switch).
- **SAS port 2:** the top port on each I/O module. Use this SAS port in wide-port configurations for the additional connection to the host (through the SAS Switch).
- **Drawer numbers:** Each MDS600 has two drawers that contain the disk drives. From the rear of the device, drawer number 1 is on the right.



1. Primary I/O module (of drawer 1)

3. MDS600 enclosure drawer 1

2. Secondary I/O module (of drawer 1)

4. MDS600 enclosure drawer 2

When cabling MDS600 enclosures to the switch, note the following:

- When only one MDS600 storage enclosure is connected to a BladeSystem c-Class enclosure, a common cabling pattern is to connect one MDS600 drawer to switch ports 1–4 and the other MDS600 drawer to switch ports 5–8. This allows server bays 1–8 to access one MDS600 drawer and server bays 9–16 to access the other MDS600 drawer.

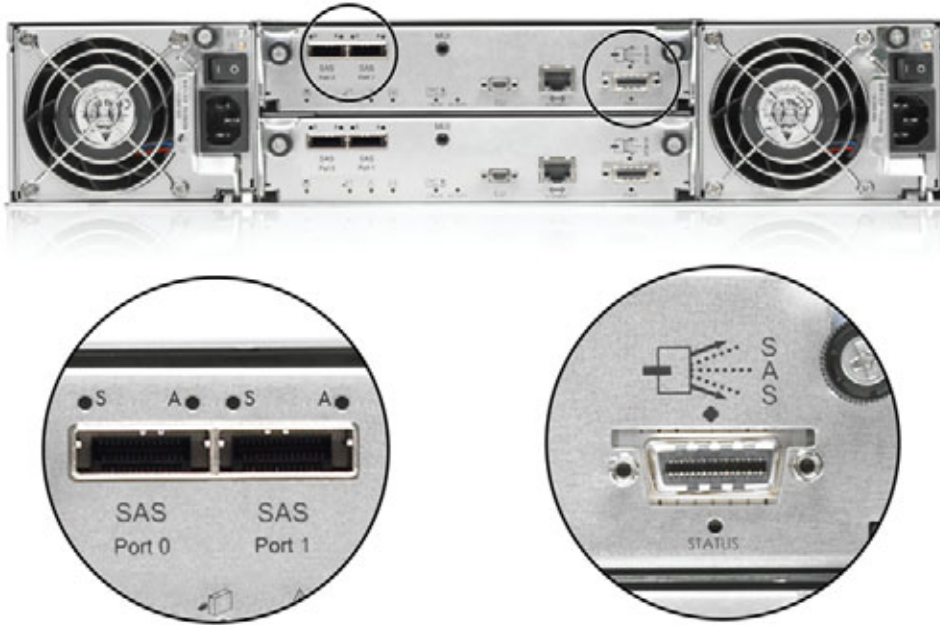
MSA2000sa controller enclosure port information

As shown in the following illustration:

- **SAS host ports:** two per controller. Labeled SAS Port 0 and SAS Port 1. Use these SAS host ports to connect to the hosts (switch).

When two controllers are installed in the enclosure, the controllers are referred to as follows:

- Top controller: A, with host ports referred to as A0 and A1
 - Bottom controller: B, with host ports referred to as B0 and B1
- **SAS expansion port:** one per controller. Labeled SAS, with a diamond symbol at the bottom of the label. Use this SAS expansion port to connect (cascade) additional MSA2000 drive enclosures.



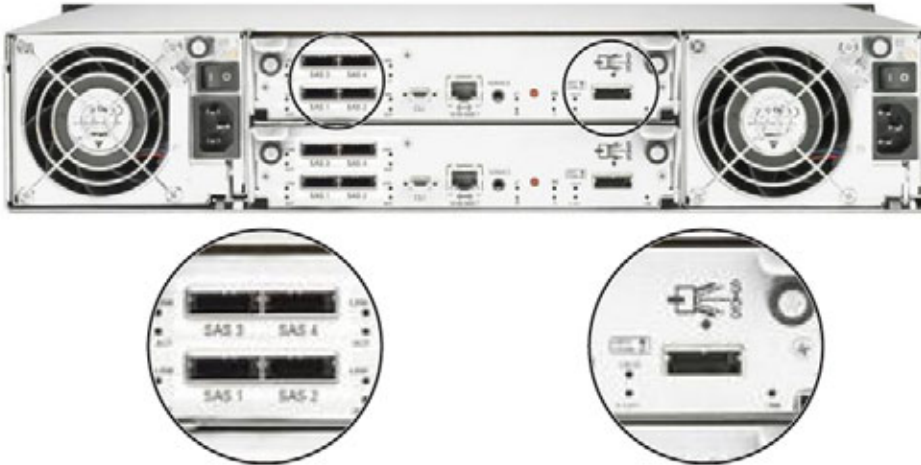
MSA2000sa G2 controller enclosure port information

As shown in the following illustration:

- **SAS host ports:** four per controller. Labeled SAS 1, SAS 2, SAS 3, and SAS 4. Use these SAS host ports to connect to the hosts (switch).

When two controllers are installed in the enclosure, the controllers are referred to as follows:

- Top controller: A, with host ports referred to as A1, A2, A3, and A4.
 - Bottom controller: B, with host ports referred to as B1, B2, B3, and B4.
- **SAS expansion port:** one per controller. Labeled SAS, with a diamond symbol at the bottom of the label. Use this SAS expansion port to connect (cascade) additional MSA2000 or MSA70 drive enclosures.

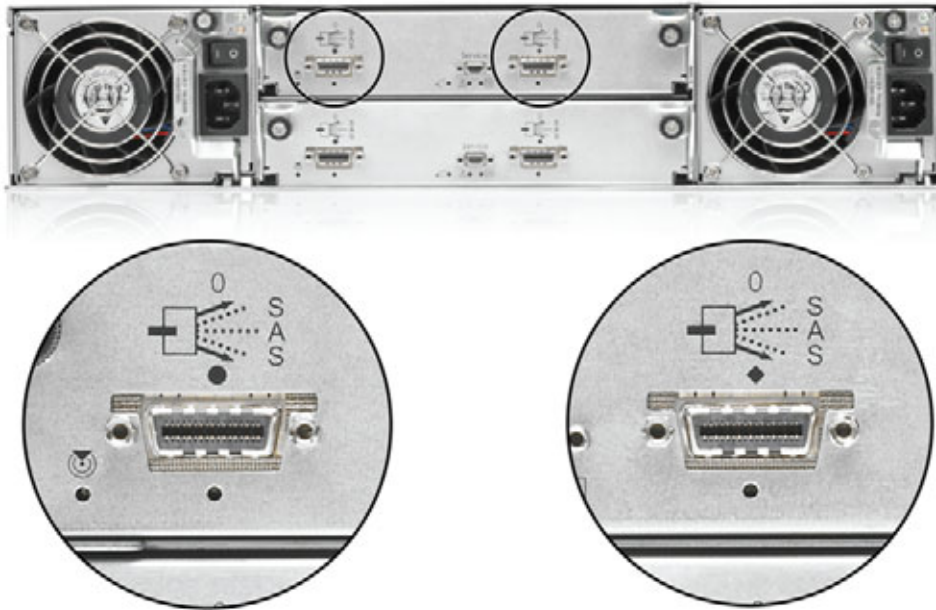


MSA2000 drive enclosure port information

MSA2000 drive enclosures are supported for use in MSA2000sa and MSA2000sa G2 environments.

As shown in the following illustration:

- **SAS In port:** one, on the left-side of the I/O module. Labeled SAS, with a round symbol at the bottom of the label. Use this SAS expansion port to connect to an MSA controller enclosure or to an MSA2000 drive enclosure that is between this drive enclosure and the controller enclosure.
- **SAS Out port:** one, on the right-side of the I/O module. Labeled SAS, with a diamond symbol at the bottom of the label. Use this SAS expansion port to connect (cascade) an additional MSA drive enclosure.



NOTE:

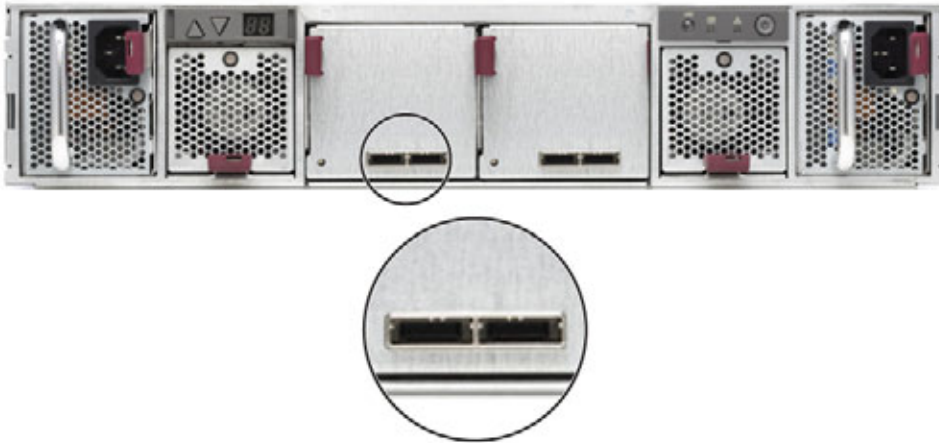
Mini-SAS to SAS cables are required when connecting MSA2000 drive enclosures. For more information, see the MSA2000 QuickSpecs or *HP StorageWorks 2000sa Modular Smart Array supported cable configurations*.

MSA70 drive enclosure port information

MSA2000 drive enclosures are supported for use in MSA2000sa G2 environments.

As shown in the following illustration:

- **SAS In port:** one, on the left-side of the I/O module. Use this SAS expansion port to connect to an MSA2000sa G2 controller enclosure or to an MSA2000 or MSA70 drive enclosure that is between this drive enclosure and the controller enclosure.
- **SAS Out port:** one, on the right-side of the I/O module. Use this SAS expansion port to connect (cascade) an additional MSA2000 or MSA70 drive enclosure.



NOTE:

Mini-SAS to SAS cables are required when connecting MSA2000 drive enclosures. For more information about purchasing these cables, see the *MSA2000sa G2 QuickSpecs* or *HP StorageWorks 2000sa G2 Modular Smart Array supported cable configurations*.

10 Deployment examples

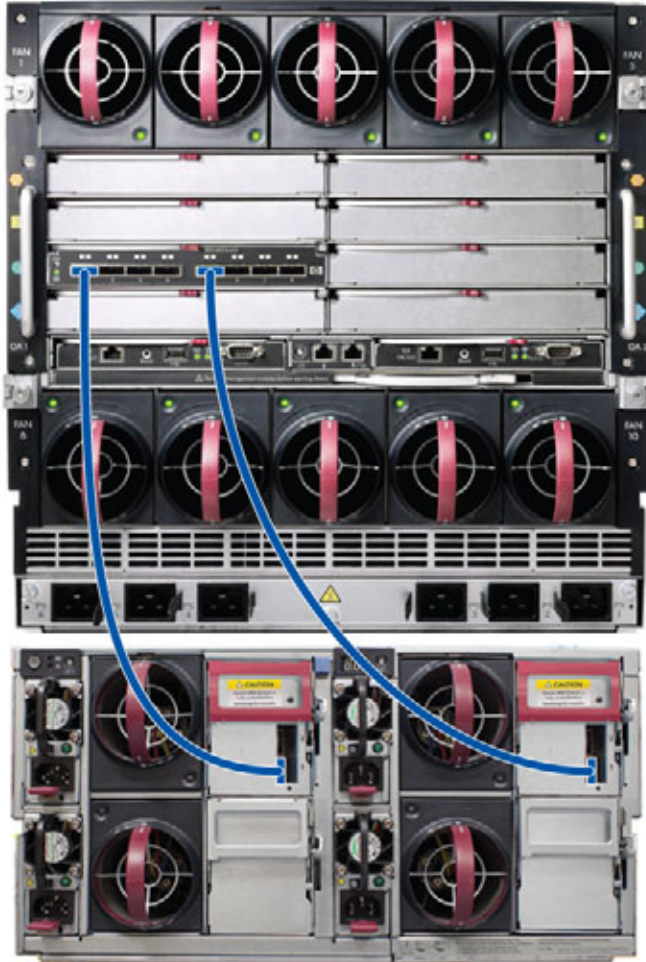
The following example deployments are illustrated:

- [Zoned storage—single domain, standard cabling, page 86](#)
- [Zoned storage—single domain, wide-port cabling, page 87](#)
- [Zoned storage—single domain, wide-port cabling, max performance with SATA disk drives, page 88](#)
- [Zoned storage—dual domain, standard cabling, page 90](#)
- [Zoned storage—dual domain, wide-port cabling, page 91](#)
- [Zoned storage—with two c-Class enclosures, page 92](#)
- [Zoned storage—maximum capacity, page 93](#)
- [Shared storage—single controller, standard cabling, page 97](#)
- [Shared storage—dual controller, standard cabling, page 98](#)
- [Shared storage—dual controller, optimal cabling, page 99](#)
- [G2 shared storage—dual controller, optimal cabling, page 100](#)
- [Shared storage—with cascaded drive enclosures, page 101](#)
- [G2 Shared storage—with two c-Class enclosures, page 102](#)
- [Shared storage—with double-density servers, page 104](#)
- [Shared storage—maximum capacity, page 103](#)
- [Zoned and Shared storage—to the same c-Class enclosure, page 106](#)
- [Tape library—basic cabling, page 107](#)

Zoned storage—single domain, standard cabling

This example illustrates standard cabling for a single-domain configuration **using single-port SATA disk drives**. In this configuration, note the following:

- One cable from each **MDS600** I/O module to the switch offers single-domain connectivity.



Devices and quantities

MDS600 storage enclosures: 1

MDS600 I/O modules: 2

BladeSystem c7000 enclosures: 1

3Gb SAS BL Switches: 1

Server blade types: half-height and full-height

Connection details

- Switch in interconnect bay 5:
 - Port 1: to MDS600 drawer 2, primary I/O module, port 1
 - Port 5: to MDS600 drawer 1, primary I/O module, port 1

Notes

- If sufficient ports on the switch are available, HP recommends connecting an additional cable from the switch to each I/O module, for additional performance. For an example, see [“Zoned storage—single domain, wide-port cabling”](#) on page 87.
- As shown in this illustration, server bays 1–8 may access MDS600 drawer 2 and server bays 9–16 may access MDS600 drawer 1. For more information, see [“3Gb SAS BL Switch port information”](#) on page 79.

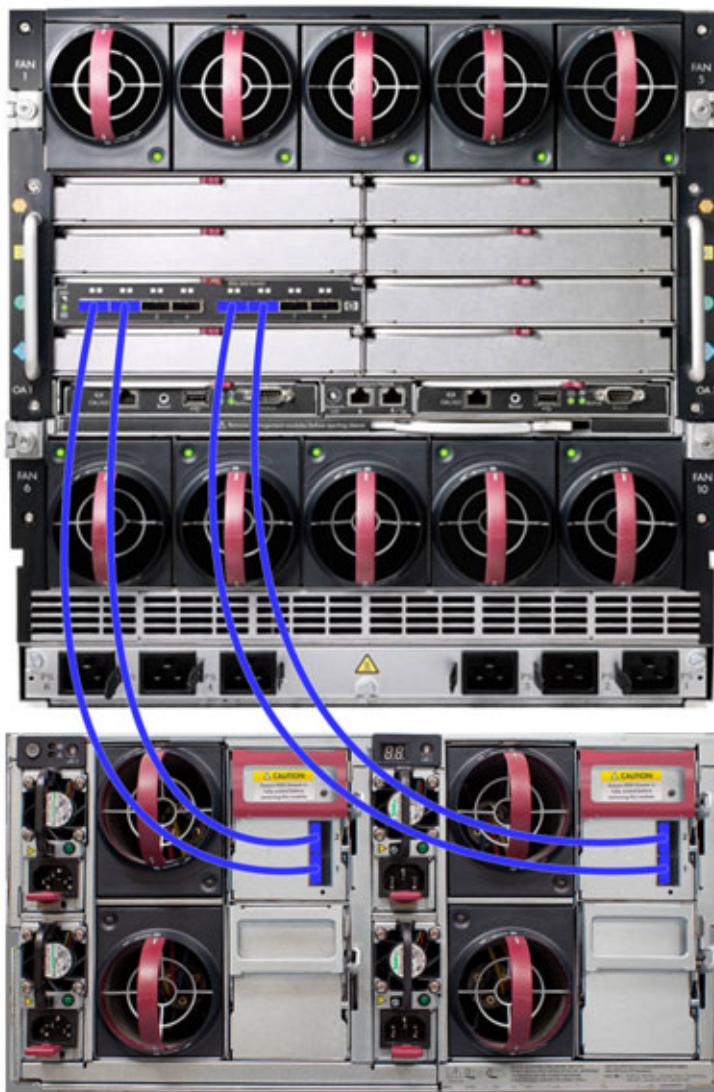
Zoned storage—single domain, wide-port cabling

This example illustrates high-performance cabling for a single-domain configuration **using single-port SATA disk drives**. In this configuration, note the following:

- An additional cable from each **MDS600** I/O module to an adjacent port on the switch offers additional performance: one cable provides a x4 connection; two cables provide a x8 (wide-port) connection. For more information on switch ports, x4, and x8 (wide-port) cabling, see “[HP StorageWorks 3Gb SAS BL Switch](#)” on page 24.

❗ IMPORTANT:

When using wide-port cabling, both cables from an MDS600 I/O module must connect to one of the following pairs of switch ports: 1/2, 3/4, 5/6, or 7/8.



Devices and quantities

MDS600 storage enclosures: 1

MDS600 I/O modules: 2

BladeSystem c7000 enclosures: 1

3Gb SAS BL Switches: 1

Server blade types: half-height and full-height

Connection details

- Switch in interconnect bay 5:
 - Port 1: to MDS600 drawer 2, primary I/O module, port 1
 - Port 2: to MDS600 drawer 2, primary I/O module, port 2
 - Port 5: to MDS600 drawer 1, primary I/O module, port 1
 - Port 6: to MDS600 drawer 1, primary I/O module, port 2

Notes

- As shown in this illustration, server bays 1–8 may access MDS600 drawer 2 and server bays 9–16 may access MDS600 drawer 1. For more information, see “[3Gb SAS BL Switch port information](#)” on page 79.

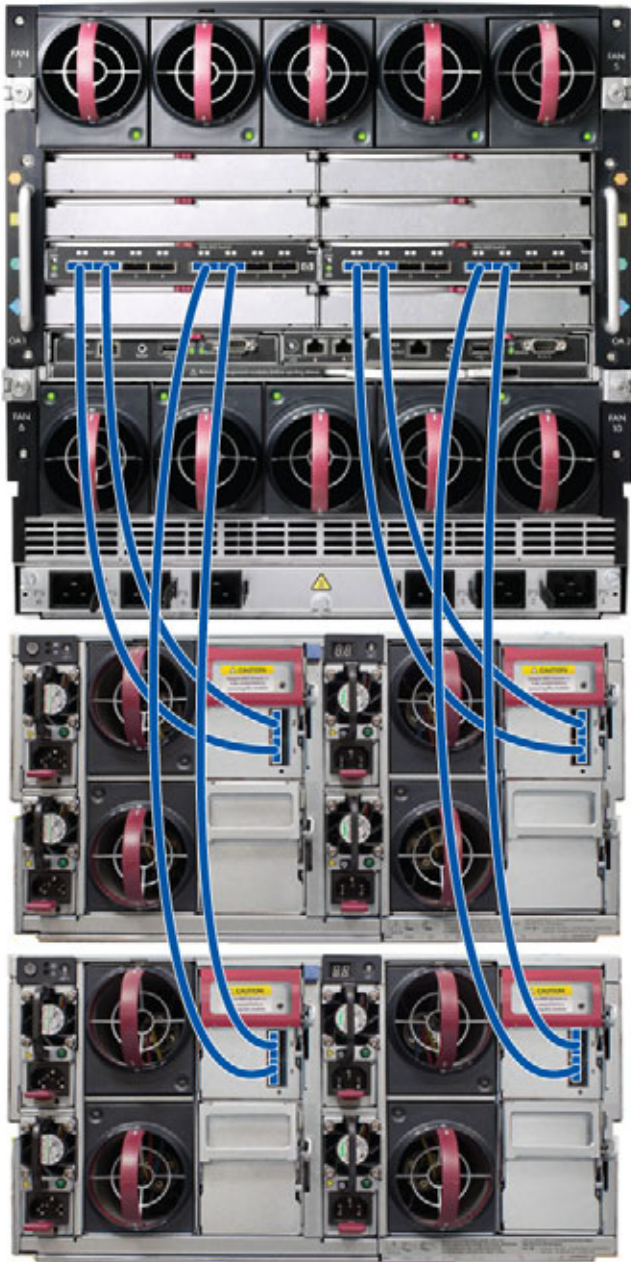
Zoned storage—single domain, wide-port cabling, max performance with SATA disk drives

This example illustrates cabling for best-possible performance in a single-domain configuration **using single-port SATA disk drives**. In this configuration, note the following:

- This configuration combines a unique cabling scheme AND zone group creation strategy to achieve best possible performance in a single-domain configuration.
- Wide-port cabling adds an additional cable from each **MDS600** I/O module (in each MDS600 drawer) to the switch, improving performance by providing an additional connection between the storage and the server: one cable provides a x4 connection; two cables provide a x8 (wide-port) connection. For more information on switch ports, x4, and x8 (wide-port) cabling, see “[HP StorageWorks 3Gb SAS BL Switch](#)” on page 24.
- Adding a second 3Gb SAS BL Switch (even though this is a single-domain environment) improves performance by providing two more connections between the MDS600 drawer and the server, for a total of four connections (when used in conjunction with the outlined cabling scheme and zone group creation strategy.)
- Connecting one MDS600 drawer to one switch and the other MDS600 drawer to the same ports on the other switch allows for the creation of zone groups that span the MDS600 drawers.
- Creating zone groups that include disk drives from each MDS600 drawer takes advantage of the unique cabling, so that all four connections between the storage and the server can be utilized.
- To achieve maximum performance, assign more than two disk drives from each MDS600 drawer to each zone group.

❗ **IMPORTANT:**

When using wide-port cabling, both cables from an MDS600 I/O module must connect to one of the following pairs of switch ports: 1/2, 3/4, 5/6, or 7/8.



Devices and quantities

- MDS600 storage enclosures: 2
- MDS600 I/O modules in each MDS600: 2
- BladeSystem c7000 enclosures: 1
- 3Gb SAS BL Switches: 2
- Server blade types: half-height and full-height

Connection details

- Switch in interconnect bay 5:
 - Port 1: to MDS600 drawer 2, primary I/O module, port 1
 - Port 2: to MDS600 drawer 2, primary I/O module, port 2
 - Port 5: to MDS600 drawer 2, primary I/O module, port 1
 - Port 6: to MDS600 drawer 2, primary I/O module, port 2
- Switch in interconnect bay 6:
 - Port 1: to MDS600 drawer 1, primary I/O module, port 1
 - Port 2: to MDS600 drawer 1, primary I/O module, port 2
 - Port 5: to MDS600 drawer 1, primary I/O module, port 1
 - Port 6: to MDS600 drawer 1, primary I/O module, port 2

Notes

- As shown in this illustration, server bays 1–8 will have exclusive access to one MDS600 enclosure and server bays 9–16 will have exclusive access to the other MDS600 enclosure.

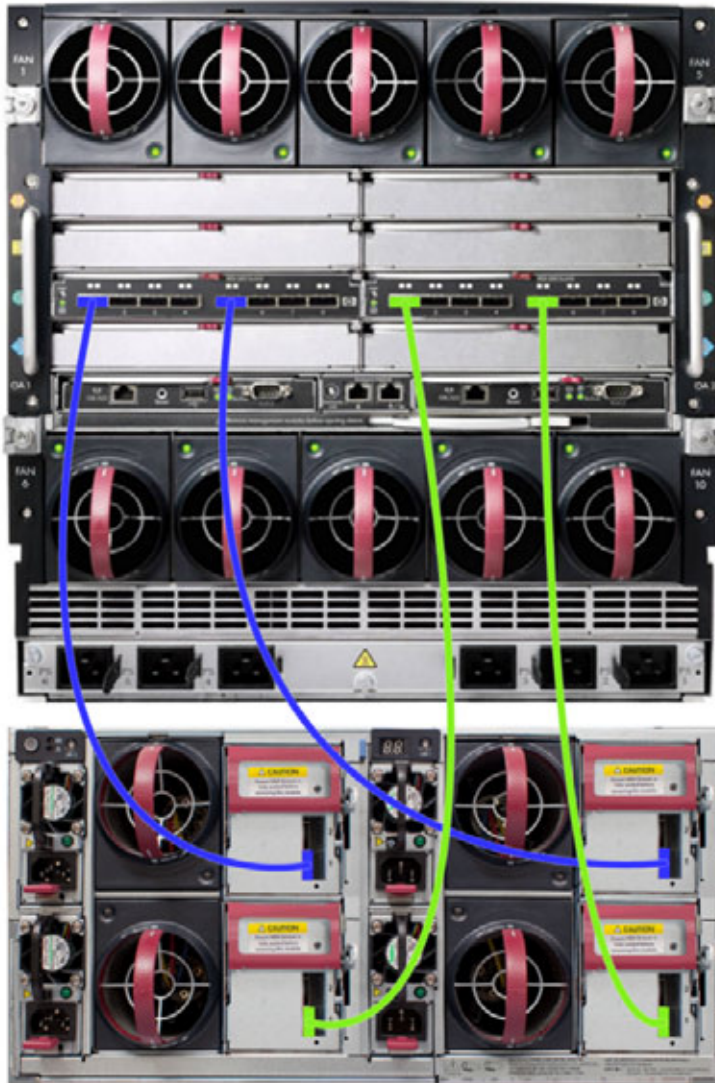
! IMPORTANT:

Because it includes two 3Gb SAS BL Switches, this configuration is similar in appearance to a dual-domain, wide-port configuration. However, because of the single I/O module in each MDS600 drawer when using single-port SATA disk drives, it is for single-domain use only. The additional switch is used in conjunction with the cabling scheme and zone group strategy to obtain best possible performance in a single-domain configuration using single-port SATA disk drives.

Zoned storage—dual domain, standard cabling

This example illustrates standard cabling for a high-availability configuration when **using dual-port SAS disk drives**. In this configuration, note the following:

- One cable from each MDS600 I/O module to each switch offers high availability.



Devices and quantities

MDS600 storage enclosures: 1

MDS600 I/O modules: 4

BladeSystem c7000 enclosures: 1

3Gb SAS BL Switches: 2

Server blade types: half-height and full-height

Connection details

- Switch in interconnect bay 5:
 - Port 1: to MDS600 drawer 2, primary I/O module, port 1
 - Port 5: to MDS600 drawer 1, primary I/O module, port 1
- Switch in interconnect bay 6:
 - Port 1: to MDS600 drawer 2, secondary I/O module, port 1
 - Port 5: to MDS600 drawer 1, secondary I/O module, port 1

Notes

- If sufficient ports on the switch are available, HP recommends connecting an additional cable from the switch to the I/O modules, for additional performance. For an example, see “Zoned storage—dual domain, wide-port cabling” on page 91
- As shown in this illustration, server bays 1–8 may access MDS600 drawer 2 and server bays 9–16 may access MDS600 drawer 1. For more information, see “3Gb SAS BL Switch port information” on page 79.

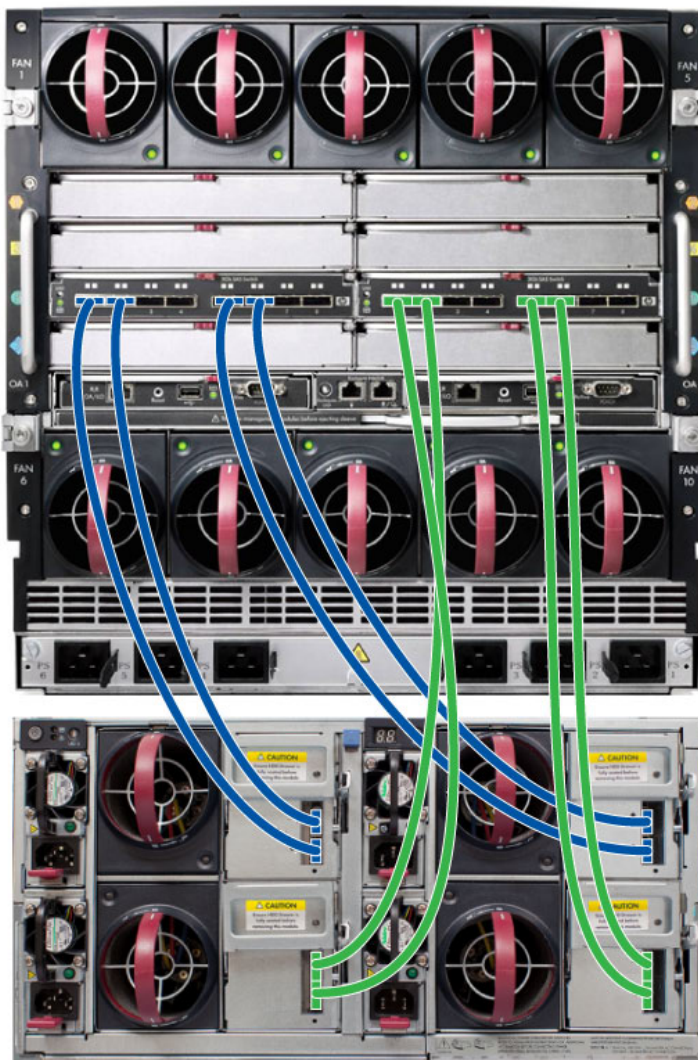
Zoned storage—dual domain, wide-port cabling

This example illustrates cabling for an optimal high-performance, high-availability configuration when using **dual-port SAS disk drives**. In this configuration, note the following:

- An additional cable from each **MDS600** I/O module to an adjacent port on the switch offers additional performance: one cable provides a x4 connection; two cables provide a x8 (wide-port) connection. For more information on switch ports, x4, and x8 (wide-port) cabling, see “[HP StorageWorks 3Gb SAS BL Switch](#)” on page 24.

ⓘ IMPORTANT:

When using wide-port cabling, both cables from an MDS600 I/O module must connect to one of the following pairs of switch ports: 1/2, 3/4, 5/6, or 7/8.



Devices and quantities

MDS600 storage enclosures: 1

MDS600 I/O modules: 4

BladeSystem c7000 enclosures: 1

3Gb SAS BL Switches: 2

Server blade types: half-height and full-height

Connection details

- Switch in interconnect bay 5:
 - Port 1: to MDS600 drawer 2, primary I/O module, port 1
 - Port 2: to MDS600 drawer 2, primary I/O module, port 2
 - Port 5: to MDS600 drawer 1, primary I/O module, port 1
 - Port 6: to MDS600 drawer 1, primary I/O module, port 2
- Switch in interconnect bay 6:
 - Port 1: to MDS600 drawer 2, secondary I/O module, port 1
 - Port 2: to MDS600 drawer 2, secondary I/O module, port 2
 - Port 5: to MDS600 drawer 1, secondary I/O module, port 1
 - Port 6: to MDS600 drawer 1, secondary I/O module, port 2

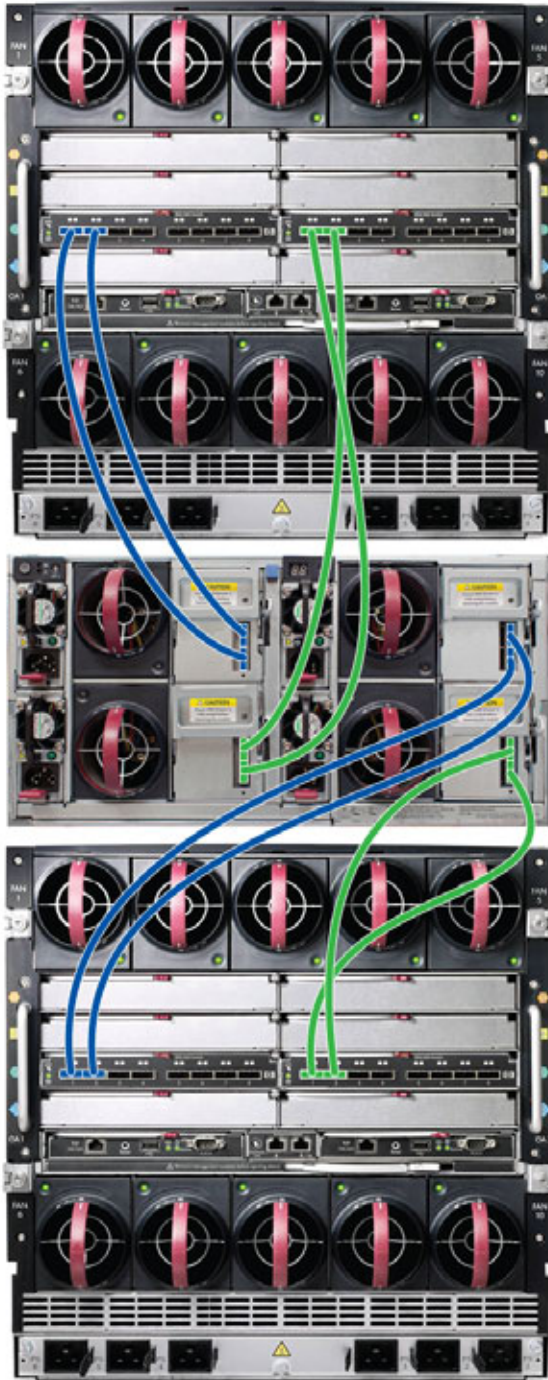
Notes

- As shown in this illustration, server bays 1–8 may access MDS600 drawer 2 and server bays 9–16 may access MDS600 drawer 1. For more information, see “[3Gb SAS BL Switch port information](#)” on page 79.

Zoned storage—with two c-Class enclosures

This example illustrates cabling from **two** BladeSystem c-Class enclosures to **one** MDS600 storage enclosure. In this configuration, note the following:

- This example shows a dual-domain MDS600 with wide-port cabling. Dual-domain standard cabling and single-domain devices are also supported.



Devices and quantities

MDS600 storage enclosures: 1

c7000 enclosures: 2

3Gb SAS BL Switches: 4 (2 in each c-Class enclosure)

Server blade types: half-height and full-height

Connection details

- Top c7000, Switch in interconnect bay 5:
 - Port 1: to MDS600 drawer 2, primary I/O module, port 1
 - Port 2: to MDS600 drawer 2, primary I/O module, port 2
- Top c7000, Switch in interconnect bay 6:
 - Port 1: to MDS600 drawer 2, secondary I/O module, port 1
 - Port 2: to MDS600 drawer 2, secondary I/O module, port 2
- Bottom c7000, Switch in interconnect bay 5:
 - Port 1: to MDS600 drawer 1, primary I/O module, port 1
 - Port 2: to MDS600 drawer 1, primary I/O module, port 2
- Top c7000, Switch in interconnect bay 6:
 - Port 1: to MDS600 drawer 1, secondary I/O module, port 1
 - Port 2: to MDS600 drawer 1, secondary I/O module, port 2

Notes

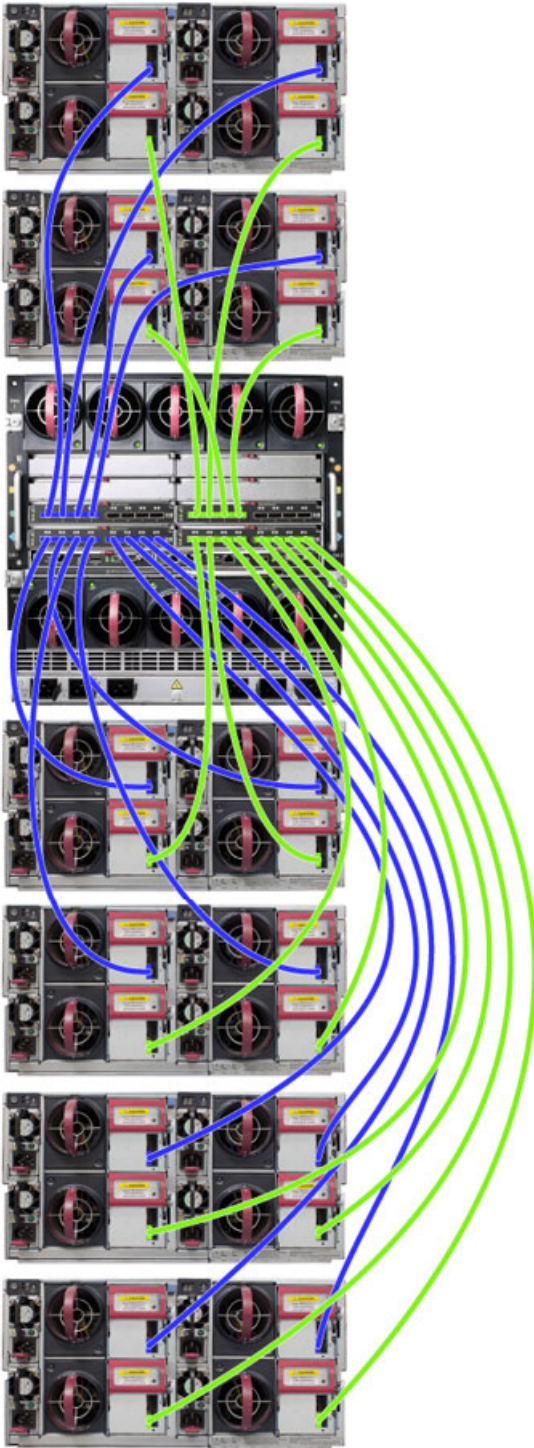
- When connecting one MDS600 storage enclosure to two BladeSystem c-Class enclosures, each c-Class enclosure has exclusive access to one of the MDS600 storage drawers.
- As shown in this illustration, server bays 1–8 in the top c7000 may access MDS600 drawer 2 and server bays 1–8 in the bottom c7000 may access MDS600 drawer 1. For more information, see [“3Gb SAS BL Switch port information”](#) on page 79.

Zoned storage—maximum capacity

This example illustrates the maximum number of MDS600 storage enclosures that can be connected to a c7000 BladeSystem enclosure. In this configuration, note the following:

- This example shows a dual-domain MDS600 with standard cabling. The following table lists the maximum number of MDS600 storage enclosures for other deployments:

Configuration type	Number of switches	Max number of MDS600 storage enclosures
Dual-domain, standard cabling	2	6 (shown)
Dual-domain, wide-port cabling	2	4
Single-domain, standard cabling	1	6
Single-domain, wide-port cabling	1	4
Single-domain, wide-port cabling for max performance	2	6



Devices and quantities

MDS600 storage enclosures: 6

MDS600 I/O modules: 4 per MDS600

BladeSystem c7000 enclosures: 1

3Gb SAS BL Switches: 4

Server blade types: half-height and full-height

Connection details

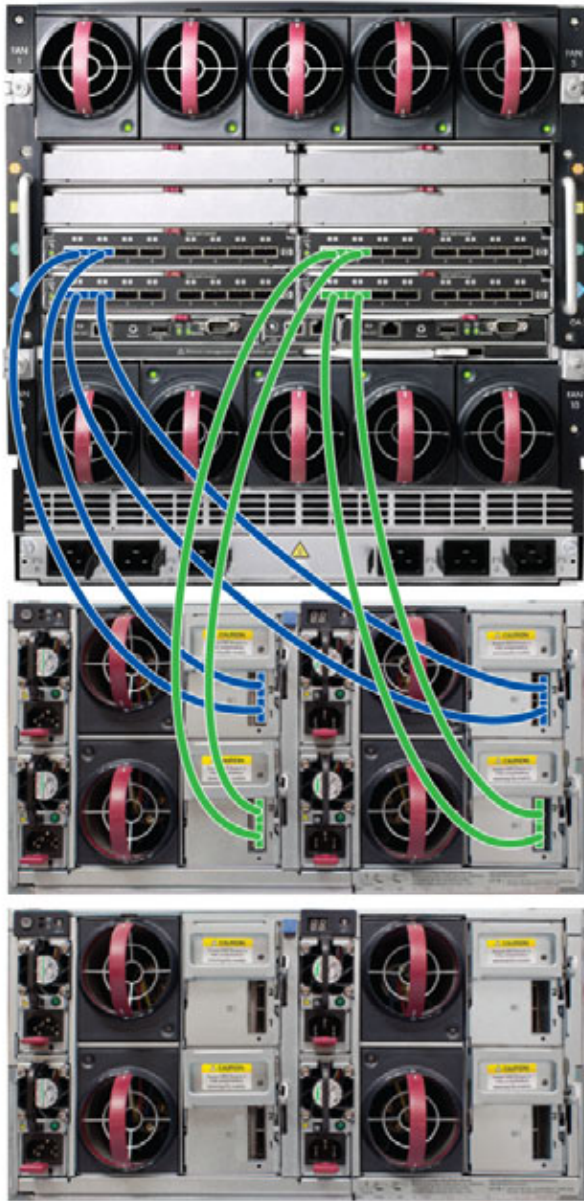
- Due to space limitations and level of detail, connection details are not listed.

Zoned storage—with double-density servers

These examples illustrate two recommended cabling configurations when using double-density server blades with zoned storage enclosures such as the MDS600. In this configuration, note the following:

- These examples show dual I/O module MDS600 and wide-port cabling. Single I/O modules and standard cabling is also supported.
- Double-density server blades allow 32 servers in the 16 available device bays of a c7000 enclosure, by including both an “a” and a “b” server node on one blade device.
- Switches in interconnect bays 5 and 6 map to the “a” server nodes in device bays 1–16. (Referred to as servers 1a–16a.)
- Switches in interconnect bays 7 and 8 map to the “b” server nodes in device bays 1–16. (Referred to as servers 1b–16b.)

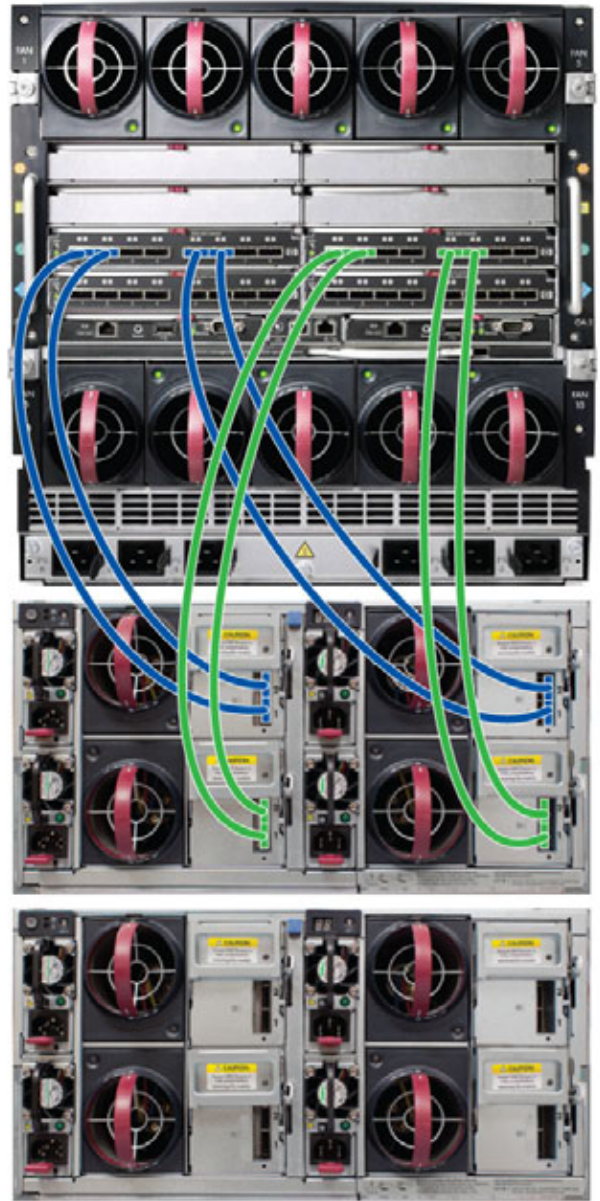
Connecting an MD600 that will be accessed based on c-Class enclosure device bay (controlled by connections to same switch ports in different interconnect rows)



To complete this example configuration, connect the bottom MDS600 in a similar cabling pattern, but to ports 5 and 6 on the four switches.

- Servers in device bays 1–8 (both a and b nodes) will have exclusive access to the top MDS600.
- Servers in device bays 9–16 (both a and b nodes) will have exclusive access to the bottom MDS600.

Connecting an MDS600 that will be accessed based on “a” or “b” server type (controlled by connections to same interconnect row)



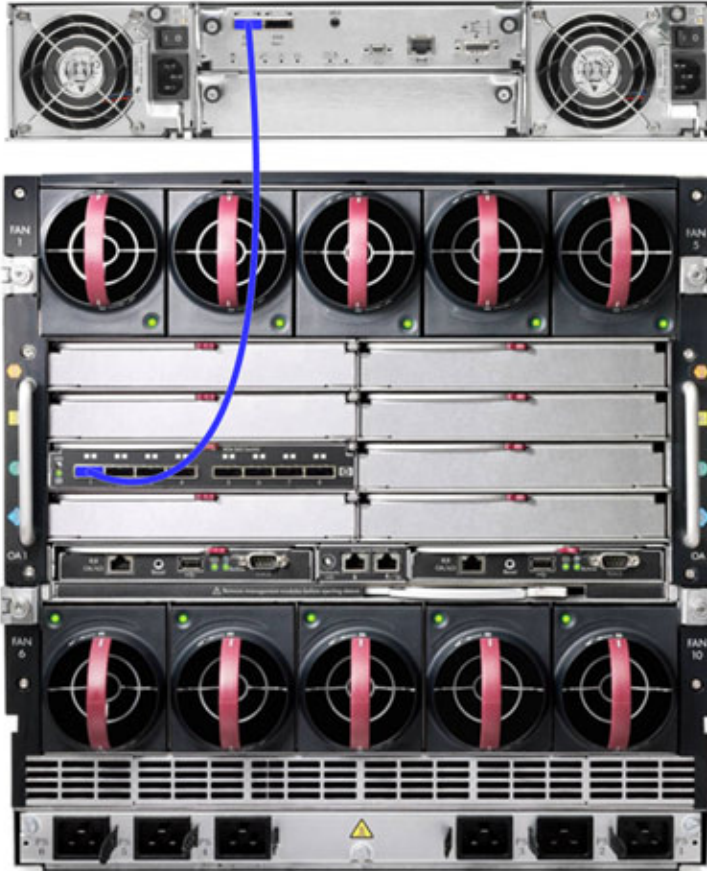
To complete this example configuration, connect the bottom MDS600 in a similar cabling pattern, but to ports on the switches in interconnect bays 7 and 8.

- All “a” servers in device bays 1–16 will have exclusive access to the top MDS600.
- All “b” servers in device bays 1–16 will have exclusive access to the bottom MDS600.

Shared storage—single controller, standard cabling

This example illustrates standard cabling for a single-controller enclosure. In this configuration, note the following:

- One cable from the switch to the MSA controller offers single-path connectivity.



Devices and quantities

MSA2000sa controller enclosures: 1

MSA2000 drive enclosures: 0

BladeSystem c7000 enclosures: 1

3Gb SAS BL Switches: 1

Server blade types: half-height and full-height

Connection details

- Switch in interconnect bay 5:
 - Port 1: to MSA SAS port A0

Notes

- If additional ports on the MSA controllers or 3Gb SAS BL Switch are available, HP recommends connecting an additional cable from the switch to the MSA controllers, for additional performance and fault tolerance. For an example, see [“Shared storage—dual controller, optimal cabling”](#) on page 99

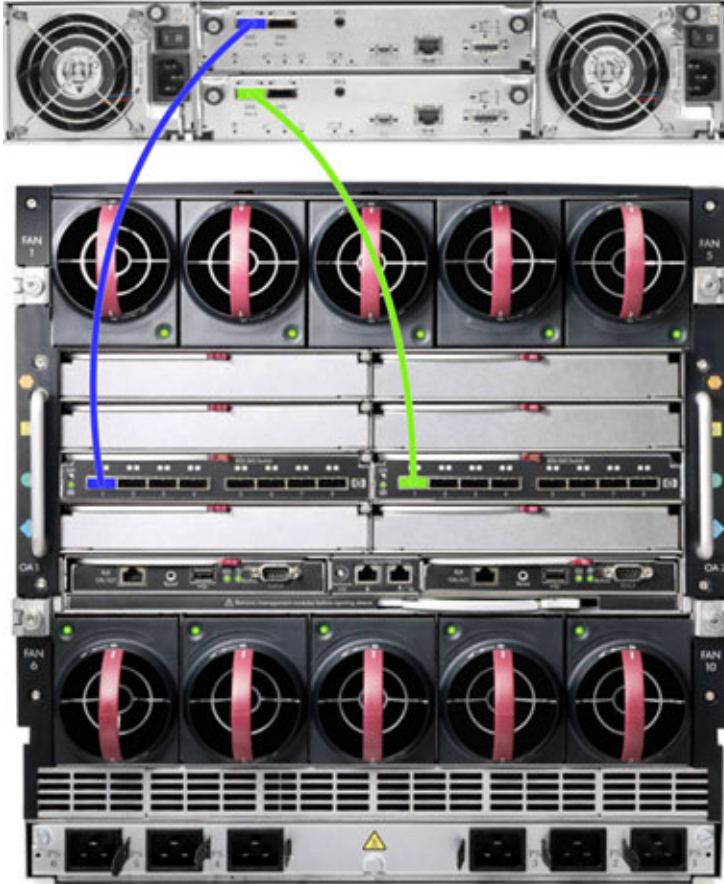
NOTE:

Connections to a single-controller MSA2000sa G2, are very similar to that of the MSA2000sa: connect the first SAS port on the MSA controller (A1) to the switch.

Shared storage—dual controller, standard cabling

This example illustrates standard cabling for a high-availability configuration. In this configuration, note the following:

- One cable from each switch to each MSA controller offers high availability.



Devices and quantities

MSA2000sa controller enclosures: 1

MSA2000 drive enclosures: 0

BladeSystem c7000 enclosures: 1

3Gb SAS BL Switches: 2

Server blade types: half-height and full-height

Connection details

- Switch in interconnect bay 5:
 - Port 1: to MSA SAS port A0
- Switch in interconnect bay 6:
 - Port 1: to MSA SAS port B0

Notes

- If additional ports on the MSA controllers or 3Gb SAS BL Switch are available, HP recommends connecting an additional cable from the switch to the MSA controllers, for additional performance and fault tolerance. For an example, see [“Shared storage—dual controller, optimal cabling”](#) on page 99

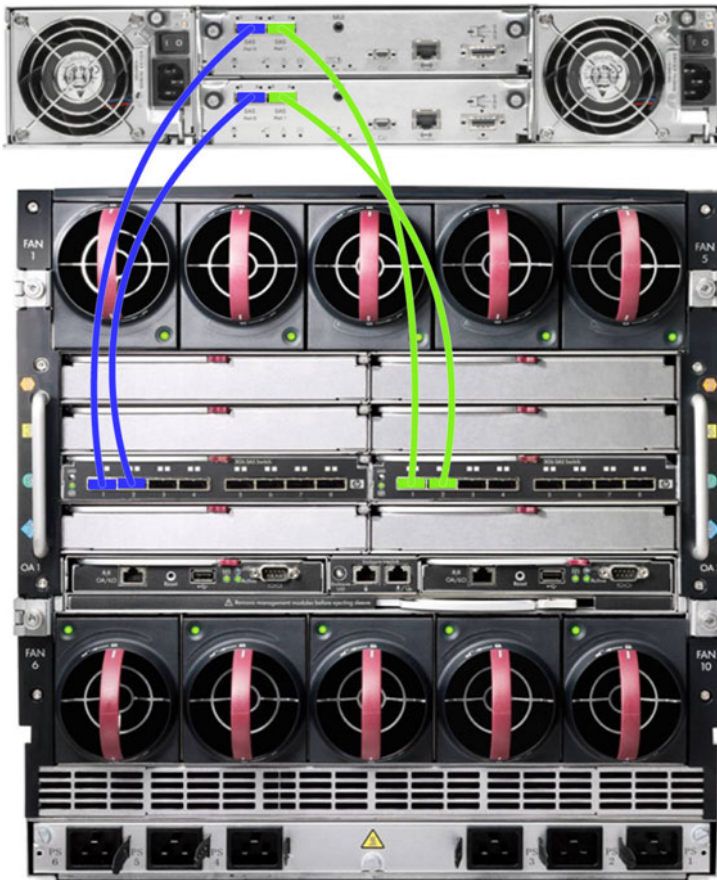
NOTE:

Connections to a dual-controller MSA2000sa G2, are very similar to that of the MSA2000sa: connect the first SAS port of the primary MSA controller (SAS port A1) to one of the switches, and connect the secondary MSA controller (SAS port B1) to the other switch.

Shared storage—dual controller, optimal cabling

This example illustrates optimal cabling for a high-performance, high-availability configuration. In this configuration, note the following:

- An additional cable from each switch to each MSA controller offers additional availability and performance.
- Connecting each controller to each switch ensures highest availability.



Devices and quantities

MSA2000sa controller enclosures: 1

MSA2000 drive enclosures: 0

BladeSystem c7000 enclosures: 1

3Gb SAS BL Switches: 2

Server blade types: half-height and full-height

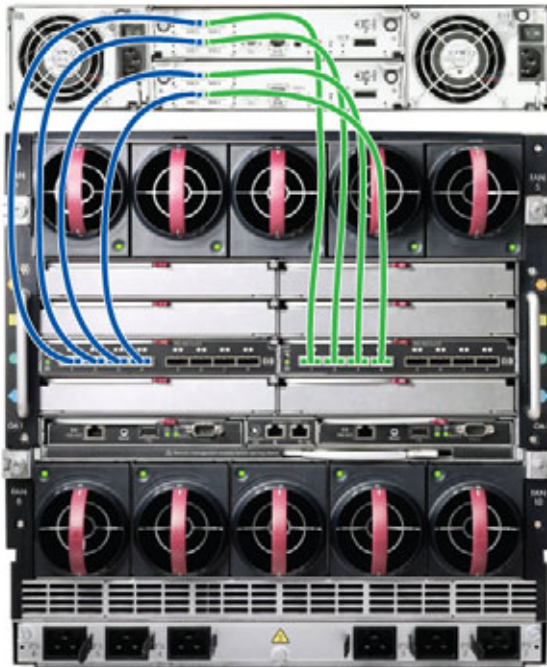
Connection details

- Switch in interconnect bay 5:
 - Port 1: to MSA SAS port A0
 - Port 2: to MSA SAS port B0
- Switch in interconnect bay 6:
 - Port 1: to MSA SAS port A1
 - Port 2: to MSA SAS port B1

G2 shared storage—dual controller, optimal cabling

This example illustrates optimal cabling for a high-performance, high-availability configuration. In this configuration, note the following:

- An additional cable from each switch to each MSA controller offers additional availability and performance.
- Connecting each controller to each switch ensures highest availability.



Devices and quantities

MSA2000sa G2 controller enclosures: 1

MSA2000 drive enclosures: 0

BladeSystem c7000 enclosures: 1

3Gb SAS BL Switches: 2

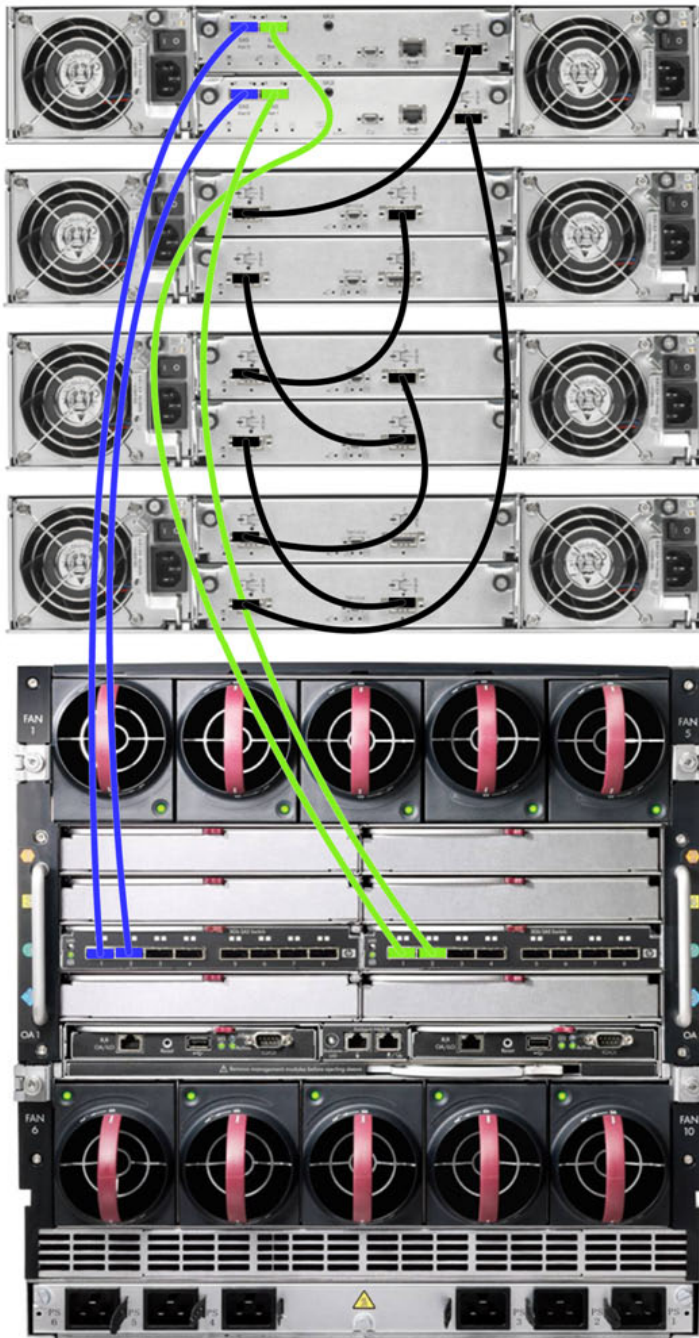
Server blade types: half-height and full-height

Connection details

- Switch in interconnect bay 5:
 - Port 1: to MSA G2 SAS port A3
 - Port 2: to MSA G2 SAS port A1
 - Port 3: to MSA G2 SAS port B3
 - Port 4: to MSA G2 SAS port B1
- Switch in interconnect bay 6:
 - Port 1: to MSA G2 SAS port A4
 - Port 2: to MSA G2 SAS port A2
 - Port 3: to MSA G2 SAS port B4
 - Port 4: to MSA G2 SAS port B2

Shared storage—with cascaded drive enclosures

This example expands on the cabling paths illustrated in [Shared storage—dual controller, optimal cabling](#) and shows connection paths from a dual-controller MSA2012sa controller enclosure to three cascaded, dual I/O module MSA2000 drive enclosures.



Devices and quantities

MSA2012sa controller enclosures: 1

MSA2000 drive enclosures: 3

BladeSystem c7000 enclosures: 1

3Gb SAS BL Switches: 2

Server blade types: half-height and full-height

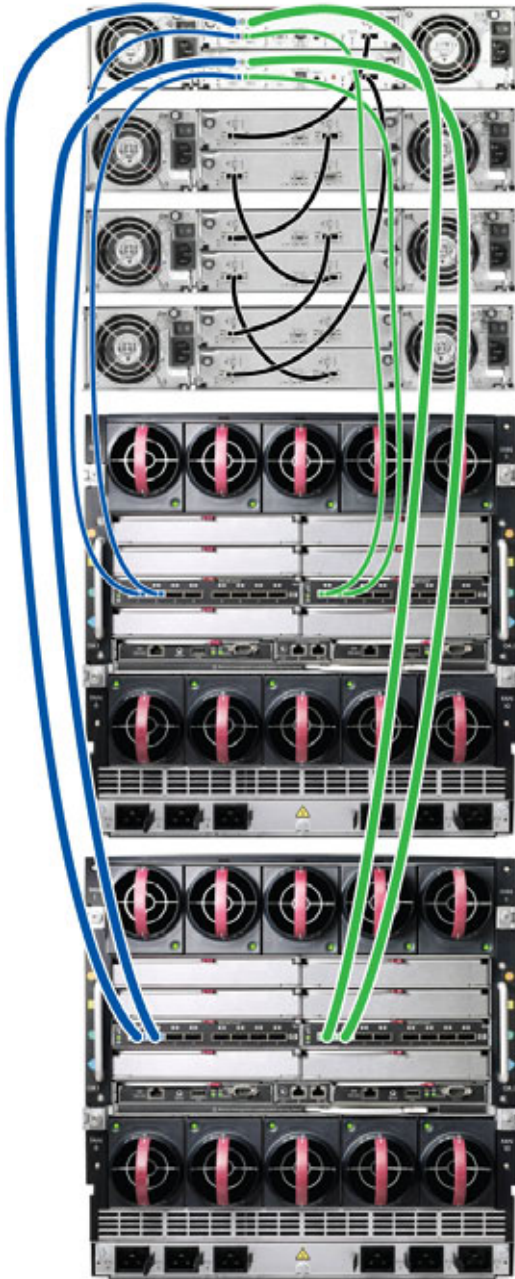
Connection details

- Switch in interconnect bay 5:
 - Port 1: to MSA2012sa SAS port A0
 - Port 2: to MSA2012sa SAS port B0
- Switch in interconnect bay 6:
 - Port 1: to MSA2012sa SAS port A1
 - Port 2: to MSA2012sa SAS port B1

G2 Shared storage—with two c-Class enclosures

This example illustrates cabling from **two** BladeSystem c-Class enclosures to **one MSA2300sa** controller enclosure. In this configuration, note the following:

- This example shows a dual-controller MSA2300sa controller enclosure with optimal cabling. Standard cabling is also supported. Standard cabling offers high availability, but, during a failover, there will be a slight performance reduction.
- Because the MSA2300sa controller includes four SAS ports, optimal cabling can be used, ensuring best-possible availability.



Devices and quantities

MSA2200sa controller enclosures: 1

MSA2000 drive enclosures: 3

c7000 enclosures: 2

3Gb SAS BL Switches: 4

Server blade types: half-height and full-height

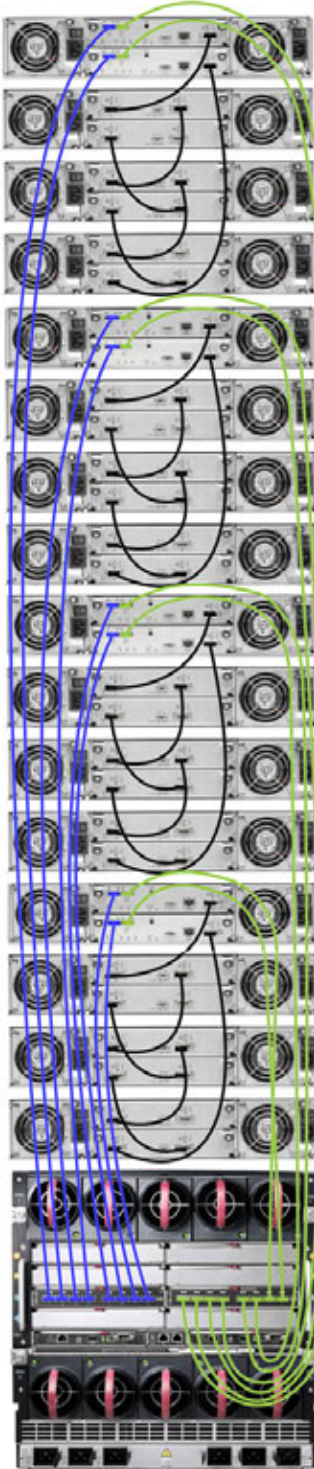
Connection details

- Switch in interconnect bay 5, c7000 #1:
 - Port 1: to MSA G2 SAS port A1
 - Port 2: to MSA G2 SAS port B1
- Switch in interconnect bay 6, c7000 #1:
 - Port 1: to MSA G2 SAS port A2
 - Port 2: to MSA G2 SAS port B2
- Switch in interconnect bay 5, c7000 #2:
 - Port 1: to MSA G2 SAS port A3
 - Port 2: to MSA G2 SAS port B3
- Switch in interconnect bay 6, c7000 #2:
 - Port 1: to MSA G2 SAS port A4
 - Port 2: to MSA G2 SAS port B4

Shared storage—maximum capacity

This example illustrates the maximum number of supported MSA controller enclosures for a c7000 BladeSystem enclosure. In this configuration, note the following:

- A maximum of four controller enclosures can be attached to a BladeSystem c-Class enclosure.



Devices and quantities

MSA2000sa controller enclosures: 4

MSA2000 drive enclosures: 12

BladeSystem c7000 enclosures: 1

3Gb SAS BL Switches: 2

Server blade types: half-height and full-height

Connection details

- Due to space limitations and level of detail, connection details are not listed.

Notes

- This example shows a dual-controller MSA2012sa with optimal cabling. Single controller and MSA2300sa controller enclosures are also supported.

Shared storage—with double-density servers

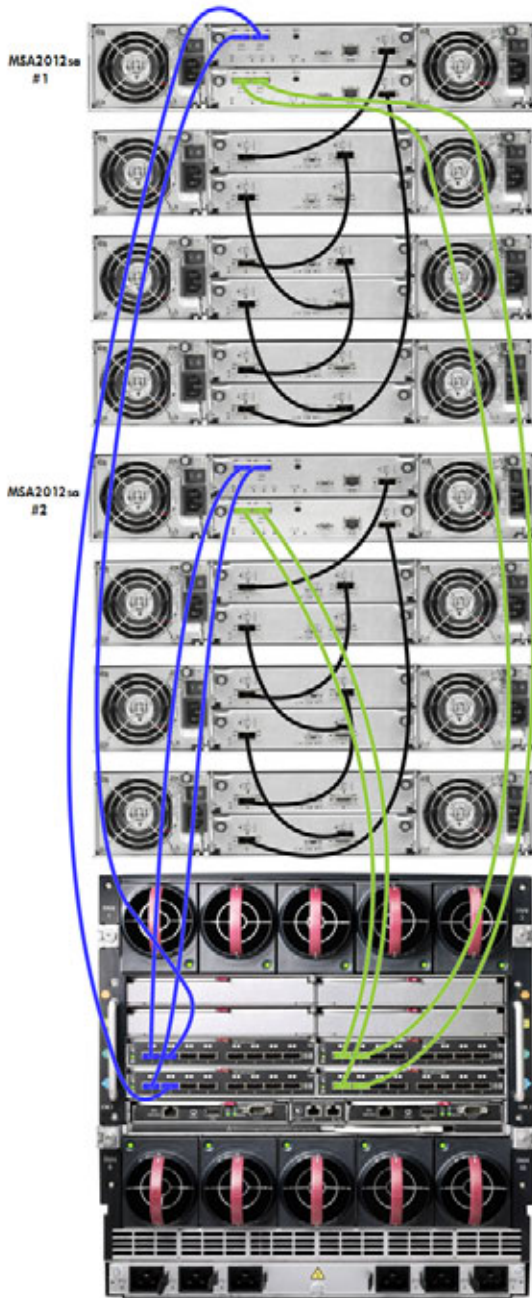
This example illustrates recommended cabling when using double-density server blades with shared storage enclosures such as the MSA2000sa. In this configuration, note the following:

- This example shows a dual-controller MSA2012sa controller enclosure and standard cabling. MSA2300sa controller enclosures (standard and optimal cabling) and single-controller devices are also supported.
- Due to limited ports on the MSA2012sa controller, only standard cabling is available. Standard cabling offers high availability, but, during a failover, there will be a slight performance reduction.
- For best possible performance, use G2 MSA2300sa controller enclosures. Because the MSA2300sa controller includes four SAS ports, optimal cabling can be used, ensuring best-possible availability.

❗ IMPORTANT:

In all configurations using double-density servers, note the following:

- Double-density server blades allow 32 servers in the 16 available device bays of a c7000 enclosure, by including both an “a” and a “b” server node on one blade device.
 - Switches in interconnect bays 5 and 6 map to the “a” server nodes in device bays 1–16. (Referred to as servers 1a–16a.)
 - Switches in interconnect bays 7 and 8 map to the “b” server nodes in device bays 1–16. (Referred to as servers 1b–16b.)
-



Devices and quantities

MSA2012sa controller enclosures: 2

MSA2000 drive enclosures: 6

c7000 enclosures: 1

3Gb SAS BL Switches: 4

Server blade types: double-density

Connection details

- Switch in interconnect bay 5:
 - Port 1: to MSA #2, SAS port A0
 - Port 2: to MSA #1, SAS port A0
- Switch in interconnect bay 6:
 - Port 1: to MSA #2, SAS port B0
 - Port 2: to MSA #1, SAS port B0
- Switch in interconnect bay 7:
 - Port 1: to MSA #2, SAS port A1
 - Port 2: to MSA #1, SAS port A1
- Switch in interconnect bay 8:
 - Port 1: to MSA #2, SAS port B1
 - Port 2: to MSA #1, SAS port B1

Notes

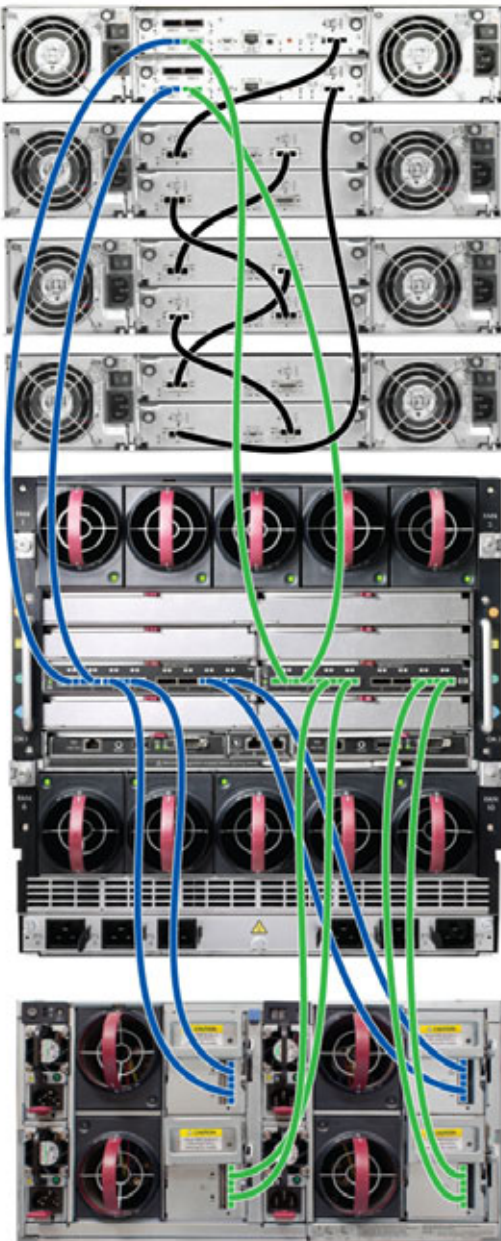
- As shown, when connecting MSA2012 controllers to two pairs of SAS BL Switches, only a single cable per switch can be connected, because each controller has only two ports, and needs to connect to two different switches. This configuration supports high availability, but, during a failover, there will be a slight performance reduction.

Zoned and Shared storage—to the same c-Class enclosure

This example illustrates cabling from **one** BladeSystem c-Class enclosure to both an MSA2300sa controller enclosure **and** an MDS600 storage enclosure. In this type of configuration, note the following:

❗ **IMPORTANT:**

- In a solution with both zoned and shared storage enclosures, a server bay can be assigned to either zoned or shared zone groups. (Cannot be assigned to both types of storage enclosures.)
- The MSA2012sa is not supported for use in this configuration.



Devices and quantities

- MSA2300sa controller enclosures: 1
- MSA2000 drive enclosures: 3
- MDS600 storage enclosures: 1
- c7000 enclosures: 1
- 3Gb SAS BL Switches: 2
- Server blade types: half-height and full-height

Connection details

- Switch in interconnect bay 5:
 - Port 1: to MSA G2 SAS port A1
 - Port 2: to MSA G2 SAS port B1
 - Port 3: to MDS600 drawer 2, primary I/O module, port 1
 - Port 4: to MDS600 drawer 2, primary I/O module, port 2
 - Port 7: to MSA2000sa drawer 1, primary I/O module, port 1
 - Port 8: to MDS600 drawer 1, primary I/O module, port 2
- Switch in interconnect bay 6:
 - Port 1: to MSA G2 SAS port A1
 - Port 2: to MSA G2 SAS port B1
 - Port 3: to MDS600 drawer 2, secondary I/O module, port 1
 - Port 4: to MDS600 drawer 2, secondary I/O module, port 2
 - Port 7: to MSA2000sa drawer 1, secondary I/O module, port 1
 - Port 8: to MDS600 drawer 1, secondary I/O module, port 2

Notes

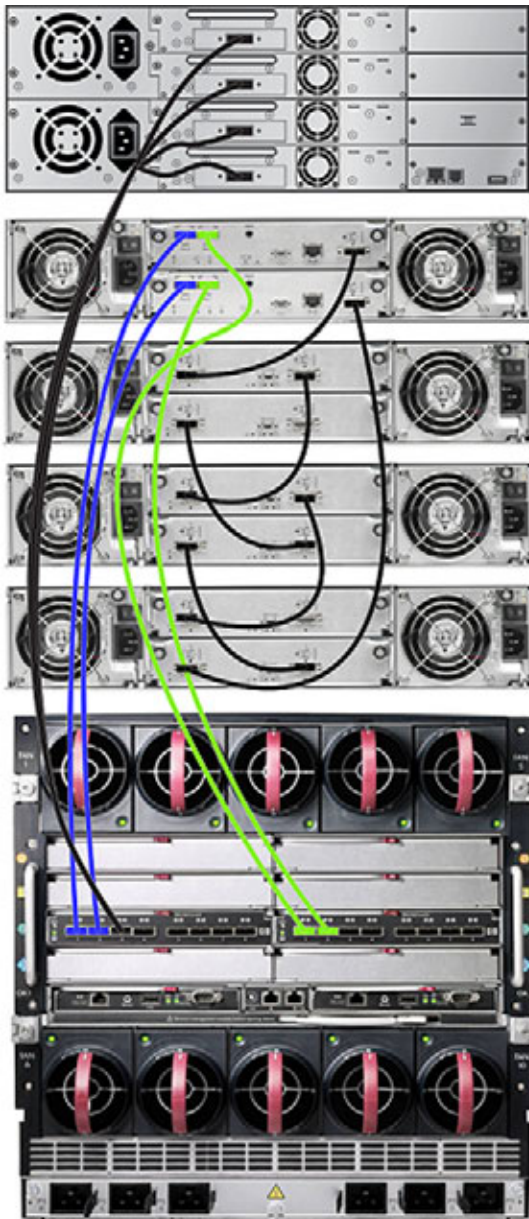
- As shown in this illustration, server bays 1–8 may access MDS600 drawer 2 and server bays 9–16 may access MDS600 drawer 1. For more information, see [“3Gb SAS BL Switch port information”](#) on page 79.

Tape library—basic cabling

The purpose of this example is to show cabling to a tape library.

❗ **IMPORTANT:**

The following illustration shows an MSA2012sa in the configuration, but tape autoloaders and tape libraries are supported with shared SAS storage enclosures and zoned SAS storage enclosures.



Devices and quantities

MSA2000sa controller enclosures: 1

MSA2000 drive enclosures: 3

BladeSystem c7000 enclosures: 1

3Gb SAS BL Switches: 2

Server blade types: half-height and full-height

MSL4048 Tape Library with four SAS Ultrium tape drives: 1

Connection details

- Switch in interconnect bay 5:
 - Port 1: to MSA2000sa SAS port A0
 - Port 2: to MSA2000sa SAS port B0
- Port 3: to MSL4048 Tape Library (all four tape drives)
- Switch in interconnect bay 6:
 - Port 1: to MSA2000sa SAS port A1
 - Port 2: to MSA2000sa SAS port B1

Notes

- Drives in the Tape Libraries and Autoloader do not have a second SAS port, so they are only connected to one switch.
- The SAS fanout cable can connect up to four tape drives to a single switch port. Coil any unused ends and secure them to the rack to minimize strain on the cable.
- Available SAS fanout cables:
 - AN975A – 2m External Mini-SAS to 2X1 Mini-SAS Cable Kit
 - AN976A – 4m External Mini-SAS to 2X1 Mini-SAS Cable Kit

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