



LSISAS6160 SAS Switch

User Guide

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Chapter 1

Overview

This document is the primary reference for the LSISAS6160 Serial Attached SCSI (SAS) switch. It describes the features of the switch and explains how to perform installation and physical configuration of the switch. The document also explains how to use both the web-based, and the command-driven SAS Domain Manager (SDM) utility interfaces to create storage configurations in the SAS domain. It also includes troubleshooting information.

This document assumes that you have some familiarity with SAS devices and SAS hardware configuration. The following people are the intended audience of this document:

- Engineers and managers who are evaluating the SAS6160 switch for possible use in a system
- System administrators and end users who are installing and using the SAS6160 switch

1.1 LSISAS6160 Switch Features

The SAS6160 switch has the following features:

- A total of 14 external SAS connectors for SAS initiators and targets that use passive cables
- Two external SAS connectors for SAS initiators and targets that use active or passive cables
- Connectors support a SAS link rates of 6.0Gb/s, 3.0Gb/s, or 1.5Gb/s
- 10/100 Based-T Ethernet for enclosure management
- Nonblocking feature provides simultaneous access of any port to any port at full port bandwidth

1.2 Serial Attached SCSI and the SAS6160 Switch

SAS replaces Ultra320 SCSI as the next phase in the evolution of the SCSI standard. The SAS interface addresses enterprise data storage and retrieval requirements with features such as point-to-point topology, 6.0Gb/s transfer rate, minimum arbitration overhead, native support for both SAS and SATA drives, and smaller cables and connectors.

In SAS storage environments, the SAS6160 switch allows connection of multiple targets and initiators through a switched device for manageable scalability. The integrated SDM application provides a central management point to view the SAS topology, manage other switches or expanders in the domain, and to configure zoning to provide exclusive access between endpoints in the domain. The SAS6160 switch allows data centers to benefit from the improved performance, minimum arbitration overhead, simplified cabling, and lower system implementation costs of SAS and SATA, while easing migration from Direct Attached Storage.



Figure 1: The LSISAS6160 Switch

The SAS6160 switch uses two LSISAS2x36 6Gb/s SAS expanders, which are compliant with the ANSI Serial Attached SCSI specification and support SATA as defined in the *Serial ATA: High Speed Serialized AT Attachment* and the *Serial ATA II: Port Selector Specification*.

The SAS6160 switch functions as a single expander and offers advanced hardware management with an external power supply module, and two enclosure fans, and temperature and power supply voltage sensing/alerts. The switch is housed in a compact chassis for easy shelf placement in rack mounted server clusters.

NOTE: The two connectors on the upper left of the face plate (port 0 and port 2) support active cabling for longer cable runs. Passive cables may also be connected to these ports for normal cable runs.

The following figure shows how the SAS6160 switch centralizes management of all application servers and data storage devices in the SAS domain.

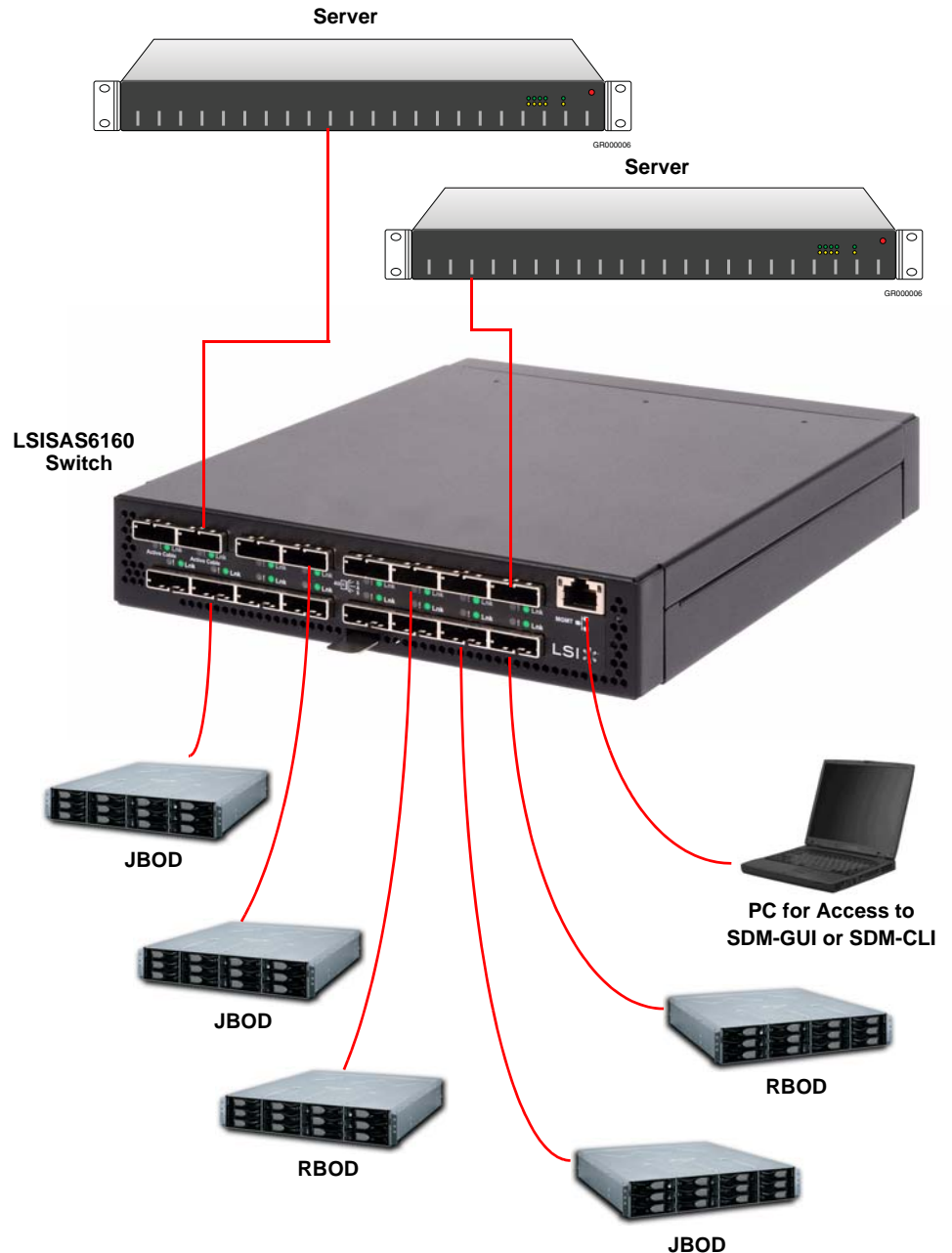


Figure 2: LSISAS6160 Resource Management

In this simplified representation, the servers at the top of the diagram must access data on the storage devices in the lower part of the diagram. The SAS6160 switch manages the SAS configuration, allowing both servers to access all storage devices. Or, if zoning is used, single application servers can access specific storage devices exclusively.

You can connect multiple SAS6160 switches in various topologies to provide failover support and to increase the number of connected devices in the SAS domain. The theoretical upper limit of SAS devices in a domain is 16,000. Each SAS6160 switch can handle 1000 SAS addresses.

The following figure shows a high-level block diagram of the SAS6160 switch.

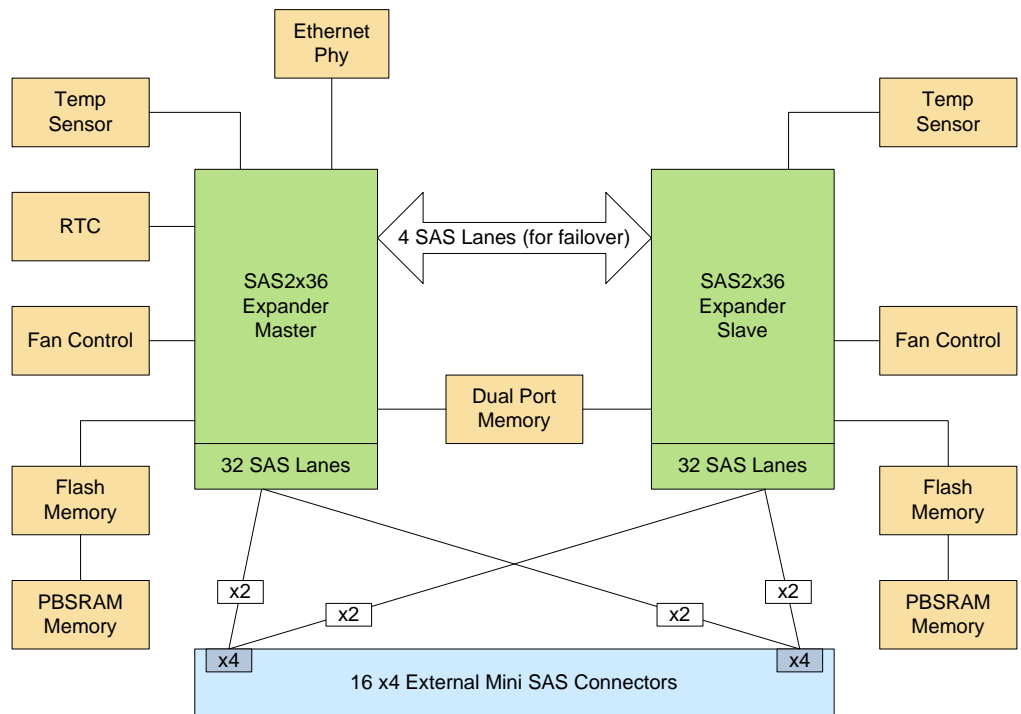


Figure 3: Block Diagram of the LSISAS6160 Switch

This diagram contains the following functional blocks:

- **SAS2X36 Expander** – This block includes such management functions as routing, device discovery, and zoning. It also includes an embedded version of SDM. This block controls the flow of data through the SAS connectors.
- **SAS Connectors** – The SAS6160 switch has 16 x4 Mini SAS connectors, numbered 0 through 15. It supports connection to SAS devices at link rates of 3.0Gb/s and 6.0Gb/s.
- **Ethernet Phy** – The external 10/100 Ethernet port provides access to the browser-based SDM management application, which sets up storage configurations in the SAS domain, monitors the status of the switch, and runs diagnostic tests. It also provides access to the SDM command line interface (CLI).
- **Real Time Clock** – The battery-powered real-time clock is set at the factory.
- **Fans** – The SAS6160 switch enclosure contains two fans. The fan speed is regulated based on the temperature inside the enclosure. You can monitor the status of the fans with the SDM utility.

- **Flash Memory** – Each LSISA2x36 expander connects to a parallel flash through the expander's external memory interface. This flash is used for firmware storage and execution, as well as nonvolatile data such as Ethernet MAC address and SAS WWID.
- **PBSRAM Memory** – The PBSRAM is attached to each expander's external memory interface, and is used for the capture buffer, run-time stack, and heap, along with miscellaneous items.
- **Dual Port Memory** – This dual port SRAM provides shared memory space between the master and slave expanders.
- **Temperature Sensors** – The temperature sensors are inputs that control the speed of the fans.

1.3 SAS Phys, Ports, and Connectors

Phys and ports are a basic concept of SAS. A phy is the basic physical connection point for a SAS device. A phy contains a single transmitter and receiver, which communicate across a SAS link to a single transmitter and receiver in another phy, as the following figure illustrates.

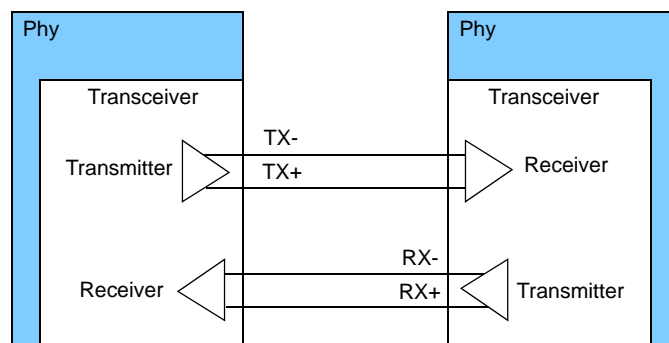
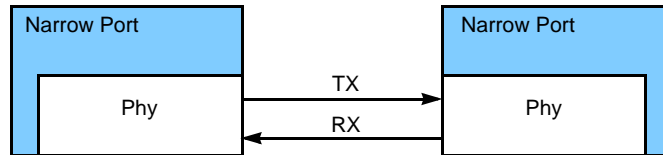


Figure 4: Link between Two Single SAS Phys

Each single-phy link (also called a narrow port) supports a maximum bandwidth of 600 MB/s (6Gb/s) per direction, with a total bandwidth of 1200 MB/s full duplex in both directions.

A SAS wide port consists of more than one SAS phy (an 8-phy SAS port is also possible) that transmit and receive data by using the same SAS address when connected to another SAS wide port. In other words, the port is created dynamically when the connection is made. The following figure shows both a narrow port and a wide port.

a. Narrow SAS Port with One Phy in Each Port



b. Wide SAS Port with Four Phys in Each Port

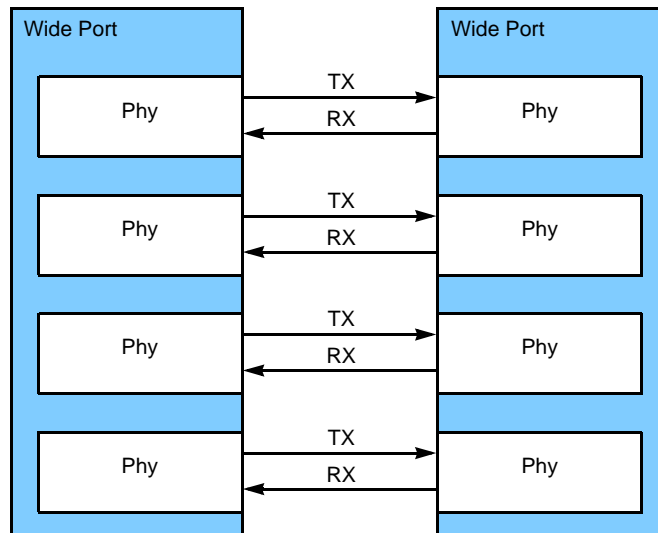


Figure 5: Narrow and Wide SAS Ports

The SAS6160 switch has 64 phys, numbered 0 through 63. Each of the 16 SAS connectors on the switch case (numbered 0 through 15 in this document) contains four phys, making them wide ports.

During normal operation, the SAS connectors on the switch are cabled to SAS connectors on initiator devices or target devices. This connection creates a wide SAS port through which data is transmitted and received.

1.4 SAS Connectors and Cabling

Use a separate crossover cable for each server, JBOD, RAID array, switch, or other device connected to the SAS6160 switch. Use Mini SAS 4x connectors (also called SFF-8088 connectors) on both ends of the crossover cables to connect the switch to all devices.

The keyed connectors at port 0 and port 2, located at the upper left on the SAS6160 switch, support active cabling. This allows longer cable lengths and requires a special type of cable. These cables are keyed so that they do not attach to a passive connector. However, you can attach a passive cable to a connector that supports active cabling.

[Chapter 2, *Installation and Hardware Setup*](#) provides information about recommended cable lengths.

The following figure shows a crossover cable with Mini SAS 4x connectors on both ends.

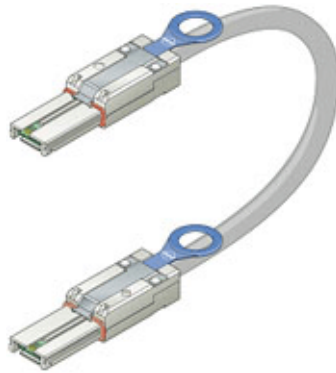


Figure 6: Mini SAS 4x Cable

All cables used with the SAS6160 switch must comply with the SAS 2.1 standard.

1.5 SAS Routing and Zoning

SAS is a connection-oriented, point-to-point technology. When a host (initiator) issues a request to read or write data, the SAS6160 switch automatically determines how to route the connection request from the initiator to the correct data storage device (target). By default, any SAS initiator or target connected to the SAS6160 switch can access any other connected initiator or target in the SAS domain, without restrictions. However, because the SAS domain grows to include multiple hosts and multiple storage volumes, you can segregate one host from another host, or restrict one host from accessing storage owned by another host.

SAS zoning partitions the SAS topology to isolate selected hosts from each other, or to allow selected hosts to access only selected storage volumes. The SAS6160 switch supports the full SAS 2.0 T10 zoning model.

There are several benefits to zoning, which can be configured accordingly:

- Security – Zoning prevents users from accessing information that is not available to them.
- Manageability – Zoning reflects operational categories, such as marketing or engineering. Zoning also can partition hosts that run different operating systems, to minimize conflicts.
- Performance – Zoning enables faster boot time because the host must discover only the storage within its zone or zones.

1.5.1 SAS Zoning Overview

SAS zoning access control is implemented by linked switch/expander devices, with zoning enabled. These devices define a Zoned Portion of a Service Delivery System (ZPSDS). No host device intervention is required. Each zoning switch/expander device maintains an identical zone permission table, so zone access control is maintained across the entire ZPSDS.

Initiators and targets see only the portions of the ZPSDS to which they are assigned in the zone permission table. These zoned portions are called zone groups. Zone groups are activated when they belong to a set. When the set is enabled, the zoning is enforced. When the set is disabled, the zoning disappears. There can be more than one set in a ZPSDS, and initiators and targets can belong to more than one set, but only one set can be active. In addition, there can be more than one ZPSDS in a SAS domain.

A ZPSDS has a zone manager for its configuration and management. The SDM utility (see [Chapter 3, SAS Domain Manager Graphical User Interface](#)) is embedded in the SAS6160 switch to configure the zone manager.

The following figure shows a simple example of zoning.

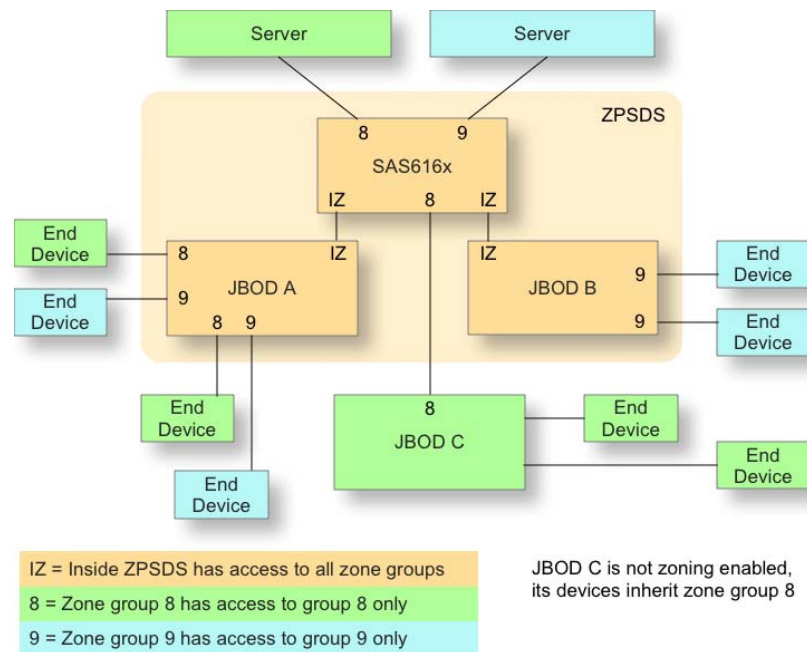


Figure 7: Simple Zoning Example

1.5.2 Creating SAS Zones

You create SAS zones by first creating zone groups that include hosts or storage devices that share common access privileges, and zone sets that connect the zone groups together. Use the SDM utility to create zones. The SDM-GUI utility provides zoning wizards to create zone groups and zone sets automatically. You also can create zone groups and zone sets manually by using the SDM utility.

The following rules apply to zone groups and zone sets:

- Only phys on the edge of the ZPSDS can be grouped into administrator-defined zone groups. Phys that interconnect zoning expanders are automatically placed into Zone Group 1.
- An administrator defines zone group permissions. This procedure allows end devices attached to, or downstream of, the zoned phy to communicate with one another.
- Zoning limits a host's access to only the targets downstream of zoned phys in which its zone phy is granted zoning permission to access. A host may access all logical unit numbers (LUNs) behind the SAS phy, and it does not restrict access to individual storage LUNs.
- You may create up to 248 zone groups within a single zone set.
- SAS phys within a zone group cannot automatically access each other, but you may grant them access privileges.
- You may grant a zone group permission to access multiple zone groups, if required.
- A zone group may be a member of more than one zone set.
- A phy may be a member of only one zone group per zone set.

- A zone set must be active for its definitions to be applied to the SAS domain. Zone sets are activated in the SDM utility.
- Only one zone set can be active at one time. When no zone set is active, zoning is disabled and domain access is unrestricted.
- Changes to the active zone set (for example, a change to zone group or zone set membership, or a change to zone group permissions) do not take effect until the next zone set activate command.
- When the SAS topology changes (for example, when a host or storage attachment is moved from one switch connection to another) you must manually redefine zone group permissions within the active zone set. The switch does not do this task automatically. Changes to the active zone set do not take effect until the zone set is updated and reactivated.
- Zoning is managed throughout the ZPSDS formed around the SAS6160 switch, used to manage zoning, and any SAS 2.0 zoning expanders that can be linked back to it without crossing a nonzoning expander. When zoning is enabled, zone group and permission data are migrated automatically between the SAS6160 switches and the SAS 2.0 zoning-enabled expanders throughout the ZPSDS. If a storage configuration includes a legacy expander that is not zoning-enabled, that expander and its attached devices inherit the zone group and permissions of the zone phy to which it is connected.
- To create a high-availability (failover) configuration, use one SAS6160 switch for each data path between the host and the shared storage. SAS allows for only a single path between endpoints. See [Figure 13](#) for more information.

1.5.3 Configuring SAS Zones

The following figure shows a sample configuration with three hosts and five JBODs.

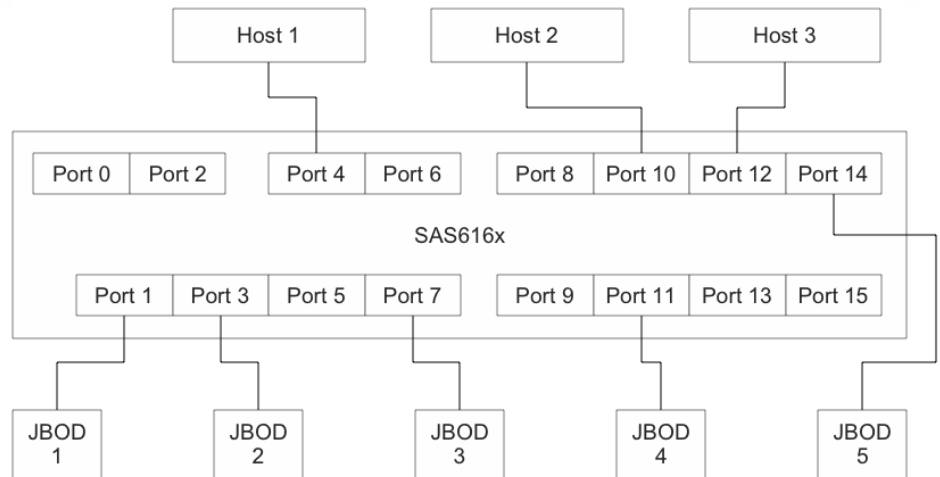


Figure 8: Configuration for Zoning Example

Host 1 belongs to a local work group and accesses JBOD 1 as its primary resource. But Host 1 also accesses JBOD 2, JBOD 3, and JBOD 4, as a backup resource.

Host 2 is a backup server, and has JBOD 2, JBOD 3, and JBOD 4 as its primary resource, but also accesses JBOD 1.

Host 3 is a web server, and has exclusive access to JBOD 5, but also accesses JBOD 2, JBOD 3, and JBOD 4 for backup.

Because Host 1 and Host 2 have the same JBOD access requirements, you can define them as a single zone group. You can define JBOD 2, JBOD 3, and JBOD 4 as a zone group because they are always used together as a backup resource.

To create a suitable configuration, run the SDM utility and create the zone groups shown in the following figure.

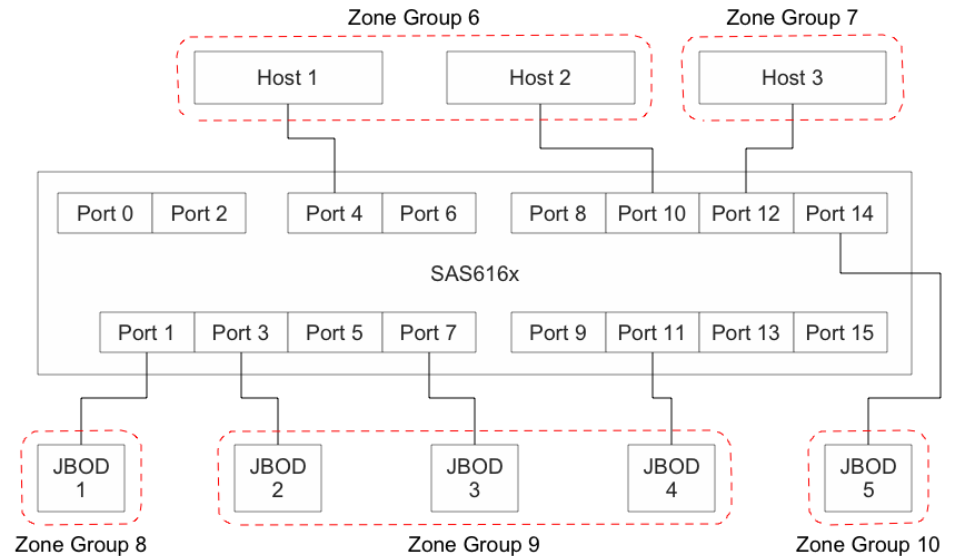


Figure 9: Creating Zone Groups

Next, use the SDM utility to assign the following permissions, by creating zone sets:

- Zone group 6 accesses zone groups 8 and 9, and vice versa.
- Zone group 7 accesses zone groups 9 and 10, and vice versa.

1.6 Connecting Devices to the SAS6160 Switch

The rules for connecting devices to the 16 SAS connectors on the SAS6160 switch are as follows:

- Any SAS initiator can be connected to any SAS connector on the switch.
- Any SAS target can be connected to any SAS connector on the switch. A target can be a RAID array, a JBOD, or another switch. Individual SAS drives or SATA drives may not be connected to the switch.
- Switches can be cascaded by connecting any SAS connector of the downstream switch to any SAS connector on the upstream switch.
- When SAS zoning is used, and multiple SAS6160 switches are used in the domain, the switches can be cabled directly to one another.
- Two switches can be connected with more than one cable to increase bandwidth between switches.
- All SAS connectors on the switch are Mini SAS, wide port style connectors. In addition, connector 0 and connector 2 are keyed for active cables (see [Section 1.4, SAS Connectors and Cabling](#)).
- All connections must be x4. For any other configuration, contact your field applications engineer.
- Maximum connections allowed:
 - Six cascaded expanders with each switch counting as one expander

- Four cascaded switches
- A total of 64 total expanders in the topology

The following examples show several ways in which you can connect devices to the SAS6160 switch.

The first example (Figure 10) shows four servers (host bus adapters) and five JBODs connected to the SAS6160 switch.

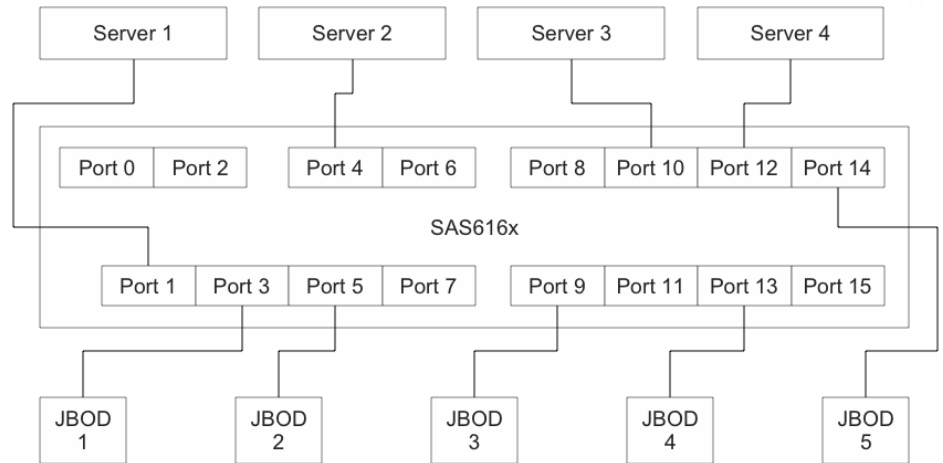


Figure 10: Example 1, Multiple Servers and JBODs

A single rack can contain the switch and all the other devices. The configuration requires nine SAS cables with a Mini SAS connector on each end. Depending on the way in which zoning is set up for the devices, all servers could access data on all the JBODs, or servers could be restricted to accessing a subset of the JBODs.

The second example (Figure 11) shows eight servers and one RAID array connected to the SAS6160 switch.

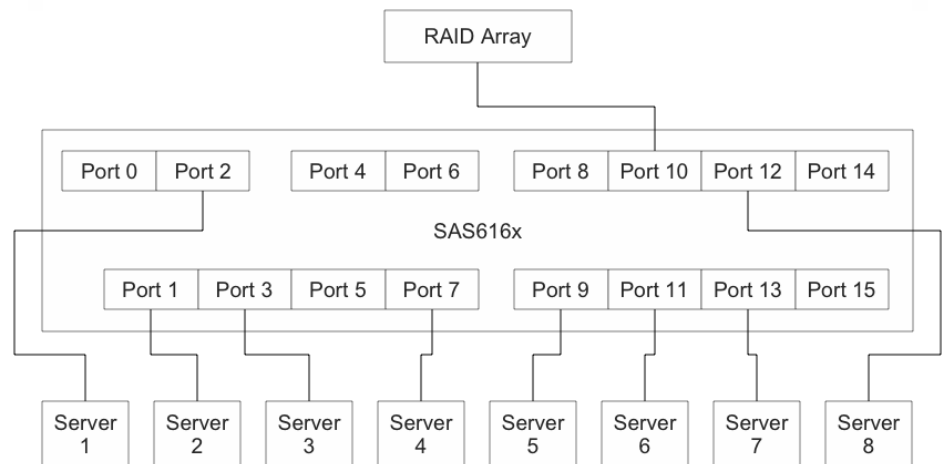


Figure 11: Example 2, Multiple Servers and One RAID

A separate cable with a Mini SAS connector on each end is used for each connection. All eight servers can access data on the RAID array. If more storage capacity is required in the future, the RAID array could be expanded, or a configuration with a second cascading switch could be created, as shown in the next example.

The third example (Figure 12) shows eight servers and one cascading switch connected to the SAS6160 switch. Several JBODs and RAID arrays connect to the other switch.

NOTE: Example 5 and example 6 also show configurations with cascading switches.

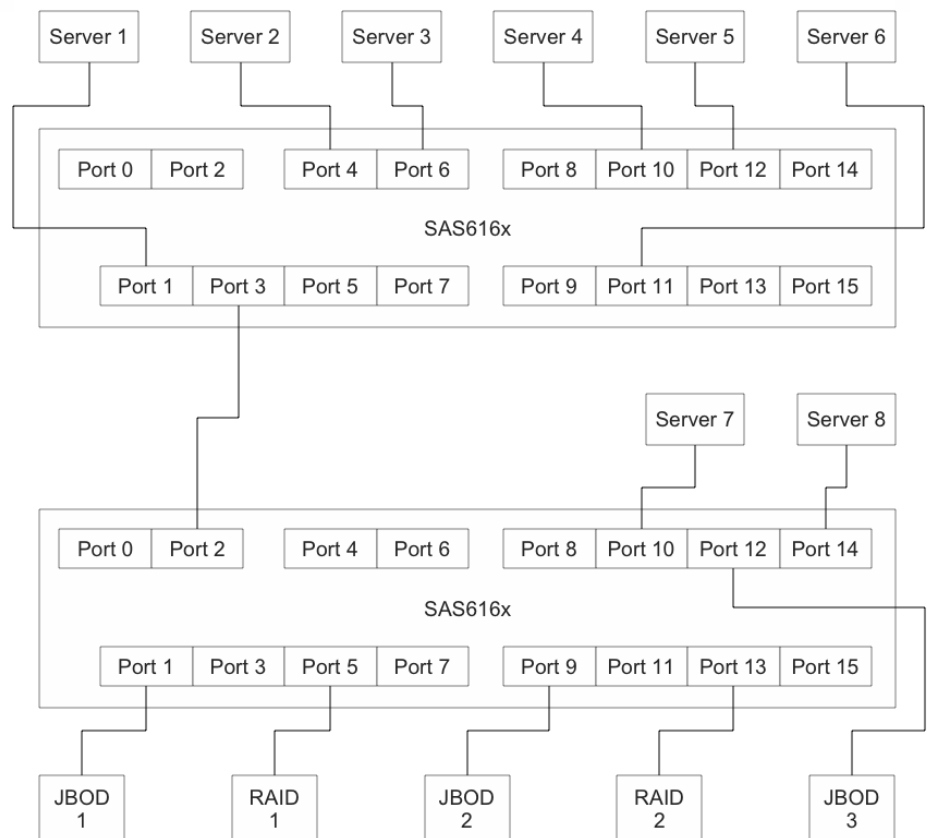


Figure 12: Example 3, Multiple Servers and a Cascading Switch

This example shows how you can cascade two SAS6160 switches to increase the number of devices in the SAS domain. Like in Example 1, all of the servers can access all the data storage devices, or you can implement a zoning configuration to restrict the access.

The fourth example (Figure 13) shows a server connected through two SAS6160 switches to two input connectors on a JBOD for a high-availability configuration.

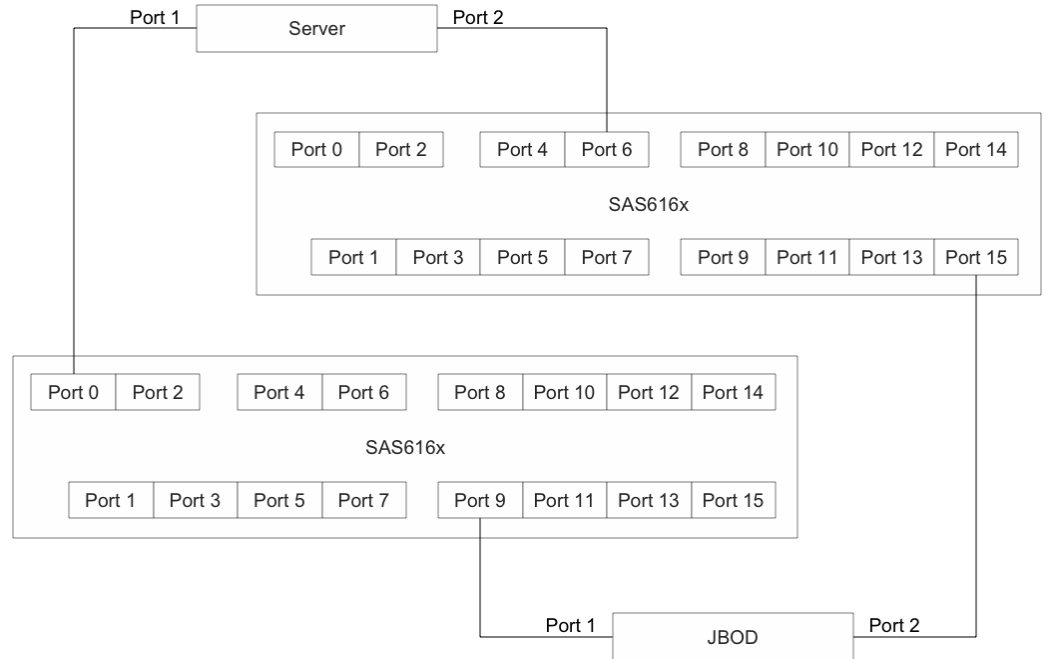


Figure 13: Example 4, High Availability

This dual porting configuration provides the server a redundant path through the switches for high availability. If one of the switches or connections fails, the server can still access the JBOD through the other connection.

The fifth example (Figure 14) shows a large data storage network that includes two SAS6160 switches and several expanders.

NOTE: Expanders are either zoning expanders or nonzoning expanders. When SAS drives are attached to a zoning expander, each drive can be zoned individually and each drive can be in its own zone group. When SAS drives are attached to a nonzoning expander, they cannot be zoned individually. All the drives behind a nonzoning expander must be in the same zone group as the expander.

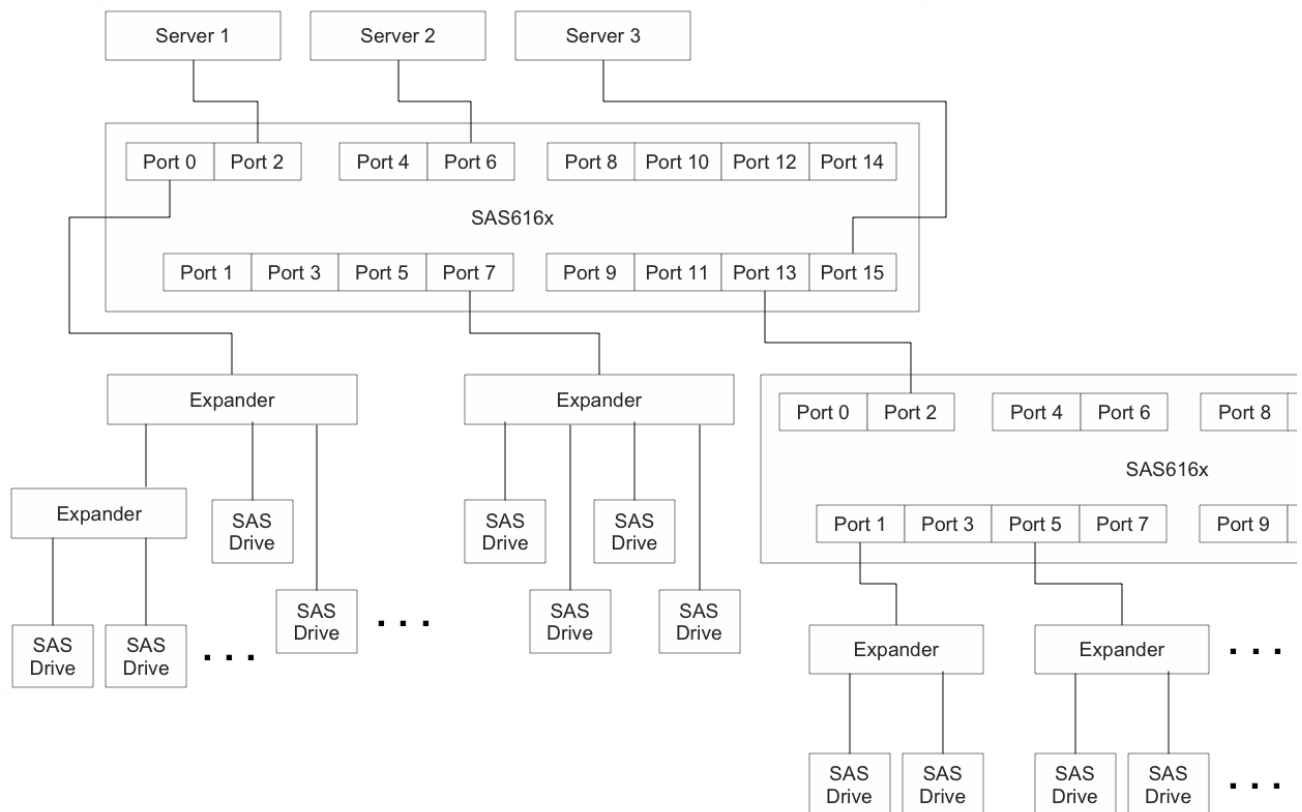


Figure 14: Example 5, Large Data Storage Topology

A complex zoning configuration like this one could potentially include hundreds of SAS initiators and targets. This flexible arrangement can easily be expanded without extensive cabling changes. The SDM utility detects newly added SAS devices during device discovery. You can use the SDM utility to modify and expand the storage configuration.

NOTE: For zoning to function correctly, you must cable SAS6160 switches directly to one another, or through SAS 2.0 zoning expanders.

The sixth example (Figure 15) shows a daisy chain, or cascaded, switch configuration, with four SAS6160 switches. This example assumes that various SAS targets and SAS initiators are attached to the other connectors on the switches.

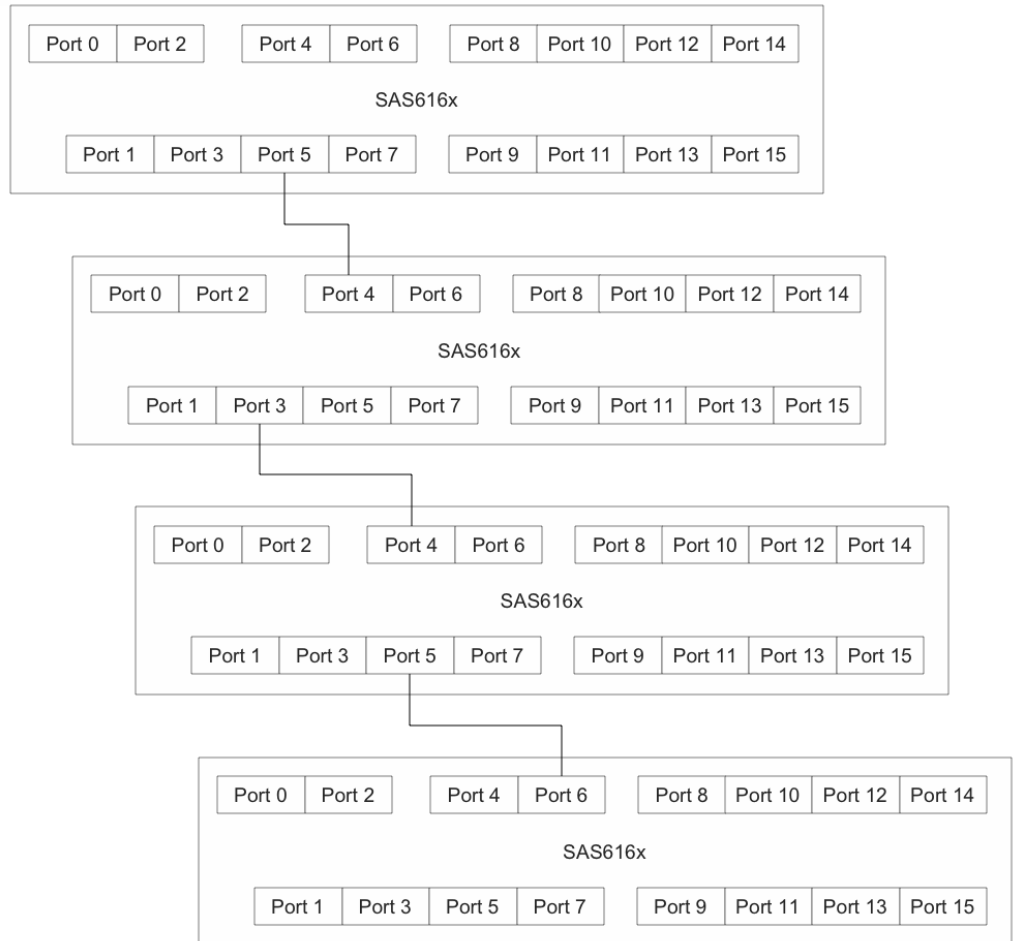


Figure 15: Example 6, Cascaded Switches

Like in Example 3, the cables in this example can run from any connector of the downstream switch to any connector in the switch above it. The cascade sequence is limited to four switches.

Example 7 (Figure 16) shows a star (tree) configuration of four switches, with switch B, switch C, and switch D connected directly to switch A. Like in Example 6, this example assumes that various SAS targets and SAS initiators are attached to the other connectors on the switches.)

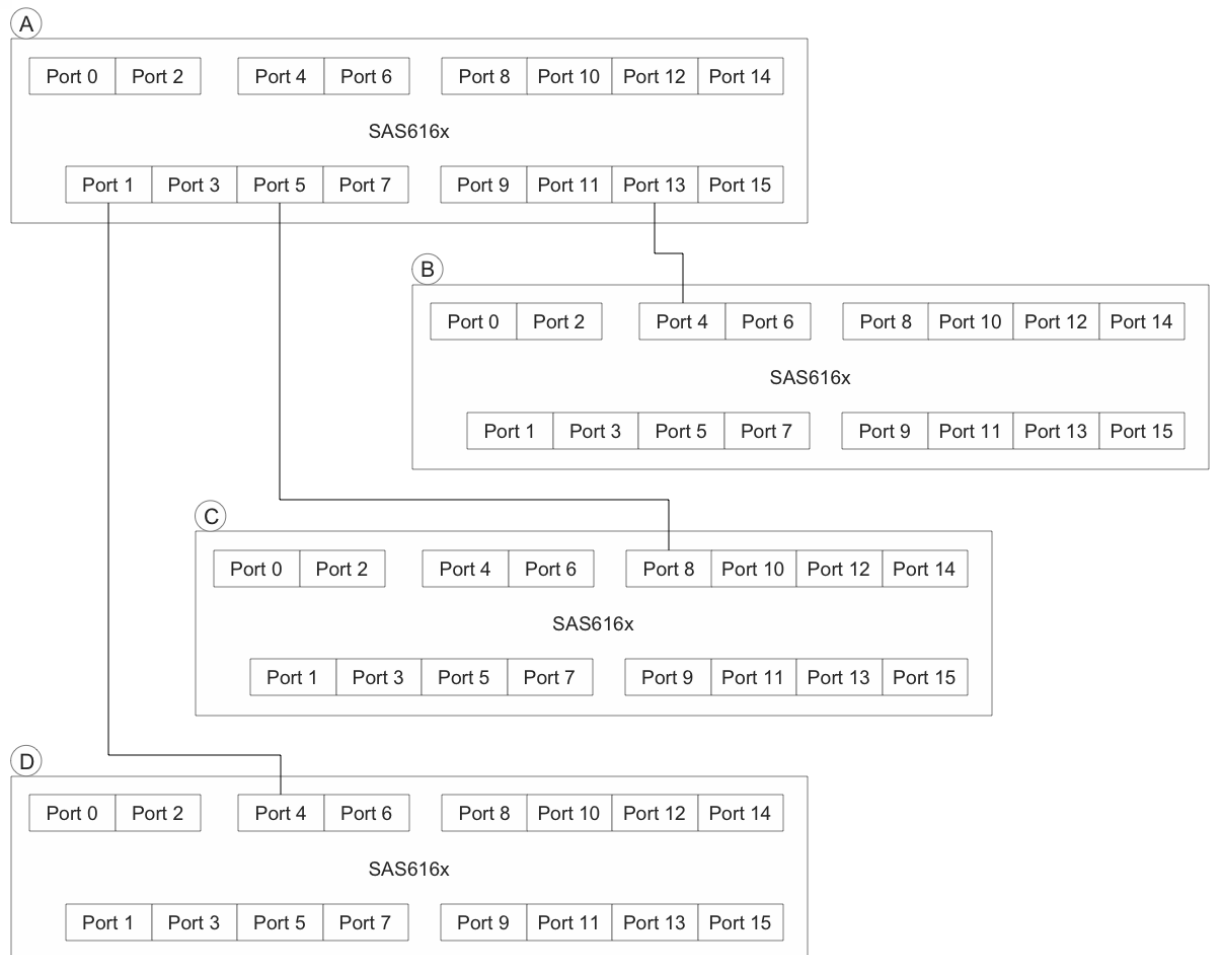


Figure 16: Example 7, Switches in a Star (Tree) Configuration

NOTE: The cables can run from any connector of switches B, C, and D to any connectors on the central switch A. You can attach more switches to the other connectors on switch A. You also can attach additional switches B, C, or D.

Chapter 2

Installation and Hardware Setup

This chapter explains how to unpack the LSISAS6160 SAS switch, install it on an optional rack shelf, connect power cables and other cables to it, change the default Static IP address, and connect SAS storage devices to it. This chapter also explains how to interpret the LEDs on the switch.

2.1 Unpacking the Switch

Place the SAS6160 switch shipping carton on a grounded surface before removing the switch from the carton. Open the shipping carton and carefully unpack its contents. The carton contains the following items:

- One SAS6160 SAS switch
- One AC power cord with inline power supply
- One CD-ROM which contains this documentation

If any of these items are missing or damaged, contact your local reseller for replacement.

2.2 Identifying Switch Components

The following figure shows the connectors and LEDs on the SAS6160 switch. There is a fault status LED and an activity LED for each of the 16 SAS connectors. There is also a power status LED for the switch, and a rate LED and activity LED for the Ethernet connector. A reset pinhole allows reloading the factory defaults, which also requires power cycling the switch (see [Chapter 5, Troubleshooting](#)).

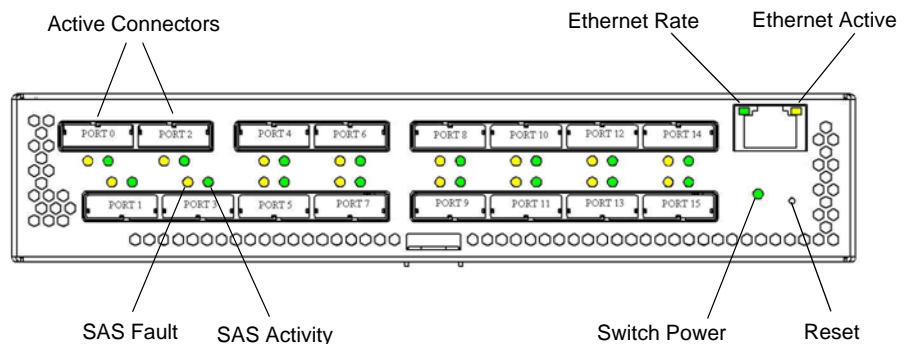


Figure 1: Switch Components

2.2.1 SAS6160 Connectors

All 16 connectors on the SAS6160 switch accept standard passive SAS cabling. The connectors at port 0 and port 2 are active, which allows longer cable lengths when using active SAS cabling. See Chapter 1 for an explanation of SAS connectors and cables.

Table 1: SAS Cable Lengths

Connectors	Cable Type	Min. Length	Max. Length
1 and 3 - 15	Passive	0.5 m	10 m
0 and 2 only	Active	—	25 m
	Passive	0.5 m	10 m

2.2.2 SAS6160 LEDs

The following table shows how to interpret the LEDs for the system, the phys, the power supply module, and the Ethernet (RJ-45) connector. The LEDs in the RJ-45 connector are built into the left and right corners of the connector.

Table 2: LED Modes

LED Name	Color	Meaning
Power (P12V)	Green	12V power is present on the board.
SAS Activity	Green	Blinks with activity on at least one of the four PHYs in the x4 SAS port.
SAS Fault	Amber	At least one of the PHYs in the x4 SAS port is down.
Ethernet Link/Activity	Amber	Link is active. Blinks with activity.
Ethernet Link Rate	Green	Rate of link. Off = 10 Mb/s. On = 100 Mb/s.

2.3 Installing the SAS6160 Switch

WARNING: To prevent the SAS6160 switch from overheating, do not operate it in an environment that exceeds the maximum recommended ambient temperature of 50 °C (122 °F).

When installing the switch, consider the following information:

- The acceptable temperature and humidity operating ranges for installation and operation of the switch are as follows:
 - Temperature Range: 5–50 °C (dry bulb)
 - Relative Humidity Range: 5%–90% noncondensing
 - Maximum Dew Point Temperature: 32 °C
- Install the SAS6160 switch in a site free from strong electromagnetic field generators (such as motors), vibration, and dust.
- Allow some space at the back of the switch (where the fans intake air) for proper ventilation.
- The AC power adapter is rated at 100 V to 240 V, and 50 Hz to 60 Hz.

2.3.1 Installing the SAS6160 Self

A special shelf is available for mounting one or two SAS6160 switches in a standard rack. These options are shown in the following figure.

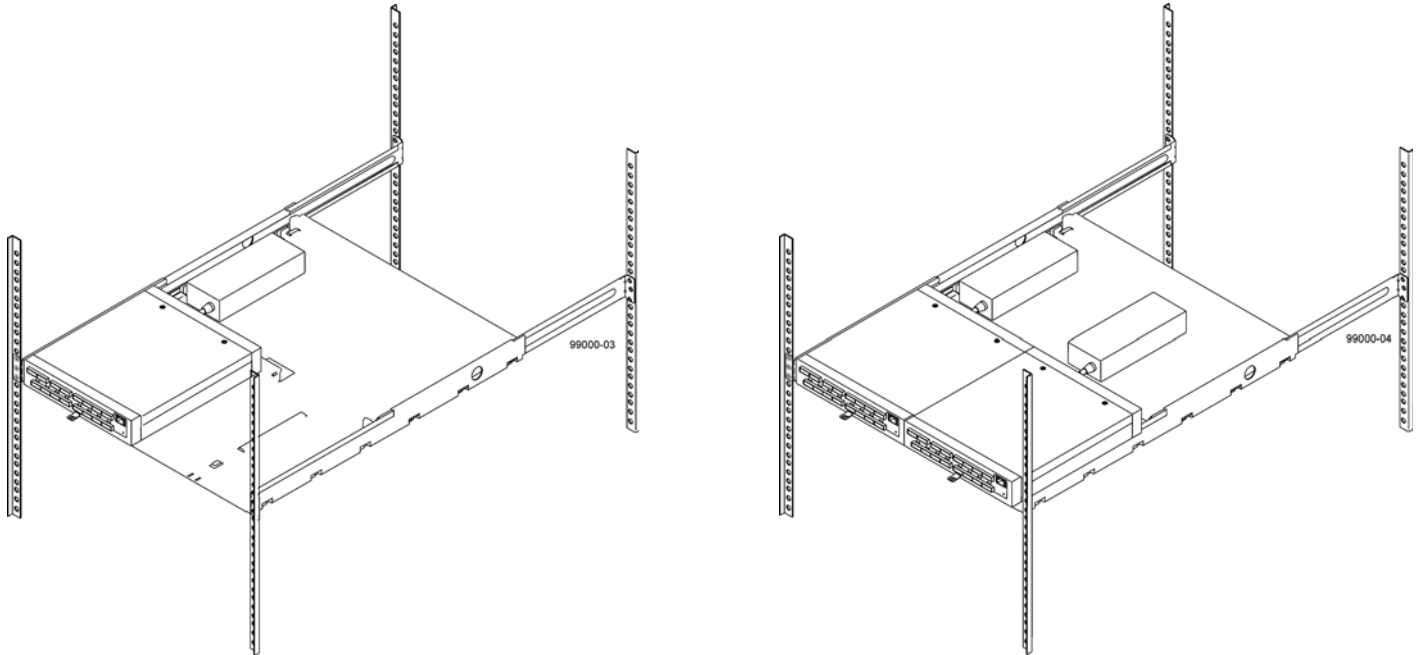


Figure 2: One or Two SAS6160 Switches on a Rack Mounted Shelf

To assemble and mount the shelf in a rack, follow these steps:

1. Unpack the SAS6160 shelf. Ensure that there is a shelf and two shelf rails along with eight screws and four clips.
2. Insert the two side rails from the back of the shelf, as shown in the following figure.

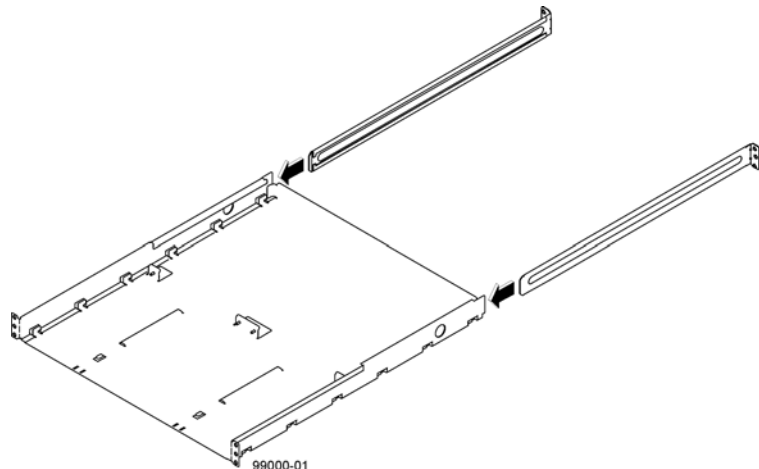


Figure 3: Inserting Side Rails into the Shelf

These rails allow adjustment of the shelf to fit different rack depths. Make sure the mounting ears on the rails are turned out as shown.

3. Bolt the shelf onto the vertical rails in the rack, as shown in the following figure.

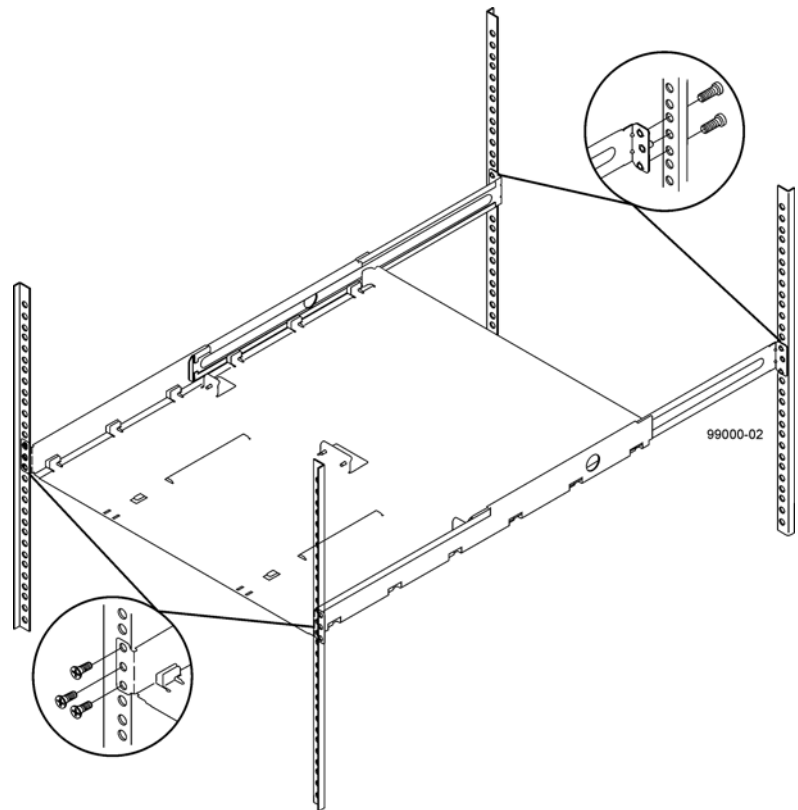


Figure 4: Mounting Shelf in a Rack

The mounting ears on the shelf rails are threaded, so place them on the inside of the vertical rack rails, and insert the bolts from the outside, as shown.

The mounting ears on the shelf itself are not threaded, so mount them with clip nuts.

4. Finally, place the SAS6160 switch and its inline power supply on the shelf. The switch enclosure fits onto a raised rib on the shelf to hold it securely in place.

When power is available at the connector side of the switch, route power cords along the enclosure on the far left or far right of the shelf.

The SAS6160 switch is now ready for connection to a host.

2.4 Connecting to a Host

To connect the SAS6160 switch to a host, follow these steps:

1. The 10/100 Ethernet connector (RJ-45 connector) on the connector side of the switch provides access to the embedded SDM Domain Manager utility. Use this utility to configure and manage the switch.
 - Use a standard RJ-45 cable, if connecting to an external Ethernet hub or switch.
 - Use a crossover RJ-45 cable, if connecting directly to a computer.
2. Plug the other end of the RJ-45 cable into an Ethernet hub/switch or a computer. Use a web browser (Microsoft® Internet Explorer®, or Mozilla® Firefox®) on the host. By default, the switch supports the configuration parameters listed in the following table, which provides a point-to-point (non-network) Ethernet connection between the switch and the host.

WARNING: Provide the SAS6160 switch with a proper AC protective earth ground connection. Never defeat the ground conductor or operate the SAS6160 switch without a suitably installed ground conductor.

The following table lists the switch configuration defaults.

Table 3: Switch Configuration Defaults

Parameter	Default
Name	SAS6160
POST	Regular
Active Zone Set	None
IP Address Assignment	Static
IP Address	192.168.1.100
IP Subnet Mask	255.255.255.0
IP Gateway	192.168.1.1

You can reconfigure the switch to connect to an Ethernet network.

2.5 Changing the Default Static IP Address

2.5.1 Setting a Static IP Address

The default IP address provides initial identification of the SAS6160 switch on a network. To change the IP address use either the SDM-GUI or the SDM-CLI interface explained in Chapter 3 and Chapter 4, respectively.

Using SDM_GUI

1. Log on to SDM_GUI using the *admin* account.
2. From the Devices tab, select the switch.
3. Click on the Operations tab.
4. Click on the Configure IP link to open the Configure IP box.
5. Click the Static IP radio button.
6. Configure the static IP address, DNS, and gateway provided by your network administrator.

7. Exit SDM-GUI and power cycle the switch.

Using SDM-CLI

1. Login to SDM-CLI using the *admin* account.
2. Enter the following command:

```
device <sasaddress> ip static <ipaddress> <netmask>
<defaultgateway>
```

for example

```
device 500605b0002453f ip static 172.21.25.204
255.255.255.0 172.21.25.1
```
3. Exit SDM-CLI and power cycle the switch.

2.5.2 Setting a Dynamic IP Address

Using SDM-GUI

1. Login to SDM_GUI using the *admin* account.
2. From the Devices tab, select the switch. Write down the switch SAS address for possible reference and identification later.
3. Click on the Operations tab.
4. Click on the Configure IP link to open the Configure IP box.
5. Click the DHCP IP radio button.
6. Power off the switch.
7. Connect the switch to the network.
8. Power on the switch, which now gets an IP address assignment.
9. Run the provided Xip utility with these options:

```
xip -i get avail
```

to see the SAS address and IP information for all attached devices.

For network management, you can contact your system administrator to create a static reservation for this IP address.

Using SDM-CLI

1. Login to SDM-CLI using the *admin* account.
2. Enter the following command:

```
device <sasaddress> ip dhcp
```

for example

```
device 500605b0002453f ip dhcp
```
3. Exit SDM-CLI and power cycle the switch.
4. Run the provided Xip utility with these options:

```
xip -i get avail
```

to see the SAS address and IP information for all attached devices.

2.6 Connecting SAS and SATA Hardware

The SAS6160 switch centralizes management for all SAS initiators and SAS targets in the SAS domain. The SAS ports on the SAS6160 switch are by default both in ports and out ports. Depending on the requirements, you can attach each port to a SAS host bus adapter, a SAS or SATA JBOD, a RAID array, or a SAS expander. You cannot connect the SAS6160 switch to individual SAS drives or SATA drives. You can use any SAS port on the SAS6160 switch to cascade to any port on another SAS6160 switch to increase the size of the storage configuration.

See Chapter 1 for examples of various kinds of hardware configurations. Chapter 1 also explains the types of SAS connectors and cables that are needed for these configurations.

2.7 Safety Notices

The SAS6160 switch uses a 3 V coin cell lithium battery for the real-time clock. The battery is not user-replaceable. The following warning and caution apply if you must dispose of a SAS6160 switch for some reason.

WARNING: Risk of fire or chemical burn – The battery used in this device might present a risk of fire or chemical burn if mistreated. Do not disassemble, heat above 60 °C (140 °F), crush or puncture, short-circuit external contacts, or dispose of the battery in fire or water.

CAUTION: Potentially hazardous material – The lithium coin cell battery contains perchlorate that might be considered hazardous material. If the used battery is physically damaged and is leaking, Do not ship the battery to a recycling center. Handling a damaged battery exposes you and others to potentially hazardous material. Dispose of the damaged battery according to all applicable regulations. If you recycle a used battery that is not damaged, use the proper facilities. Handle the battery according to all applicable regulations.

2.7.1 FCC

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the Federal Communications Commission (FCC) Rules. These limits are designed to provide reasonable protection against harmful interference in a commercial installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case you must correct the interference at your own expense.

LSI Corporation, is not responsible for any radio or television interference caused by unauthorized modification of this equipment or the substitution or attachment of connecting cables and equipment other than those specified by LSI. It is your responsibility to correct interference caused by such unauthorized modification, substitution, or attachment.

2.7.2 Canada Mark

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

2.7.3 VCCI

この装置は、クラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。 VCCI-A

2.7.4 BSMI

台灣BSMI認證

警告使用者：

這是甲類的資訊產品，居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

電池警示認證

注意事項：如果電池未正確安裝，可能有爆炸的危險。請選用與制造商所推薦相同或相等型式的電池來進行替換。請依據制造商的指示處理使用過的電池。

2.7.5 CCC

China CCC Notification

声 明

此为 A 级产品，在生活环境中，该产品可能会造成无线电干扰。在这种情况下，可能需要用户对其干扰采取切实可行的措施。

电池警示认证

注意事项:

如果电池未正确安装，可能有爆炸的危险。请选用与制造商所推荐相同或相等型式的电池来进行替换。请依据制造商的指示处理使用过的电池。

Chapter 3

SAS Domain Manager Graphical User Interface

This chapter explains how to use the SAS Domain Manager Graphical User Interface (SDM-GUI) application to configure and monitor storage configurations with the LSISAS6160 SAS switch. The SDM-GUI utility is a Java Web Start application, and the LSISAS6160 SAS switch functions as an HTTP server that launches it. You can run the SDM-GUI utility from a browser by pointing the browser to the switch's IP address.

SDM-GUI has an easy-to-use graphical interface that enables you to manage the host switch, and other switches or expanders within the domain in which the host switch resides. You can use the interface to view domain information, create and modify aliases, and manage zone groups and zone sets.

3.1 SDM-GUI Accounts

You can run SDM from a *user* account or from an *admin* account.

- The *user* account allows you to view the domain topology, configuration, and operating environment. The default password is **user**.
- The *admin* account allows you to view the same information as the *user* account. In addition, it allows you to change the configuration of the domain and of the managed devices within the domain. The default password is **admin**.
- The SAS6160 switch's zone manager password is handled separately. Its default password is **lynx**.

3.2 Starting SDM-GUI

Follow these steps to start SDM-GUI:

1. Open a web browser and point it to the switch's IP address or host name.
Java Web Start downloads and launches the SDM-GUI automatically.
The Password window appears.
2. Enter your user name and password.
3. Click **Login**.
The main window and Summary tab appear.

3.3 Summary Tab and Menu Options

The following figure shows the SDM-GUI main window, with the menu bar and Summary tab.

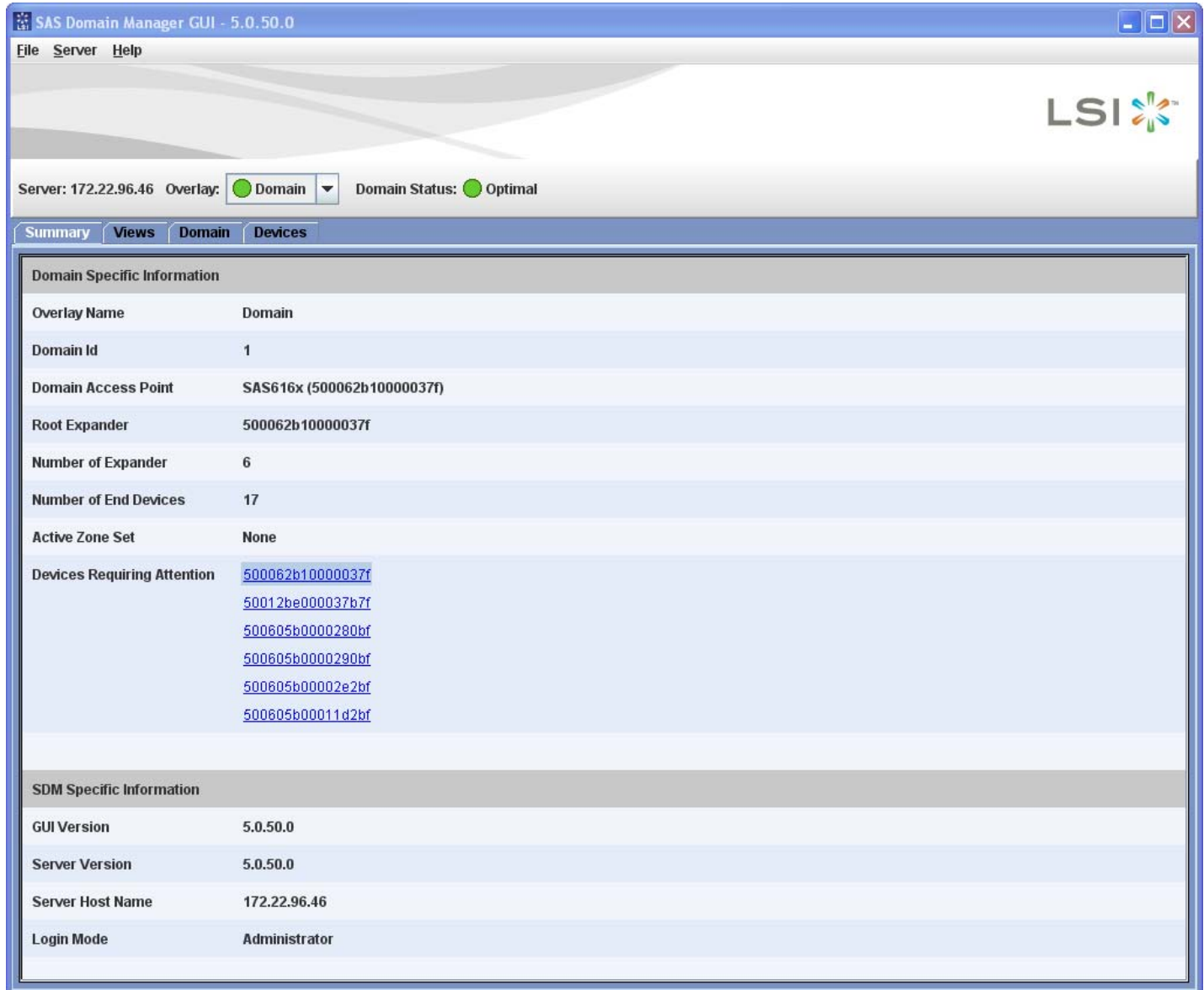


Figure 1: SDM-GUI Summary Window

The Summary tab indicates the IP address of the device SDM is currently accessing, as well as the domain status and domain ID, and the overlay name. The bottom section of the window lists information about SDM-GUI, including the software version, the host name of the current server, and the login mode (*admin* or *user*).

Embedded SDM only supports a single domain.

3.4 File, Server, and Help Menu Options

The menu bar at the top of the window provides you several options for managing the server. The available commands are as follows:

- Select **File >> Refresh** to scan the domain for topology or status changes. (SDM automatically scans the domain once a minute.)
- Select **File >> Exit** to exit SDM-GUI.
- Select **Server >> Change Password** to change passwords for either the *admin* account or the *user* account. To do this task, you must know the current *admin* password.
- Select **Server >> Change Connect** to return to the login screen.
- Select **Help >> About** to view information about the GUI and the server on which it is running. The information includes the version, host name, and operating system.

3.5 Views Tab

The Views tab enables you to view information about the current domain. You can view information about the end device table, the alias table, zone groups, and zone sets. This information is available to both *admin* and *user* accounts.

3.5.1 View End Device Table

As shown in the following figure, the View End Device Table option displays a list of end devices in the current domain, the expanders to which they attach, and their entry point into the Zoned Portion of a Service Delivery Subsystem (ZPSDS), which is useful for zoning.

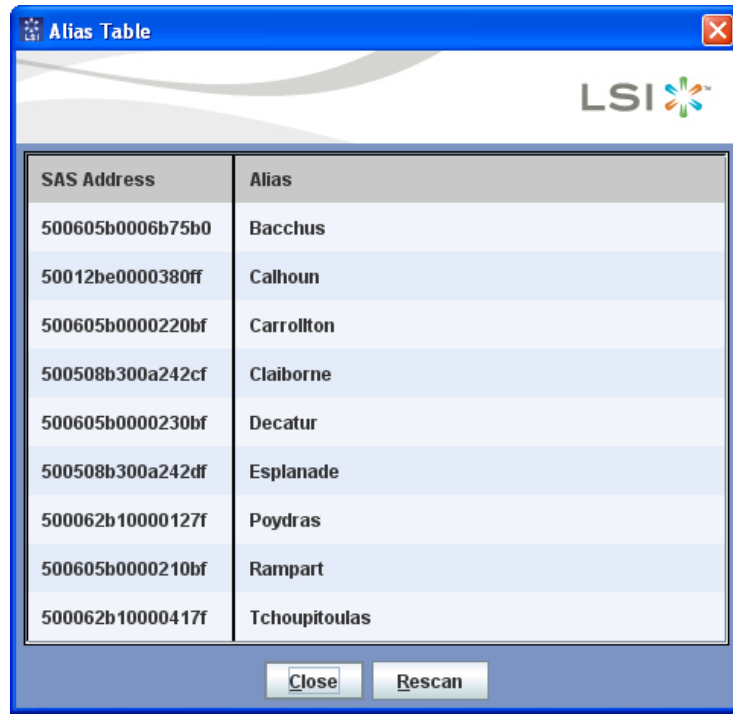
End Device		Attached Expander		
Device	Phys	Device	Phys	Device
Bacchus	00-01-02-03	Poydras	40-41-42-43	Poydras
5000c500176c844d	00	Calhoun	00	Calhoun
5000c500176c9609	00	Calhoun	01	Calhoun
5000c500176e7041	00	Calhoun	02	Calhoun
5000c500176c9959	00	Calhoun	03	Calhoun
5000c500176a867d	00	Calhoun	04	Calhoun
5000c5001769ed95	00	Calhoun	05	Calhoun
5000c500176d141d	00	Calhoun	06	Calhoun
5000c500176cb319	00	Calhoun	07	Calhoun
5000c500176a1ff5	00	Calhoun	12	Calhoun
5000c500176cf39d	00	Calhoun	13	Calhoun
5000c500176cb0f1	00	Calhoun	14	Calhoun
5000c500176e7165	00	Calhoun	15	Calhoun
5000c50017689651	00	Calhoun	28	Calhoun
5000c5001765e50d	00	Calhoun	29	Calhoun
5000c500176a32cd	00	Calhoun	30	Calhoun

Close Rescan

Figure 2: End Device Table

3.5.2 View Alias Table

As shown in the following figure, the View Alias Table option displays a list of all aliases.



SAS Address	Alias
500605b0006b75b0	Bacchus
50012be0000380ff	Calhoun
500605b0000220bf	Carrollton
500508b300a242cf	Claiborne
500605b0000230bf	Decatur
500508b300a242df	Esplanade
500062b10000127f	Poydras
500605b0000210bf	Rampart
500062b10000417f	Tchoupitoulas

Figure 3: Alias Table

3.5.3 View Zone Groups

As shown in the following figure, the View Zone Groups option displays a list of zone groups. To view details about any zone group, select it in the list on the left. An asterisk at the end of a zone group name indicates that the zone group is currently active.

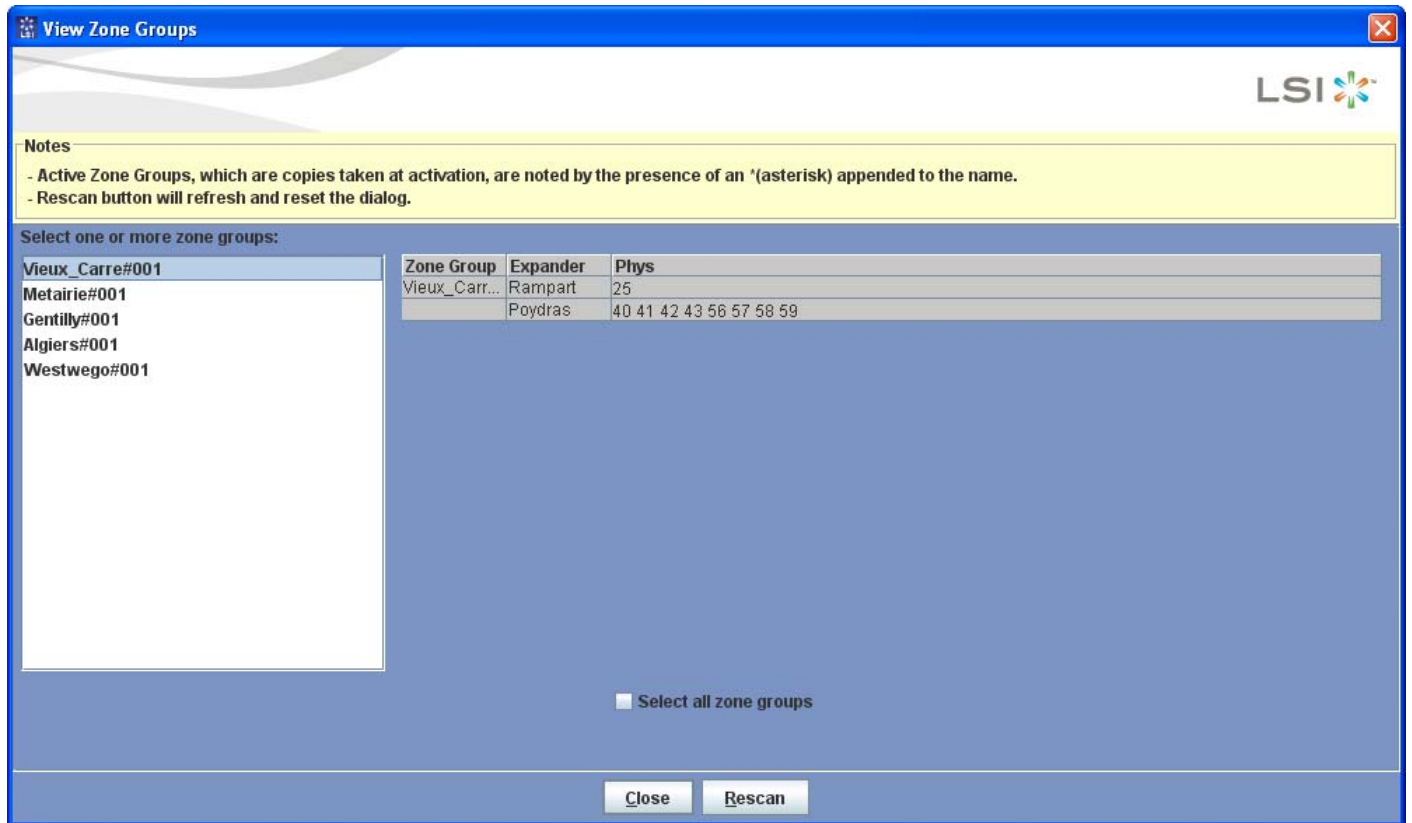


Figure 4: View Zone Groups

3.5.4 View Zone Sets

As shown in the following figure, the View Zone Sets option displays a list of zone sets. To view details about any zone set, select it in the list on the left. An asterisk at the end of a zone set name indicates that the zone set was active at the time of activation.

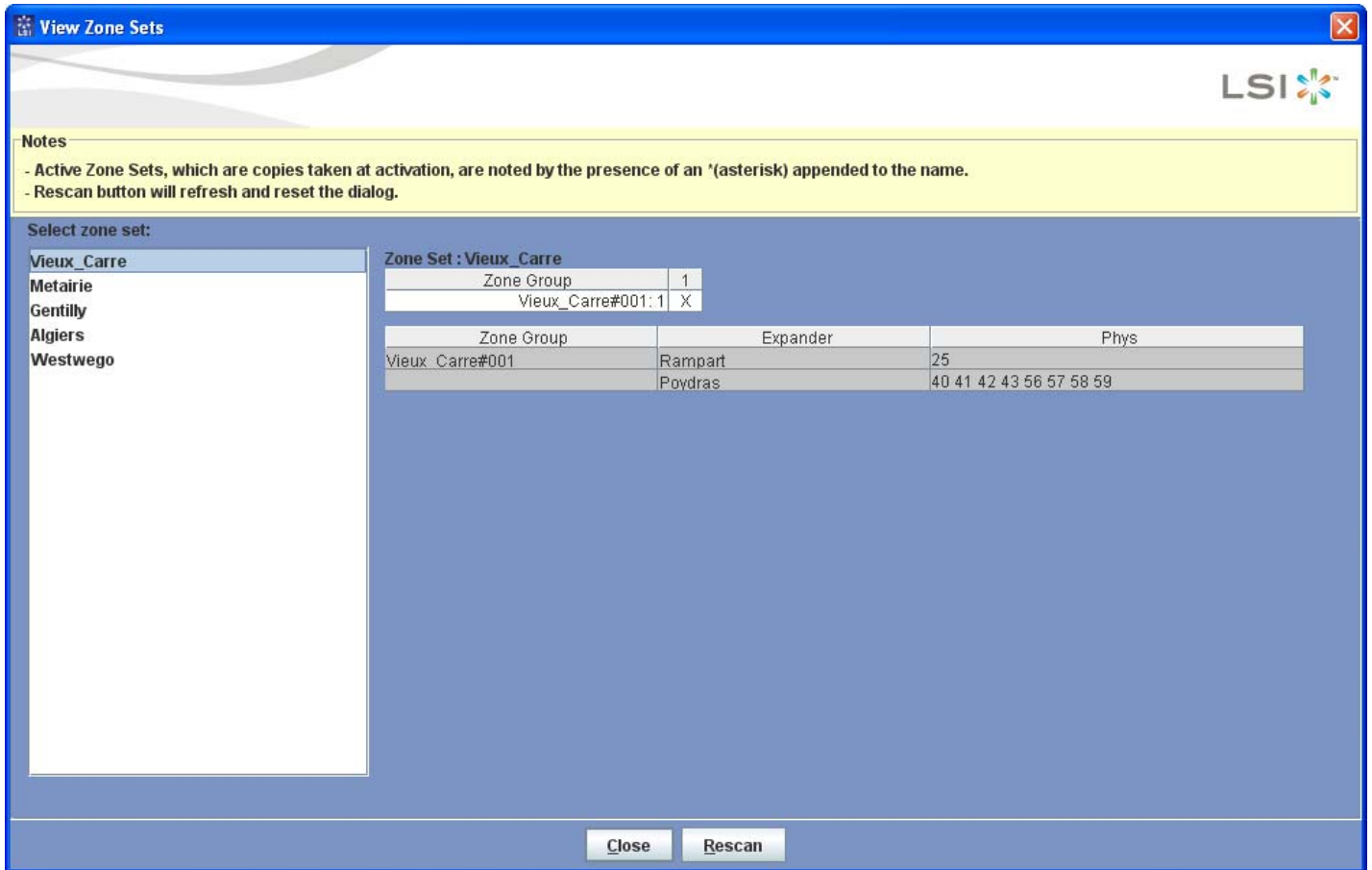


Figure 5: View Zone Sets

3.6 Domain Tab

The Domain tab, which is available only in the *admin* account, has commands that manage aliases, zone groups, and zone sets. In addition, it has several wizards for domain configuration and management tasks. To use the specific commands described in this section, click the hyperlinks on the Domain tab.

3.6.1 Alias Management

The Alias Management options enable you to create, modify, and delete aliases.

3.6.1.1 Create/Modify Aliases

Use the Create/Modify Aliases option to create or modify aliases. An alias is a user-defined name that is bound to a specific SAS Address. After you create an alias, you can use it anywhere that you would normally use a SAS address. Aliases are convenient because they can be easy-to-remember names such as Summit, Turbo, Node100, and so on.

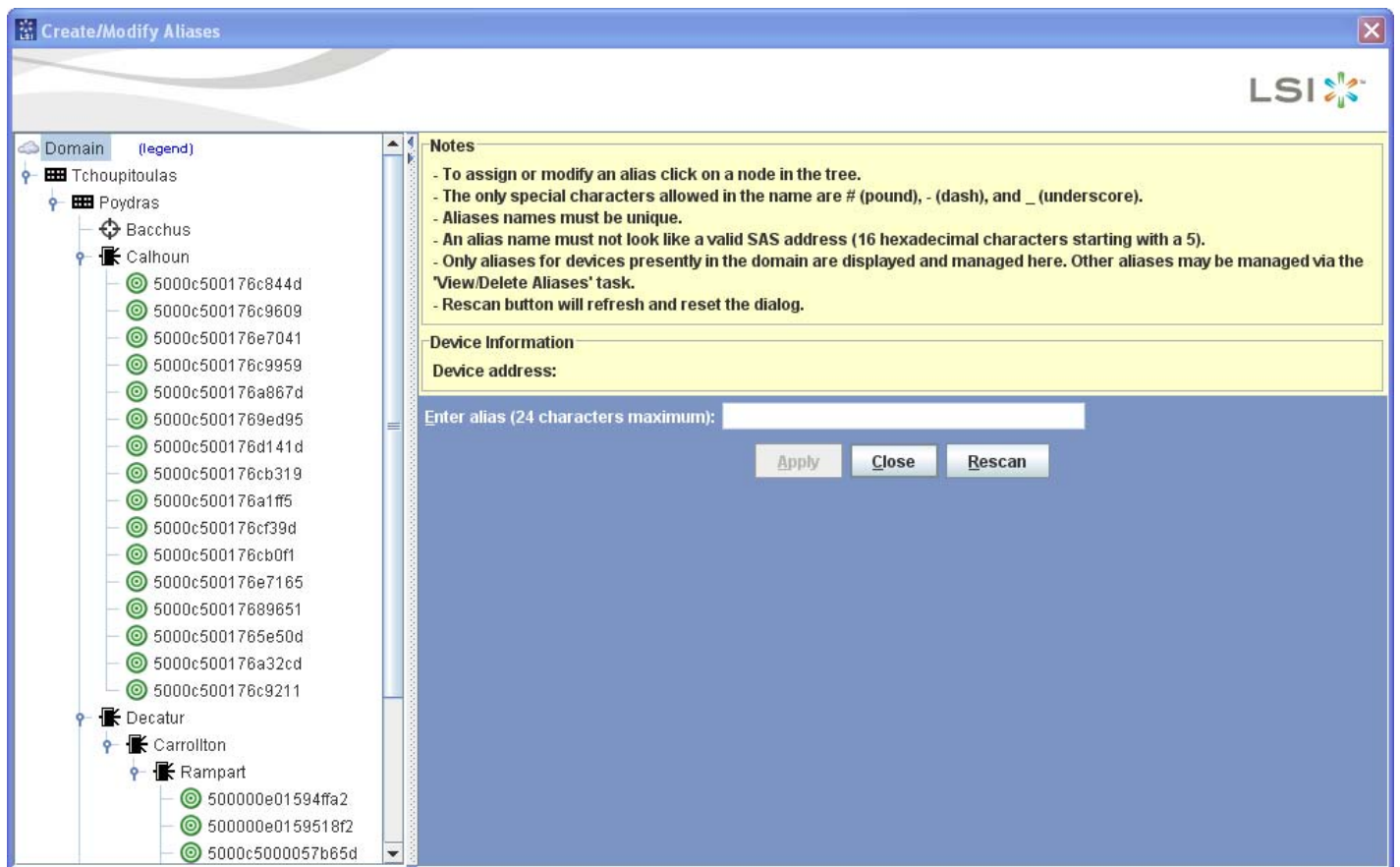


Figure 6: Create/Modify Aliases

To assign an alias, click on a node in the tree on the left of the window and type an alias of up to 24 characters in the field on the right. Click **Apply** to assign the alias. You can change existing aliases in addition to assigning new ones.

Alias names must be unique and must not resemble valid SAS addresses (16 hexadecimal characters that start with the number 5). The only special characters you can use in an alias are pound (#), dash, and underscore. The tree displays aliases only for the devices presently in the domain. To see aliases for other devices, use the View/Delete Aliases command.

3.6.1.2 View/Delete Aliases

Use the View/Delete Aliases command to display a list of all aliases associated with the focused domain, including aliases assigned to devices that are not presently in the domain. You also can use this command to delete aliases.

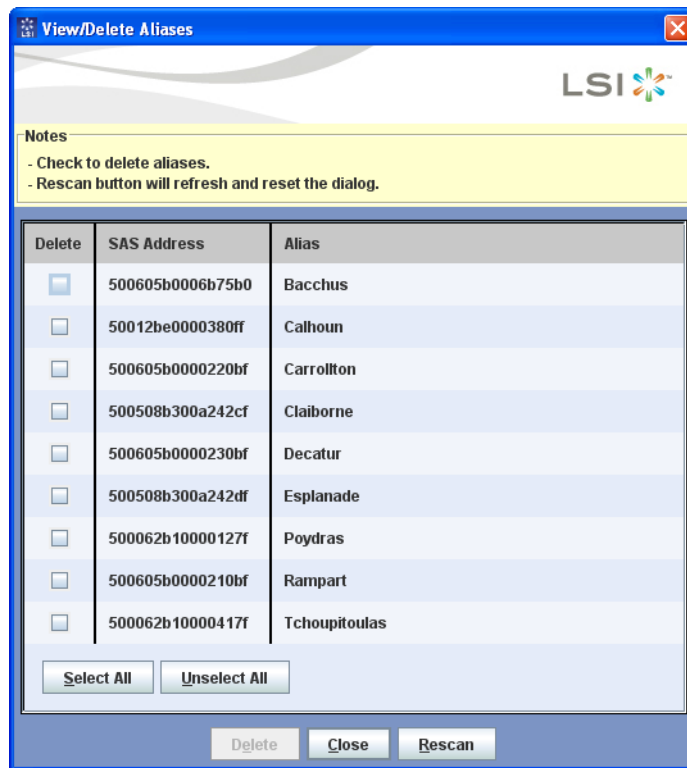


Figure 7: View/Delete Aliases

To delete an alias, select the check box next to it and click **Delete**.

3.6.2 Automatically Configure Zone Groups and Zone Sets

Zoning wizards simplify zone set creation. The Automatically Configure Zone Groups and Zone Sets commands include three wizards that can automate the configuration of zone groups and zone sets.

3.6.2.1 Initiator Isolation Wizard

The Initiator Isolation Wizard creates a zone set that isolates initiators from one another, while exposing all targets to each other. Use the Initiator Isolation Wizard to automatically configure a zone set and two associated zone groups based on a snapshot of the current domain. Each window of the wizard includes instructions to guide you through the configuration process.

After it prompts you to type the zone set name (maximum of 28 characters), the wizard checks the domain to determine if any initiators or targets are attached to the ZPSDS at the same point and share a common ZPSDS entry point. If so, the topology cannot support this zoning configuration, and the wizard terminates with an error message.

If the topology supports the configuration, the wizard builds two zone groups: one for the initiators, and one for the targets, with the names `<zone set name> + #001` and `<zone set name> + #002`. The wizard scans through the domain and assigns to one zone group all the ZPSDS entry point phys that are upstream from initiators. The wizard assigns to another zone group all the ZPSDS entry point phys that are upstream from targets. The wizard then sets up permissions to allow the two zone groups to communicate with each other, but it prevents phys in one zone group from making connections to each other. When you click the **Apply** button, the wizard creates the zone set and the two associated zone groups.

3.6.2.2 Connector Wizard

Use the Connector Wizard to automatically configure a zone set and associated zone groups by grouping connectors on the edge of the ZPSDS. Each window of the wizard includes instructions to guide you through the configuration process.

The wizard uses a snapshot of the current domain to identify the connectors on the edge of the ZPSDS and then displays a list of these connectors. (The list does not include connectors that link expanders within the ZPSDS.) Type the zone set name (maximum of 28 characters) and bundle the connectors into zones by selecting one or more connectors from the list. You can define multiple zones as needed in order to meet your zoning requirements. Zones can overlap, but the wizard removes zones that are subsets of larger zones. You can delete the defined zones by selecting the check box and clicking the **Delete** button.

After you define all the zones, the wizard uses the zone definitions to create the minimal number of zone groups and to configure their permissions. The wizard creates one zone group per defined zone, populating the zone group with the phys associated with the connectors in that zone, and setting up permission for the phys in the zone group to communicate with each other.

The wizard then compares each zone group to all other zone groups, including zone groups created during this process, searching for phys that are in both zone groups. If it finds any such phys (parents), it creates a new zone group (child) and moves the identified phys to the child. The wizard then grants permission for the child's phys to communicate with each other, as well as with the phys of the two parent zone groups.

If one of the parent zone groups is emptied in this process, the wizard transfers all permissions from the parent to the child. Empty zone groups are later ignored and are not transferred to the zone manager.

The wizard creates the zone set and associated zone group when you click the **Apply** button. It assigns to zone groups the names `<zone set name> + #001`, `<zone set name> + #002`, and so on. If the number of generated zone groups exceeds the maximum number of 248, the wizard displays an error message.

NOTE: If phys on the edge of the ZPSDS are associated with connectors, then their connectors are displayed in the selection list. If phys on the edge of the ZPSDS are not associated with connectors, but they have formed into ports (they are connected to a device), then ports are displayed in the selection list. If phys on the edge of the ZPSDS are not associated with connectors, and have not formed into ports, individual phys are displayed in the selection list.

3.6.2.3 End Device Wizard

Use the End Device Wizard to automatically configure a zone set and associated zone groups by grouping end devices. Each window of the wizard includes instructions to guide you through the configuration process.

This wizard uses a snapshot of the current domain to determine the available end devices and then displays lists of initiators and targets. Type the zone set name (maximum of 28 characters) and bundle one or more initiators with one or more targets into a zone by selecting them from these lists. You can define multiple zones as needed in order to meet your zoning requirements. Zones can overlap, but zones that are subsets of larger zones are removed. The wizard forces devices that share the same ZPSDS entry point (siblings) into the same zone by automatically selecting all siblings when you select a single sibling. You can delete the defined zones by selecting the check box and clicking the **Delete** button.

After you define all the zones, the wizard uses the zone definitions to create the minimal number of zone groups and to configure their permissions. The wizard creates one zone group per defined zone, populating the zone group with the ZPSDS entry point phys of the end devices in that zone, and setting up permission for the phys in the zone group to communicate with each other.

The wizard then compares each zone group to all other zone groups, including zone groups created during this process, searching for phys that are in both zone groups. If it finds any such phys (parents), it creates a new zone group (child) and moves the identified phys to the child. The wizard then grants permission for the child's phys to communicate with each other, as well as with the phys of the two parent zone groups.

If one of the parent zone groups is emptied in this process, the wizard transfers all permissions from the parent to the child. Empty zone groups are later ignored and are not transferred to the zone manager.

The wizard creates the zone set and associated zone group when you click the **Apply** button. The wizard assigns to zone groups the names *<zone set name> + #001*, *<zone set name> + #002*, and so on. If the number of generated zone groups exceeds the maximum number of 248, the wizard displays an error message.

3.6.3 Manually Configure Zone Groups

The Manually Configure Zone Groups commands allow you to manually create, view, modify, and delete zone groups. This command provides greater control of zone set creation, and allows an administrator to edit an existing zone set or zone group.

3.6.3.1 Create Zone Group

Use the Create Zone Group command to manually create zone groups. As the following figure shows, you complete this task by typing a zone group name and then selecting members for the zone group from the list on the left.

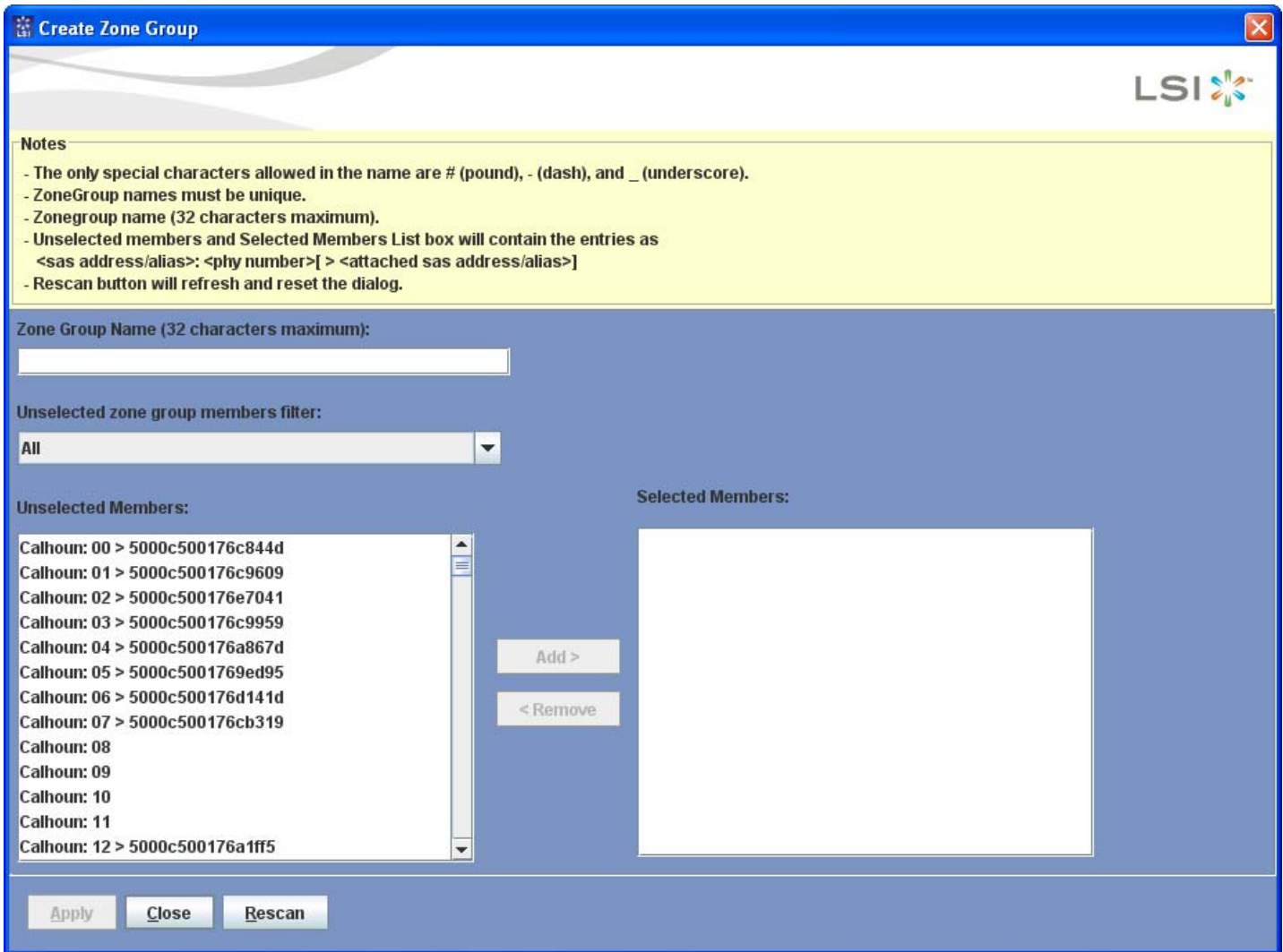


Figure 8: Create Zone Group

Zone group names must be unique and must be no longer than 32 characters. The only special characters you can use in a zone group name are pound (#), dash, and underscore.

The list of unselected zone group members contains only the expanders that are inside the ZPSDS boundary. The unselected members list box contains only the phys that are inside the ZPSDS boundary.

3.6.3.2 View Zone Group

Use the View Zone Groups command to view information about zone groups. To view details about any zone group, select the group from the pull-down list on the left. An asterisk at the end of a zone group name indicates that the zone group was active at the time of activation. [Figure 4](#) shows the View Zone Group window.

3.6.3.3 Modify Zone Group

Use the Modify Zone Groups command to modify existing zone groups. You can add or remove phys or rename an existing zone group. The list of unselected zone group members contains only the expanders and phys that are inside the ZPSDS boundary. As the following figure shows, you rename a zone group by selecting the zone group from the pull-down list at the upper left, typing a new name, and clicking **Apply**.

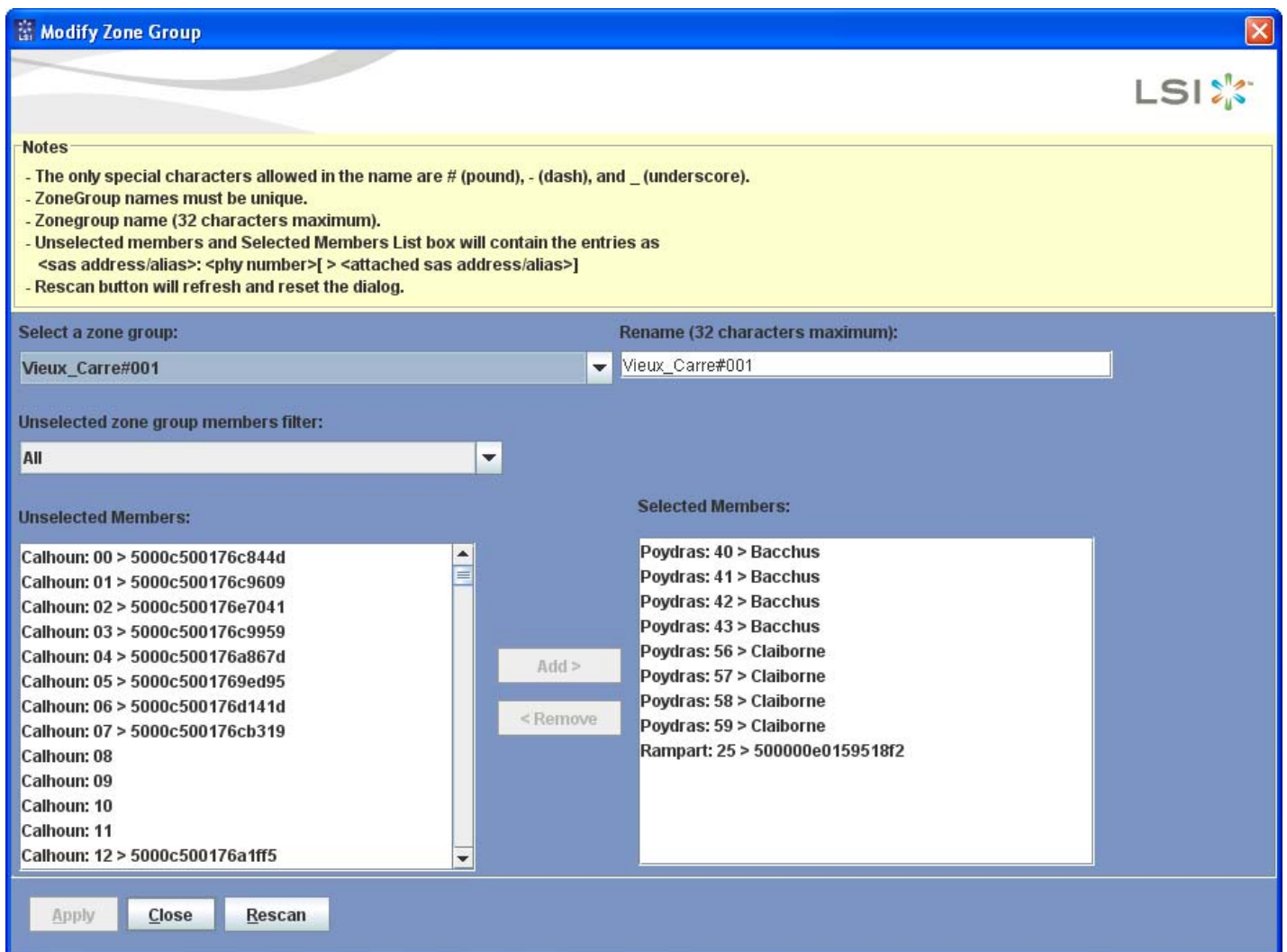


Figure 9: Modify Zone Group

3.6.3.4 Delete Zone Group

Use the Delete Zone Group command to delete an existing zone group. You can delete any zone group that is not currently a member of any zone set. Select the zone group name from the pull-down list in the upper left and click **Delete**.

3.6.4 Manually Configure Zone Sets

The Manually Configure Zone Sets commands enable you to manually create, view, activate/deactivate, and delete zone sets.

3.6.4.1 Change Zone Manager Password

Use the Change Zone Manager Password command to change the password used to manage the zoning expanders in the domain. When the window appears, type the current password in the indicated field. Then type the new password and type it again to confirm it. Passwords are text strings that consist of any valid ASCII character. The maximum password length is 32 characters.

If you enter a null string, the password is set to its default value, ZERO (32 bytes of binary 0), as defined by the SAS 2.0 specification.

3.6.4.2 Create Zone Set

Use the Create Zone Set command to create a new zone set. You can click on the matrix to indicate that both zone groups in the associated row/column may communicate with one another. A blank cell indicates that the two zone groups may not communicate. A dash in a cell indicates an illegal selection because of a phy conflict between zone groups. A phy can be a member of one zone group per zone set.

To see the details of a particular zone group, click the zone group link in the left column of the matrix.

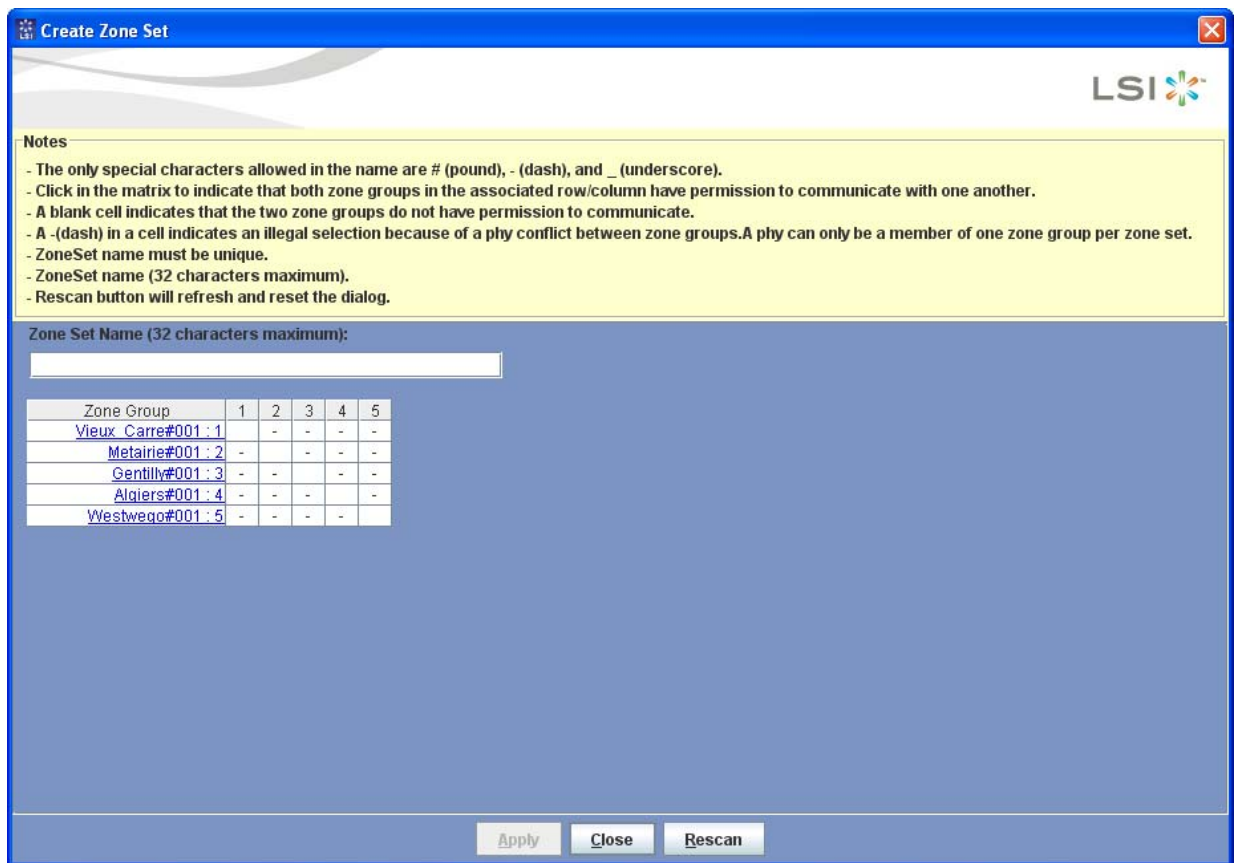


Figure 10: Create Zone Set

3.6.4.3 View Zone Set

Use the View Zone Set command to view information about zone sets. To view details about any zone set, select it in the list on the left. An asterisk at the end of a zone set name indicates that the zone set was active at the time of activation. Figure 5 shows the View Zone Set window.

3.6.4.4 Modify Zone Set

Use the Modify Zone Set command to modify existing zone sets. As shown in the following figure, the Modify Zone Set window allows you to give or revoke the permission to communicate among the zone groups. You also can rename an existing zone set.

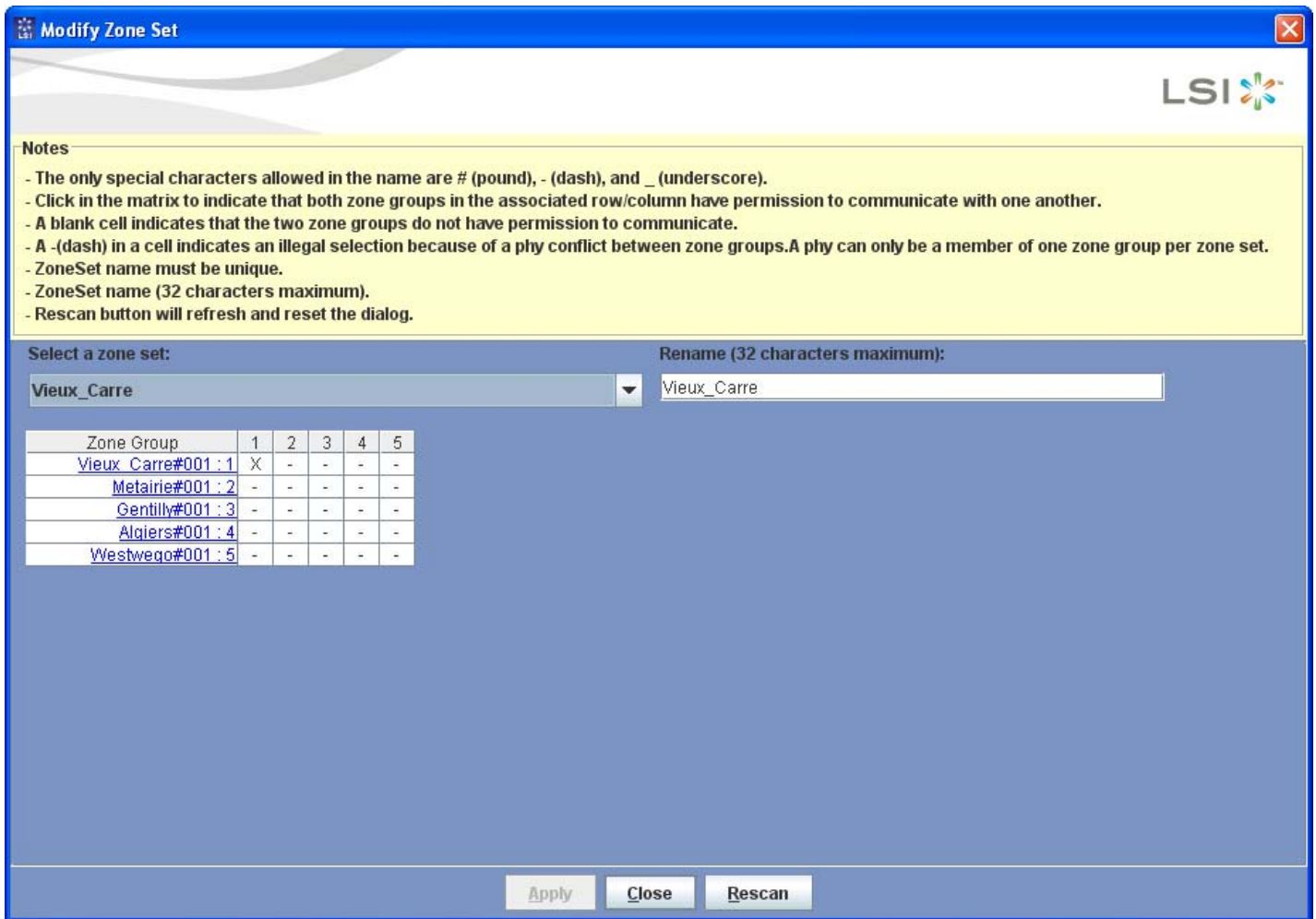


Figure 11: Modify Zone Set

3.6.4.5 Activate/Deactivate Zone Set

Use the Activate/Deactivate Zone Set command to activate or deactivate a zone set. Only one zone set can be active at a time, and a zone set must be active for its definitions to be applied to the domain. Changes to the active zone set or zone group permissions do not take effect until the next zone set activation. When all zone sets are inactive, zoning is disabled and domain access is unrestricted.

As shown in the following figure, the Activate/Deactivate window lists the currently active zone set. To deactivate all zone sets, click the button on the left of the window, and click **Apply**.

NOTE: The default password for the zone manager is **lynx**.

To activate a zone set, select it from the pull-down list, type the zone manager password, and click **Apply**.

When activated, copies of the zone set and component zone groups are made. An asterisk at the end of a zone group name indicates that the zone group is currently active.

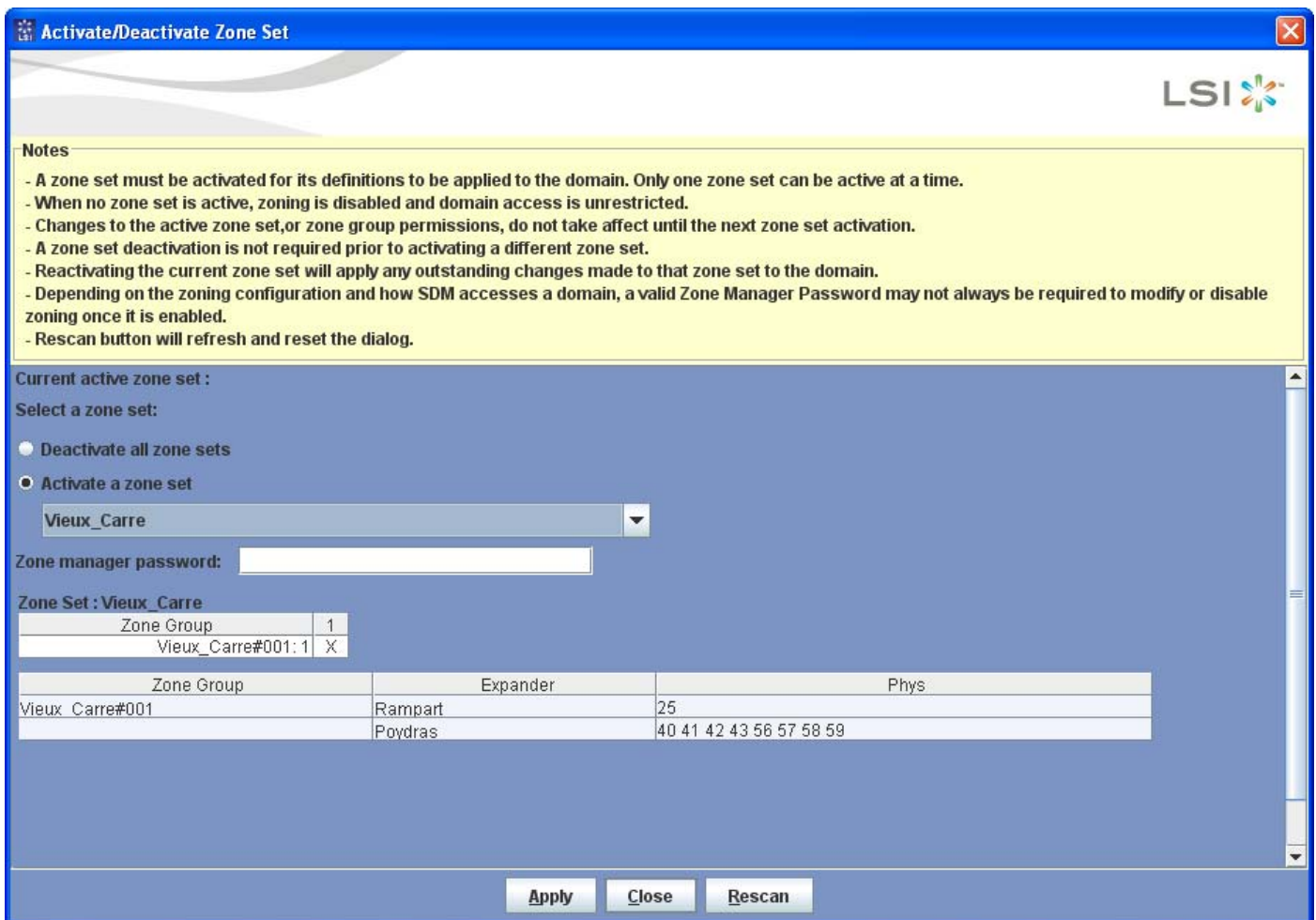


Figure 12: Activate/Deactivate Zone Set

3.6.4.6 Delete Zone Set

Use the Delete Zone Set command to delete an existing zone set. As shown in the following figure, you delete a zone set by selecting the zone set from the list on the left of the window and then clicking **Delete**.

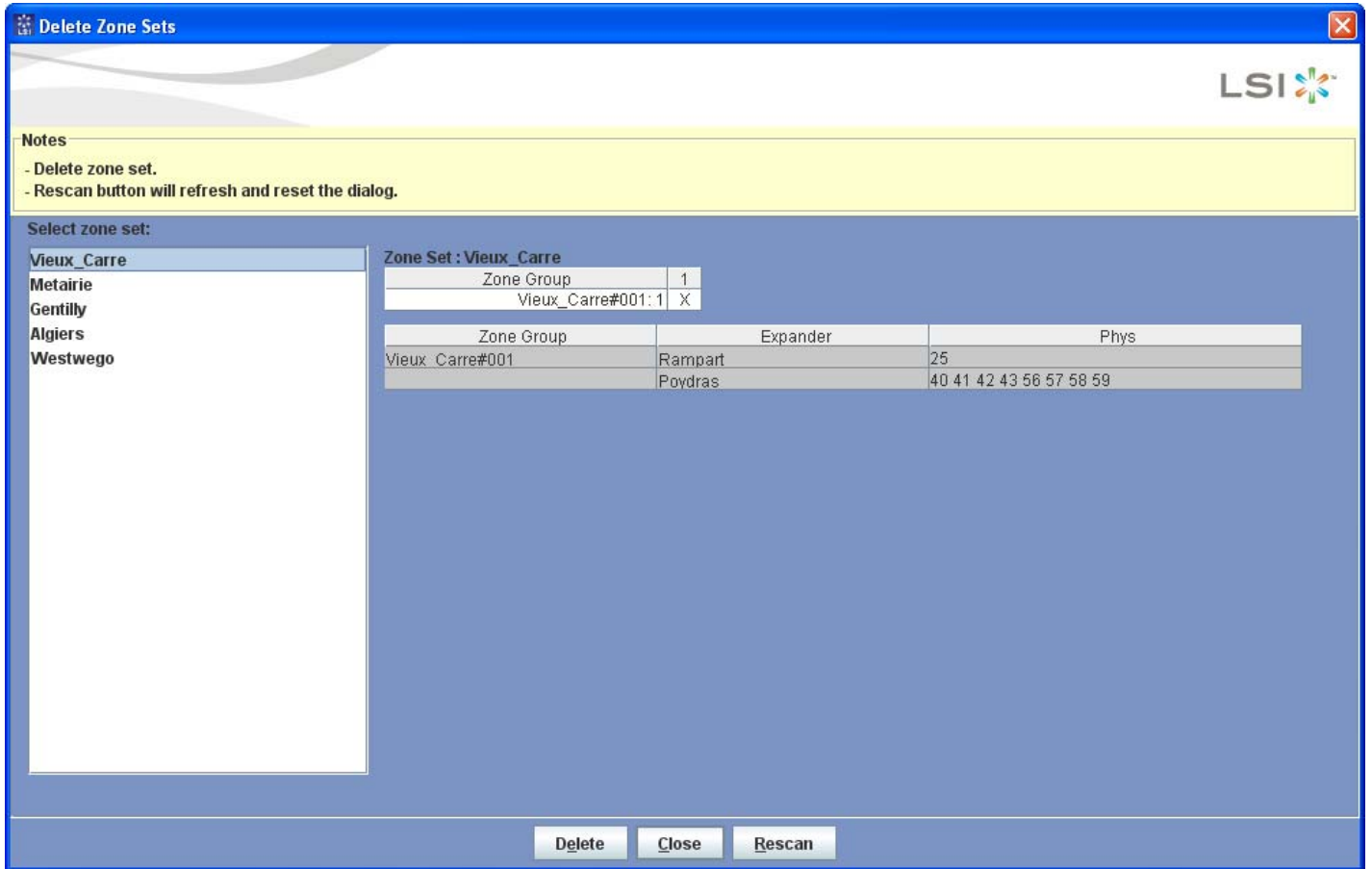


Figure 13: Delete Zone Set

3.7 Devices Tab

The Devices tab displays the topology of the current domain in the form of a tree. When you select items on the tree, you access a secondary set of tabs, including Properties, Environmental, Attached Devices, and Phys. The tabs displayed on this row depend on both the account type and the device selected in the tree. You can access an Operations tab if you select an edge expander on the tree while using an *admin* account.

The following figure shows a device tree on the Devices tab. The Properties tab appears on the right side of the window.

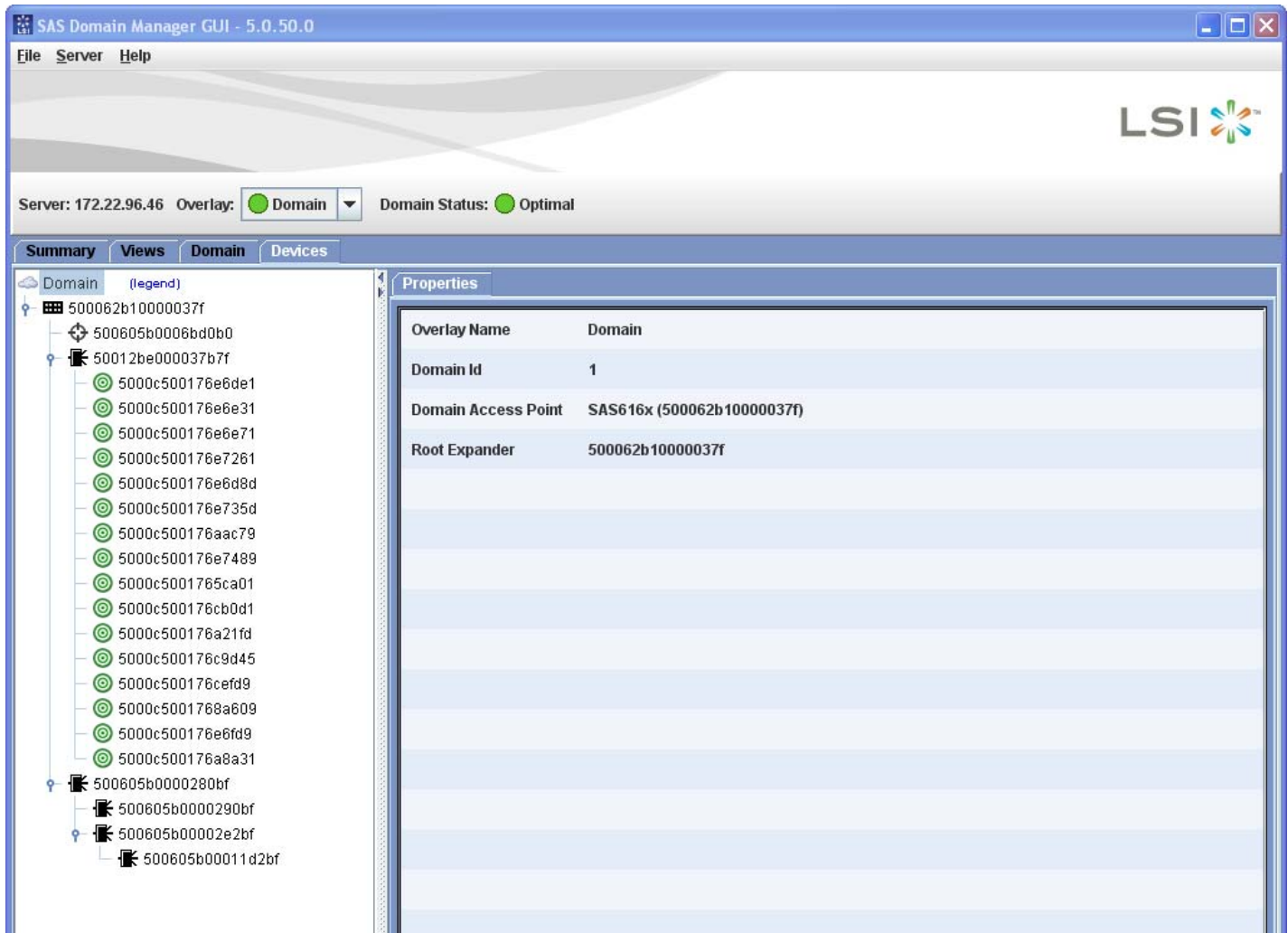


Figure 14: Device Tree and Properties Tab

NOTE: In the SDM-CLI, the Device Type might be ZExpander, which means *zoning capable expander*.

NOTE: If there is an active zone set, and if you click on an end device, all of the other end devices with which it has permission to communicate appear in blue.

3.7.1 Properties Tab

As Figure 14 shows, the Properties tab displays information about the currently selected device in the tree in the left panel. Properties information includes SAS Address, Vendor ID, and Device Type. The rest of the displayed information varies, depending on the type of the selected device. In Figure 14, the domain properties are shown.

The following figure shows the Properties tab.

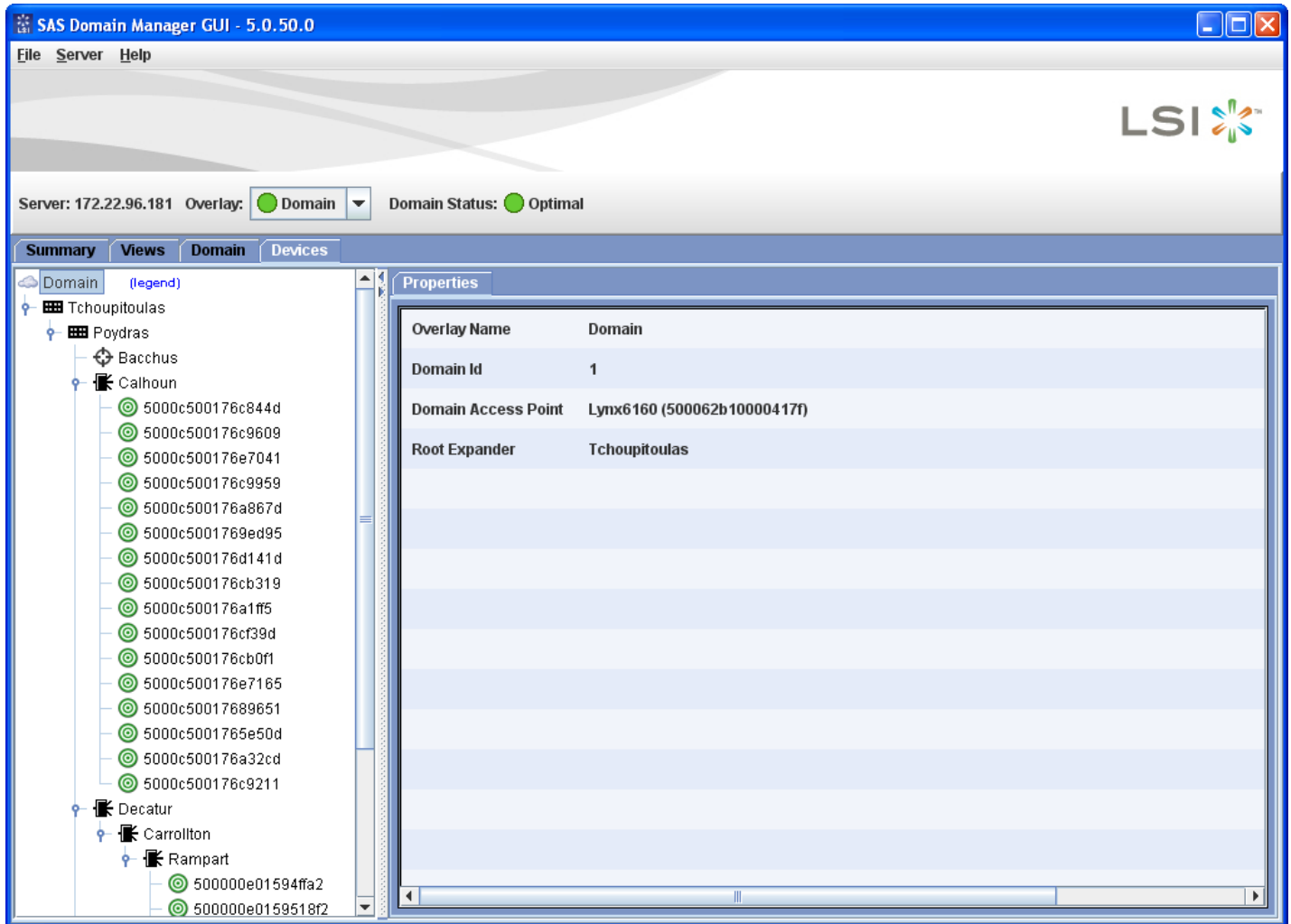


Figure 15: Properties Tab

3.7.2 Environmentals Tab

The Environmentals tab appears for devices that contain SCSI Enclosure Services (SES) targets. The following figure shows an example of the type of data that appears on this tab. Environmental data, for each device that supports an SES target, is polled in a background loop.

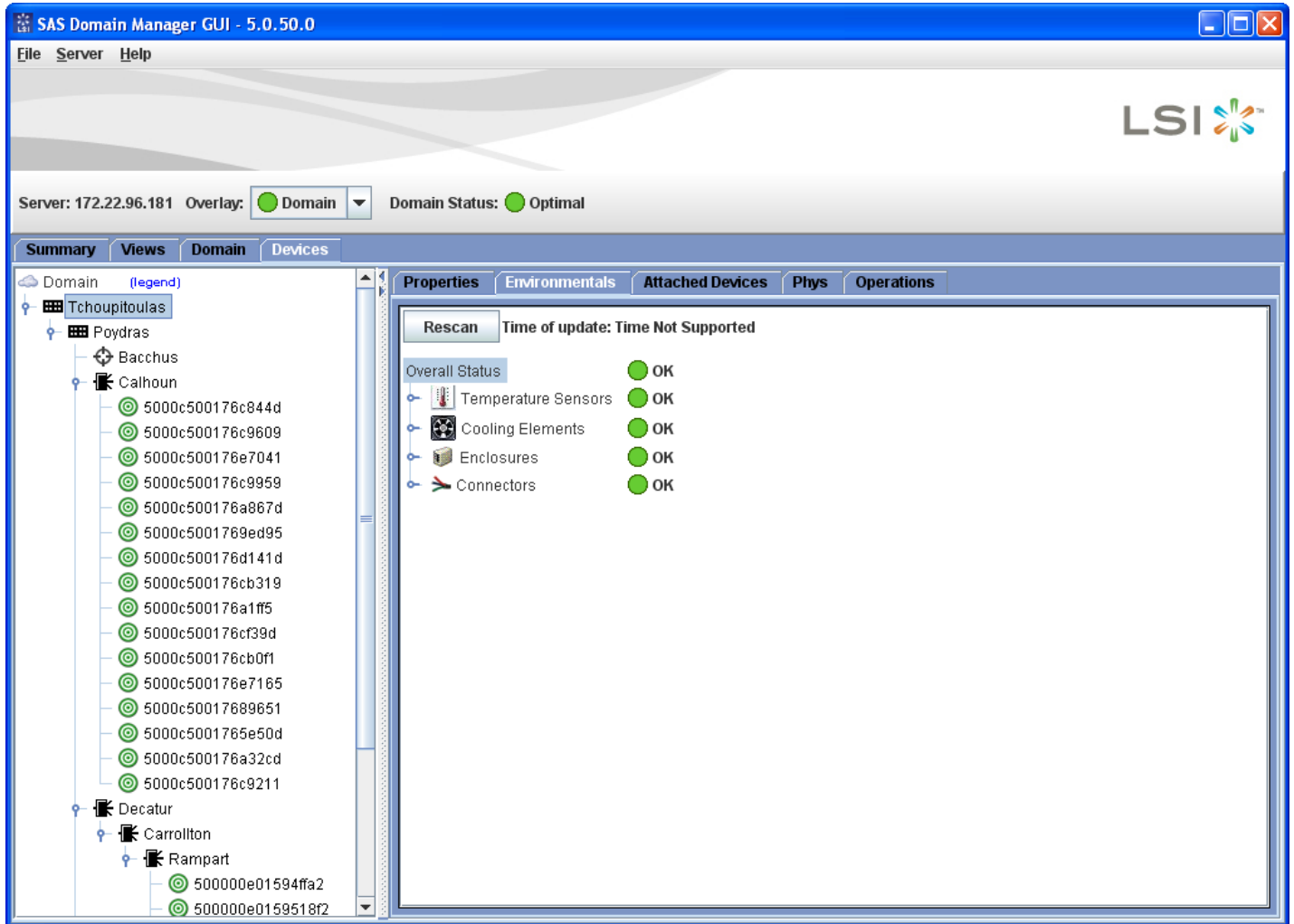


Figure 16: Environmentals Tab

3.7.4 Phys Tab

The Phys tab appears for expanders. It lists information about the phys on the selected expander.

The following figure shows the Phys tab.

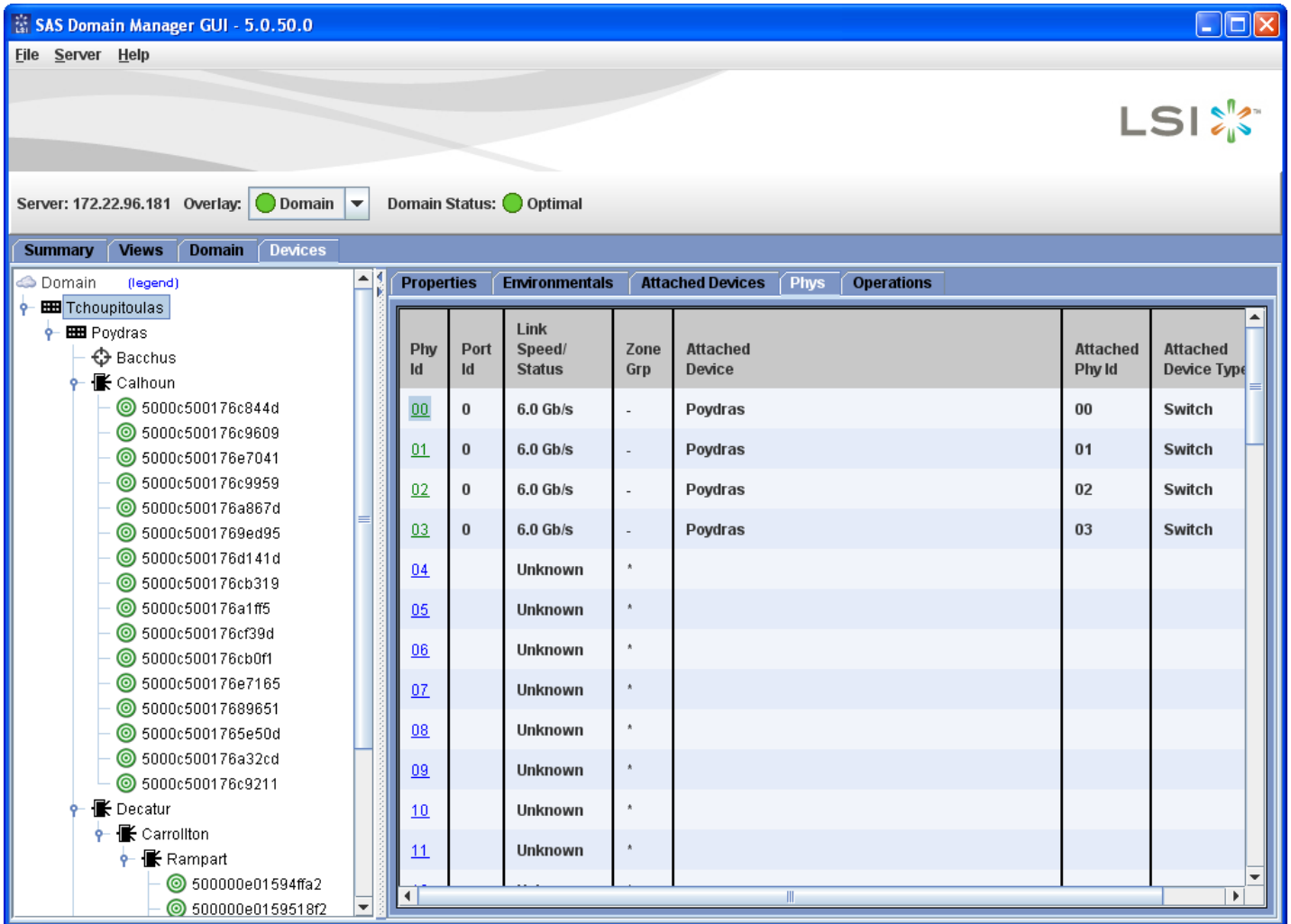


Figure 18: Phys Tab

To view detailed information about any phy, click on an entry in the Phy ID column. A pop-up window appears with detailed status information.

3.7.5 Zone Group Tab

The Zone Group tab becomes active if there is an active zone set, and if you click on an end device. In the following figure, the Zone Group tab is active because the selected initiator is a member of an active zone set. In the device tree, the devices that may communicate appear in blue. There are two sections in the Zone Group tab:

- The Zone Group Membership section shows the zone group to which the selected device belongs.
- The Zone Group Permission section shows that zone_group_1 may communicate with zone_group_2.

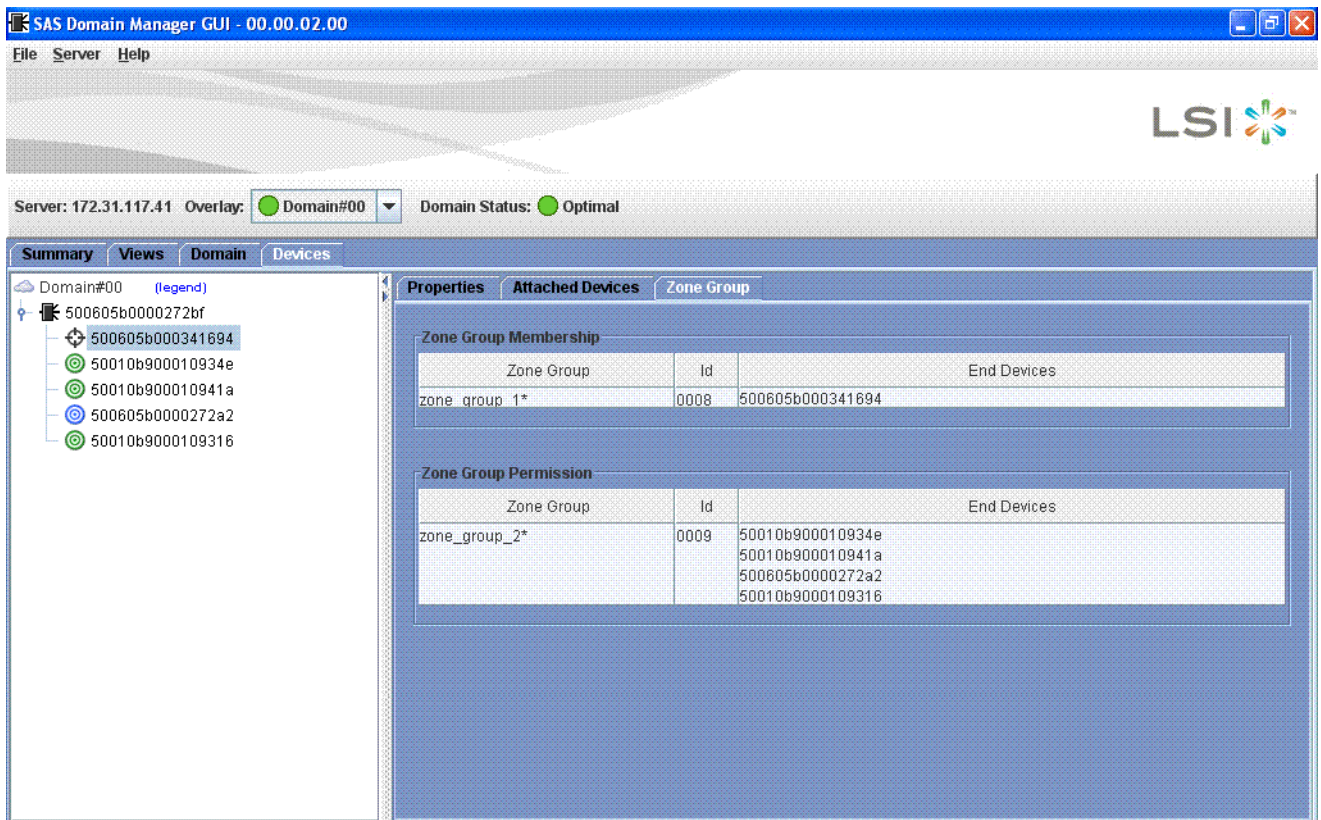


Figure 19: Zone Group Tab

3.7.6 Operations Tab

The Operations tab appears only when you select an expander from an *admin* account. This tab contains the following commands.

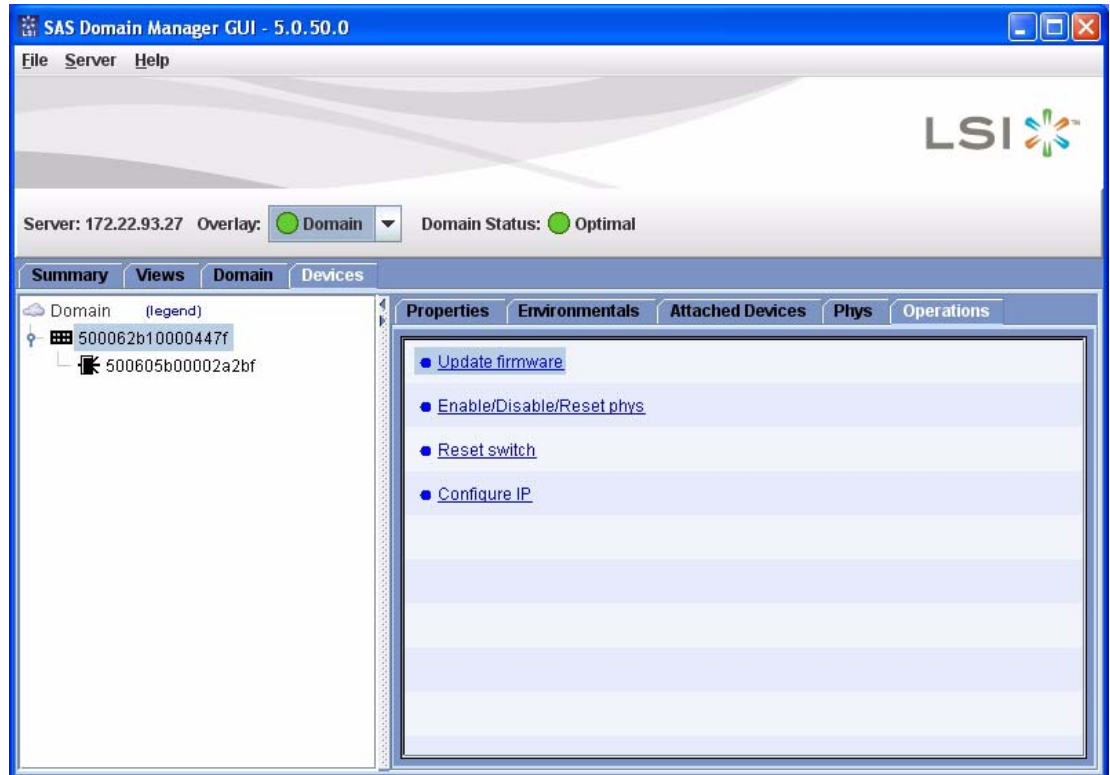


Figure 20: Operations Tab

3.7.6.1 Update Firmware

Use the Update Firmware command to update the firmware on LSI SAS expanders, LSI SAS2 expanders, and LSI SAS2 switches. SDM verifies that the product identification of the image matches the targeted device. SDM automatically resets the expander after a successful update.

The following figure shows the first step of the update process: selecting an expander firmware image. The next step is to verify and activate the file.

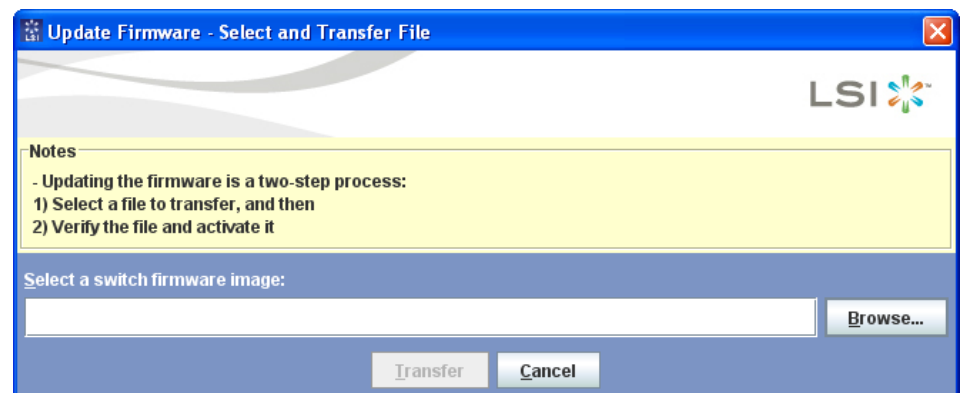


Figure 21: Update Firmware

3.7.6.2 Enable/Disable/Reset Phys

Use the Enable/Disable/Reset Phys command to enable, disable, or reset specified expander phys. To disable one or more phys, remove the check mark in the Enabled column and click **Apply**. To reset one or more phys, select the check box in the Reset column and click **Apply**. The phys are automatically enabled after a switch reset. The following figure shows the Enable/Disable/Reset window.

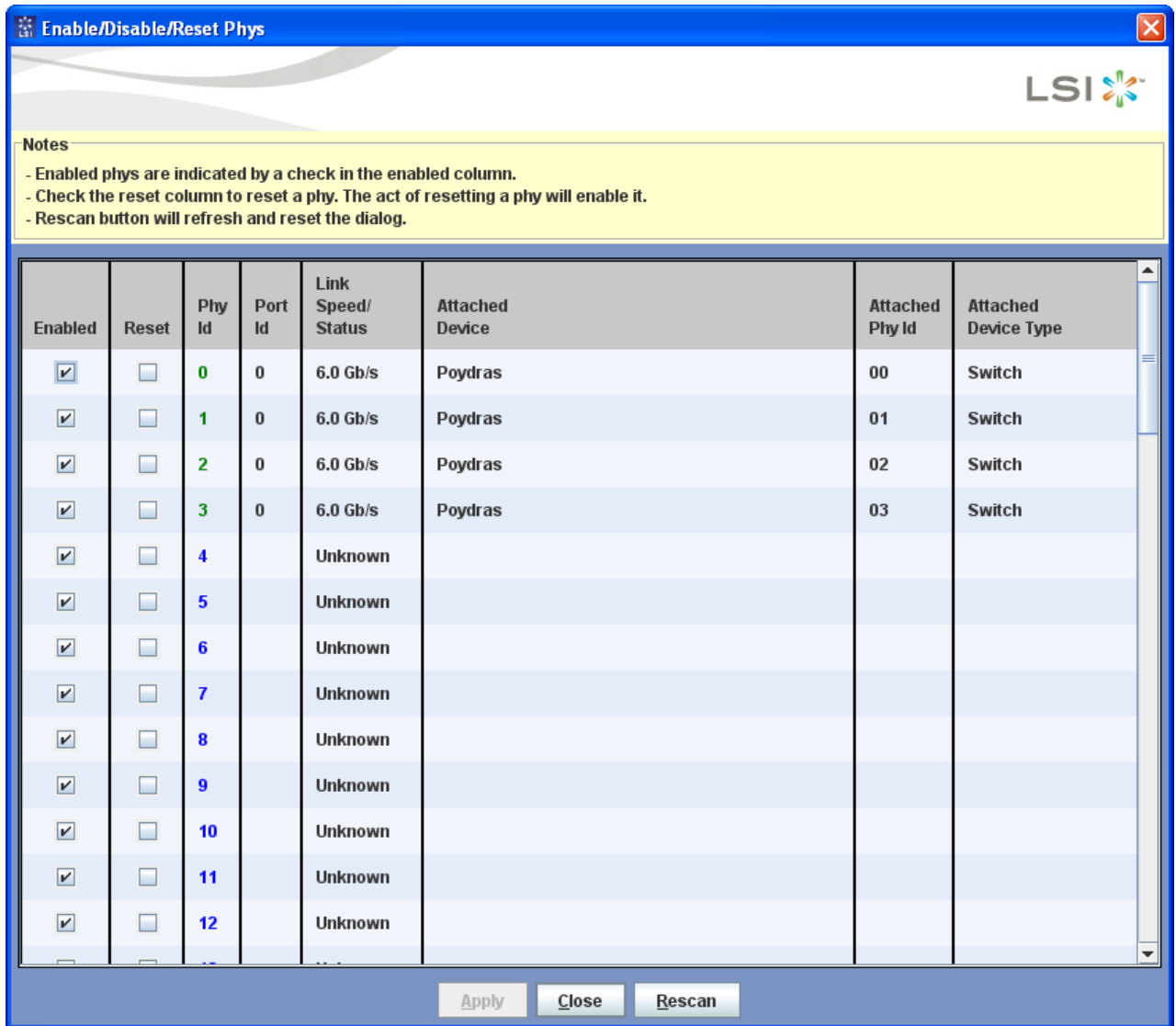


Figure 22: Enable/Disable/Reset Phys

3.7.6.3 Reset Switch

Use the Reset Switch command to reset the LSI SAS2 switch that is currently selected in the device tree. You must confirm the reset before it is executed.

3.7.6.4 Configure IP

Use the Configure IP command to change the IP address for the LSI SAS2 switch that is currently selected in the device tree. You can set either a static or a dynamic IP address as shown in the following figures.



The screenshot shows the 'Configure IP' dialog box with the LSI logo in the top right. A yellow 'Notes' section contains the following text:

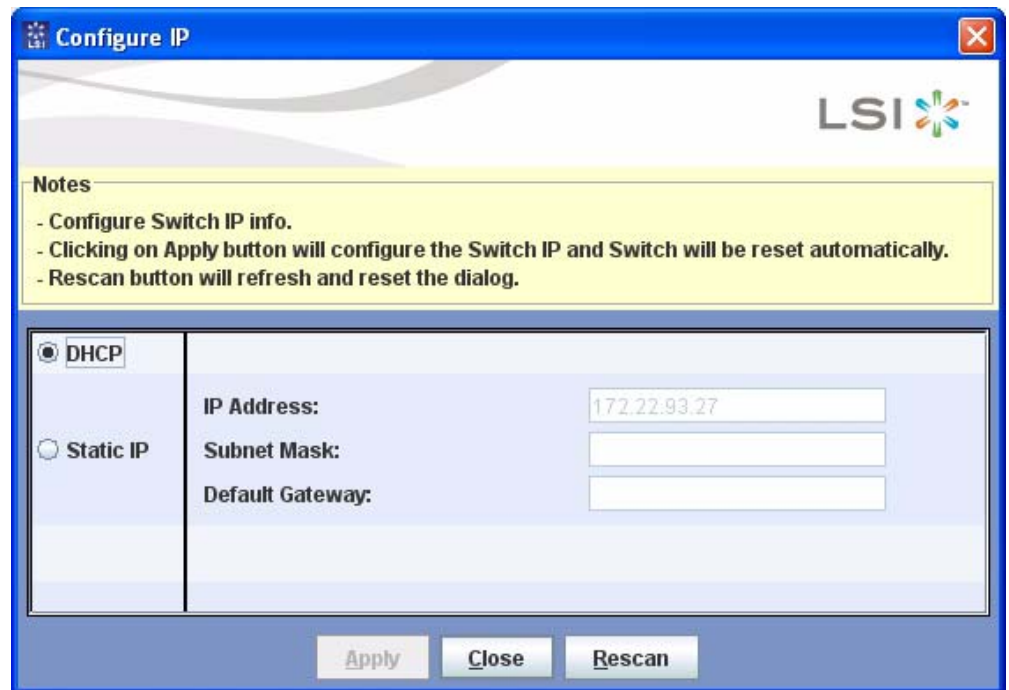
- Configure Switch IP info.
- Clicking on Apply button will configure the Switch IP and Switch will be reset automatically.
- Rescan button will refresh and reset the dialog.

Below the notes, there are two radio buttons: 'DHCP' (unselected) and 'Static IP' (selected). To the right of these buttons are three input fields:

- IP Address: 192.168.93.72
- Subnet Mask: 255.255.255.0
- Default Gateway: 192.168.93.1

At the bottom of the dialog are three buttons: 'Apply', 'Close', and 'Rescan'.

Figure 23: Set a Static IP Address



The screenshot shows the 'Configure IP' dialog box with the LSI logo in the top right. A yellow 'Notes' section contains the following text:

- Configure Switch IP info.
- Clicking on Apply button will configure the Switch IP and Switch will be reset automatically.
- Rescan button will refresh and reset the dialog.

Below the notes, there are two radio buttons: 'DHCP' (selected) and 'Static IP' (unselected). To the right of these buttons are three input fields:

- IP Address: 172.22.93.27
- Subnet Mask: (empty)
- Default Gateway: (empty)

At the bottom of the dialog are three buttons: 'Apply', 'Close', and 'Rescan'.

Figure 24: Set a Dynamic IP Address

Chapter 4

SAS Domain Manager Command Line Interface

This chapter explains how to use the commands supported by the SAS Domain Manager Command Line Interface (SDM-CLI) with the LSISAS6160 SAS switch. SDM-CLI can be accessed using a telnet client.

SDM-CLI has powerful, flexible commands that allow you to manage the host switch, and other switches or expanders within the domain in which the host switch resides.

4.1 Command Usage and Syntax

To start the embedded SDM-CLI, open a telnet session to the switch's IP address or host name. You will be prompted to login.

The syntax for CLI commands is as follows:

```
command [arguments]
```

In this syntax, [arguments] may consist of any combination of the following:

- [optional]: Optional argument
- (a|b): Choose between a or b
- <string>: User-supplied value or string

SDM does not allow spaces in file names and paths, even if the operating system allows them. All user-supplied names (domains, aliases, zone groups, zone sets, etc.) are case sensitive.

Use the up and down arrow keys to access a small command history buffer. Use the left and right arrow keys to edit commands.

SDM-CLI provides two accounts that control access and privileges: *user* and *admin*.

- The *user* account permits you to view the domain topology, configuration, and operating environment. The default password is **user**.
- The *admin* account permits you to view domain information. It also grants permission to use commands that may change the configuration of the domain or of managed devices within the domain. The default password is **admin**.
- The LSISAS6160 zone manager is handled separately. Its default password is **lynx**.

4.2 SDM-CLI Commands

There are two types of SDM-CLI commands:

- *Extra-Domain* commands manage SDM-D itself and to control the domain focus of the Intra-Domain commands.
- *Intra-Domain* commands manage a single domain at a time.

Each command description indicates whether the command is *Extra-Domain* or *Intra-Domain*.

NOTE: You can use shortcuts when you type commands. In the following command descriptions, the bolded letters indicate the minimum characters that are necessary to recognize the command.

4.2.1 Domain Command

(*Extra-Domain*) Use the `domain` command to perform the listed tasks.

Authority: *User* for domain. *Admin* for all other variations.

Syntax:

```
domain focus <domain name>
```

Usage:

- `domain focus <domain name>`
Changes the domain on which SDM-CLI is focused. Embedded SDM only supports a single domain.

4.2.2 Help Command

(*Extra-Domain*) Use the `help` command to display the SDM-CLI command line help.

Authority: *User*

Syntax:

```
help [h<command>]
```

Usage:

- `help [h<command>]`
Displays detailed help for a specific command if you provide the [**h**<command>] name. Otherwise, it displays a list of all available commands.

4.2.3 Passwd Command

(*Extra-Domain*) Use the `passwd` command to change the password for an account after prompting for the admin password. Passwords must have between four and 16 characters.

Authority: Admin

Syntax:

```
passwd (admin | user)
```

Usage:

- `passwd admin`
Starts a dialog to change the password for the *admin* account.
- `passwd user`
Starts the following dialog to change the password for the *user* account:

```
SDMCLI> passwd user
passwd user
Please enter the current 'admin' password: *****
Please enter the new password for user: *****
Please re-enter the new password for user: *****
Password changed.
```

4.2.4 Quit Command

(*Extra-Domain*) Use the `quit` command (or the `exit` or `logout` command) to log out and exit SDM-CLI.

Authority: User

Syntax:

```
exit
logout
quit
```

4.2.5 Alias Command

(*Intra-Domain*) Use the `alias` command to create or delete aliases. An *alias* is a user-defined name that is bound to a SAS address. After you create an alias, you can use it anywhere that you would normally use a SAS address.

NOTE: You can assign only a single alias to a SAS address.

SDM does not use aliases directly. For example, if you use an alias to define a zone group, SDM does not track the alias in the zone group's structures. Instead, it tracks the SAS address bound to the alias. Therefore, the zone group is not affected if you make subsequent changes to the alias.

Authority: Admin

Syntax:

```
alias create <name> <sas address>
alias delete (single <name> | all [noconfirm])
```

Usage:

- **alias create** <name> <sas address>
Creates an alias that is bound to a specific device within the domain. The alias name can have a maximum of 24 characters. Valid characters are 0 through 9, A through Z, a through z, # (pound), - (dash), and _ (underscore). An alias name must not closely resemble a valid SAS address (16 hexadecimal characters that start with a 5).
- **alias delete single** <name>
Deletes a single specified alias.
- **alias delete all** [**noconfirm**]
Deletes all aliases. If you specify the [**noconfirm**] option, the deletion occurs immediately without an additional confirmation prompt. Otherwise, SDM first prompts you to confirm the action.

4.2.6 Device Command

(*Intra-Domain*) Use the `device` command to manage individual devices (LSI expanders) within the domain.

Authority: Admin

Syntax:

```
device (<sas address>|<alias>) reset [noconfirm]
device (<sas address>|<alias>):<phy> reset [counters]
device (<sas address>|<alias>):<phy> (disable|enable)
device (<sas address>|<alias>) update <file> <ip address>
device (<sas address>|<alias>) ip (dhcp|static <ip
address> <mask> <gateway>)
Configure IP address for the switch.
```

Usage:

- **device** (<sas address>|<alias>) **reset** [**noconfirm**]
Resets a device after user confirmation. If you specify the [**noconfirm**] option, the reset occurs immediately without an additional confirmation prompt. Otherwise, SDM first prompts you to confirm the action.
- **device** (<sas address>|<alias>):<phy> **reset**
Resets a phy.
- **device** (<sas address>|<alias>):<phy> **reset counters**
Clears a phy's counters.
- **device** (<sas address>|<alias>):<phy> **disable**
Disables a phy until the next device reset.
- **device** (<sas address>|<alias>):<phy> **enable**
Enables a previously disabled phy.
- **device** (<sas address>|<alias>) **update** <file> <ip address>
Installs a new firmware image on the specified device and automatically resets the device after a successful update. SDM checks to ensure that the product identification of the image matches the targeted device. The targeted device is responsible for any other image validation.

4.2.7 Show Command

(*Intra-Domain*) Use the `show` command to display domain, device, and phy information. (See [Section 4.3, Sample Output for Show Command](#), to view samples of the kind of information that is returned.)

Authority: User

Syntax:

```
show alias [<alias>]
show device [<sas address>|<alias>]
show domain
show phy [(<sas address>|<alias>):<phy>]
show version
show zonegroup [<name>]
show zoneset [active|data <name>]
```

Usage:

- **show alias**
Displays a list of all aliases.
- **show alias <alias>**
Displays detailed information for a single alias.
- **show device**
Displays a table of all devices (expanders and end devices) in the domain.
- **show device <sas address>|<alias>**
Displays detailed information about a particular device (expander or end device). SES environmental data is a subset of the information displayed for expanders.
- **show domain**
Displays all domain overlays and their bindings to physical domains, flagging the domain currently under focus.
- **show phy**
Displays, in a tabular format, all expander phys residing in the domain.
- **show phy (<sas address>|<alias>)**
Displays, in a tabular format, all phys residing on a specific expander.
- **show phy (<sas address>|<alias>):<phy>**
Displays detailed information about a particular phy.
- **show version**
Displays version information for both SDM-CLI and SDM-D.
- **show zonegroup**
Displays a list of all zone groups.
- **show zonegroup <name>**
Displays detailed information about a single zone group.
- **show zoneset**
Displays a list of all zone sets.
- **show zoneset active**
Displays the name and detailed information for the active zone set.
- **show zoneset data <name>**
Displays detailed information about a single zone set.

4.2.8 Zonegroup Command

(*Intra-Domain*) Use the `zonegroup` command to manage zone groups and zone group membership. Zonegroup commands have no effect on the active zone set until you reactivate it.

Authority: Admin

Syntax:

```
zonegroup add <name> (<sas_address>|<alias>):<phy>
zonegroup create <name>
zonegroup delete ((single <name>)|(all [noconfirm]))
zonegroup remove <name> (<sas_address>|<alias>):<phy>
zonegroup rename <old> <new>
```

Usage:

- `zonegroup add <name> (<sas address>|<alias>):<phy>`
Adds a phy to an existing zone group.

NOTE: Phys internal to the ZPSDS must be in Zone Group 1. Therefore, exclude them from this command.

- `zonegroup create <name>`
Creates a new zone group. The zone group name can have a maximum of 32 characters. Valid characters are 0 through 9, A through Z, a through z, # (pound), - (dash), and _ (underscore).
- `zonegroup delete single <name>`
Deletes a single zone group.

NOTE: You cannot delete a zone group if it is currently a member of a zone set. This restriction also applies to the `zonegroup delete all` command.

- `zonegroup delete all [noconfirm]`
Deletes all zone groups. If you specify the `[noconfirm]` option, the action occurs immediately without an additional confirmation prompt. Otherwise, SDM first prompts you to confirm the action.
- `zonegroup remove <name> (<sas address>|<alias>):<phy>`
Removes a phy from an existing zone group.
- `zonegroup rename <old> <new>`
Renames an existing zone group.

4.2.9 Zoneset Command

(*Intra-Domain*) Use the `zoneset` command to manage zone sets and zone set membership.

NOTE: Only the `zoneset activate` and `zoneset deactivate` commands affect the state of the active zone set. Other zone group commands and zone set commands have no effect until you subsequently activate the zone set.

Authority: Admin

Syntax:

```
zoneset activate <name>
zoneset add <name> <zone group> <zone group>
zoneset create <name>
zoneset deactivate
zoneset delete (single <name> | all [noconfirm])
zoneset passwd
zoneset remove <name> <zone group> <zone group>
zoneset rename <old> <new>
```

Usage:

- `zoneset activate <name>`
Activates a zone set after prompting you for the zone manager password. Only a single zone set can be active at a time, so this command also deactivates the current active zone set before it activates a new one. Changes to the active zone set, or changes to zone group permissions, do not take effect until the next zone set activates.

NOTE: Depending on the zoning configuration and how SDM accesses a domain, you might not always be required to enter a valid Zone Manager Password to modify or disable zoning after it is enabled. You can apply changes made to the active zone set by reactivating it. SDM-D validates the zone set within the current topology when activation occurs.

- `zoneset add <name> <zone group> <zone group>`
Adds two zone groups to an existing zone set, which gives them permission to communicate with one another. The maximum number of zone groups is 248 for a zone set.

NOTE: A phy can only be a member of one zone group per zone set.

- `zoneset create <name>`
Creates a new zone set. The zone set name can have a maximum of 32 characters. Valid characters are 0 through 9, A through Z, a through z, # (pound), - (dash), and _ (underscore).
- `zoneset deactivate`
Deactivates the active zone set after it prompts you for the zone manager password.

NOTE: Zoning within the domain is disabled when no zone set is active, and access is unrestricted. Therefore, all end devices in the domain can see one another.

- **zoneset delete single <name>**
Deletes a single zone set.
- **zoneset delete all [noconfirm]**
Deletes all zone sets. If you specify the [**noconfirm**] option, the action occurs immediately without an additional confirmation prompt. Otherwise, SDM first prompts you to confirm the action.
- **zoneset passwd**
Starts a dialog to change and synchronize the password on all zoning expanders throughout the domain. Passwords are text strings that contains any valid ASCII character. The maximum password length is 32 characters.

NOTE: The default zone manager password is **lynx**.

- **zoneset remove <name> <zone group> <zone group>**
Removes communication privileges between two zone groups in an existing zone set. A zone group is purged from the zone set if no other communication privileges remain.
- **zoneset rename <old> <new>**
Renames an existing zone set.

4.3 Sample Output for Show Command

This section shows sample output for some variations of the `show` command. The first line of each example shows the actual syntax of the command that you enter at the **SDMCLI** prompt.

The examples in this section detail the `show` command output.

4.3.1 show alias

SDMCLI> show alias

SAS Address	Alias
500605b0006b75b0	Bacchus
50012be0000380ff	Calhoun
500605b0000220bf	Carrollton

4.3.2 show alias <alias>

SDMCLI> show alias Calhoun

SAS Address	Alias
50012be0000380ff	Calhoun

4.3.3 show device

SDMCLI> show device

NOTE: In the following example, ZExpander means *zoning capable expander*.

Device			Parent		
Type	Num Phys	Alias / SAS Address	Phys	Alias / SAS Address	Phys
Switch	64+2	Tchoupitoulas			
End	01	500062b10000417d	00	Tchoupitoulas	64
Switch	64+2	Poydras	00-01-02-03	Tchoupitoulas	00-01-02-03
End	04	Bacchus	00-01-02-03	Poydras	40-41-42-43
End	01	500062b10000127d	00	Poydras	64
ZExpander	36+2	Calhoun	32-33-34-35	Poydras	16-17-18-19
End	01	5000c500176c844d	00	Calhoun	00
End	01	5000c500176c9609	00	Calhoun	01
End	01	5000c500176e7041	00	Calhoun	02
End	01	5000c500176c9959	00	Calhoun	03
End	01	5000c500176a867d	00	Calhoun	04
End	01	5000c5001769ed95	00	Calhoun	05
End	01	5000c500176d141d	00	Calhoun	06
End	01	5000c500176cb319	00	Calhoun	07
End	01	5000c500176a1ff5	00	Calhoun	12
End	01	5000c500176cf39d	00	Calhoun	13
End	01	5000c500176cb0f1	00	Calhoun	14
End	01	5000c500176e7165	00	Calhoun	15
End	01	5000c50017689651	00	Calhoun	28
End	01	5000c5001765e50d	00	Calhoun	29
End	01	5000c500176a32cd	00	Calhoun	30
End	01	5000c500176c9211	00	Calhoun	31
End	01	50012be0000380fd	00	Calhoun	36

4.3.4 show device <alias>

SDMCLI> show device Calhoun

```

=====
                        Domain Device Information
=====
Company Name: Astek Corporation
SAS Address: 50012be0000380ff
IEEE ID: 0012be
Device Type: Edge Expander
Number of Physical Phys: 36
Number of Virtual Phys: 2
Zoning Expander: Yes
Zoning Enabled: Yes
Vendor Id: AstekCor
Product Id: Snowcat-Brann
Product Revision Level: 0100
Firmware Version: 3.1.0.0
Component Vendor Id: LSI
Component Id: 547
Component Revision Id: 4
Table-to-Table Supported: Yes
    
```

```

Device Phys: 32-33-34-35
Parent SAS Address: 500062b10000127f
Parent Phys: 16-17-18-19
Vendor Specific (hex): 00 00 00 00 00 00 00 00
Vendor Specific (ASCII):

```

- Environmentals Information -

```

Last Update: Time Not Supported
Chip Temperature: OK, 68 Celsius
Board Temperature: OK, 44 Celsius
Astek-Brann: OK
Expander: OK
J1:Interconnect 32-35: OK, SAS Mini 4i Plug
J2:Uplink 24-27: OK, SAS Mini 4i Plug
J3:Drives 20-23: OK, SAS Mini 4i Plug
J4:Drives 16-19: OK, SAS Mini 4i Plug
J5:Drives 12-15: OK, SAS Mini 4i Plug
J6:Interconnect 28-31: OK, SAS Mini 4i Plug
J7:Drives 00-03: OK, SAS Mini 4i Plug
J8:Drives 04-07: OK, SAS Mini 4i Plug
J9:Drives 08-11: OK, SAS Mini 4i Plug

```

4.3.5 show domain

SDMCLI> show domain

Overlay Name	Id	Domain Access Point
(Domain)	1	SAS6160 (500062b10000417f)

Note: (Name) denotes focused domain

[Name] denotes domain overlays currently not bound to a physical domain

4.3.6 show phy

SDMCLI> show phy

NOTE: In the following example, T = Table, S = Subtractive, and D = Direct.

Notes:

- RA - Routing Attributes
- VP - Virtual PHY
- LS/S - Link Speed/Status: 1.5|3.0|6.0 Gb/s
 - phy enabled but link uninitialized
 - * phy disabled
- ZG - Zone Grp
 - Zoning Active: Zone Group Number
 - Zoning Inactive: * phy may be assigned to a zone group
 - phy may not be assigned to a zone group
- Capabilities
 - lxxxxxxx - Attached SMP Initiator

```

xlxxxxxxx - Attached STP Initiator
xxlxxxxxx - Attached SSP Initiator
xxxlxxxxx - Attached SATA Host
xxxxlxxxx - Attached SMP Target
xxxxxlxxx - Attached STP Target
xxxxxxlxx - Attached SSP Target
xxxxxxxlx - Attached SATA Target
xxxxxxx1l - Attached SATA Port Selector
    
```

Phy						Attached			
Alias / SAS Address	Phy	RA	VP	LS/S	ZG	Alias / SAS Address	Phy	Device Type	Capabilities IIIITTTTS
Tchoupitoulas	00	T	-	6.0	-	Poydras	000	Switch	000010000
Tchoupitoulas	01	T	-	6.0	-	Poydras	001	Switch	000010000
Tchoupitoulas	02	T	-	6.0	-	Poydras	002	Switch	000010000
Tchoupitoulas	03	T	-	6.0	-	Poydras	003	Switch	000010000
Tchoupitoulas	04	T	-	-	*	-----	---	None	000000000
Tchoupitoulas	05	T	-	-	*	-----	---	None	000000000
Tchoupitoulas	06	T	-	-	*	-----	---	None	000000000
Tchoupitoulas	07	T	-	-	*	-----	---	None	000000000
Tchoupitoulas	08	T	-	-	*	-----	---	None	000000000
Tchoupitoulas	09	T	-	-	*	-----	---	None	000000000
Tchoupitoulas	10	T	-	-	*	-----	---	None	000000000
Tchoupitoulas	11	T	-	-	*	-----	---	None	000000000
Tchoupitoulas	12	T	-	-	*	-----	---	None	000000000
Tchoupitoulas	13	T	-	-	*	-----	---	None	000000000
Tchoupitoulas	14	T	-	-	*	-----	---	None	000000000
Tchoupitoulas	15	T	-	-	*	-----	---	None	000000000
Tchoupitoulas	16	T	-	-	*	-----	---	None	000000000

Not all output shown in this example.

Rampart	32	T	-	-	*	-----	---	None	000000000
Rampart	33	T	-	-	*	-----	---	None	000000000
Rampart	34	T	-	-	*	-----	---	None	000000000
Rampart	35	T	-	-	*	-----	---	None	000000000
Rampart	36	D	*	6.0	-	500605b0000210bd	000	End	101000100
Rampart	37	D	*	-	-	-----	---	None	000001000

4.3.7 show phy <alias>

SDMCLI> show phy Calhoun

NOTE: In the following example, T = Table, S = Subtractive, and D = Direct.

Notes:

- RA - Routing Attributes
- VP - Virtual PHY
- Zone Grp

Zoning Active: Zone Group Number
 Zoning Inactive: * phy may be assigned to a zone group
 - phy may not be assigned to a zone group

- Capabilities

- lxxxxxxx - Attached SMP Initiator
- xlxxxxxxx - Attached STP Initiator
- xxlxxxxxxx - Attached SSP Initiator
- xxxlxxxxx - Attached SATA Host
- xxxxlxxxx - Attached SMP Target
- xxxxxlxxx - Attached STP Target
- xxxxxxlxx - Attached SSP Target
- xxxxxxxlx - Attached SATA Target
- xxxxxxx1 - Attached SATA Port Selector

Phy Table for 50012be0000380ff (Calhoun):

Phy						Attached			
Phy	RA	VP	State	Link Speed	Zone Grp	Alias / SAS Address	Phy	Device Type	Capabilities IIIITTTTS
000	D	-	Enabled	6.0	*	5000c500176c844d	000	End	00000010
001	D	-	Enabled	6.0	*	5000c500176c9609	000	End	00000010
002	D	-	Enabled	6.0	*	5000c500176e7041	000	End	00000010
003	D	-	Enabled	6.0	*	5000c500176c9959	000	End	00000010
004	T	-	Enabled	6.0	*	5000c500176a867d	000	End	00000010
005	T	-	Enabled	6.0	*	5000c5001769ed95	000	End	00000010
006	T	-	Enabled	6.0	*	5000c500176d141d	000	End	00000010
007	T	-	Enabled	6.0	*	5000c500176cb319	000	End	00000010
008	T	-	Enabled	-	*	-----	---	None	00000000
009	T	-	Enabled	-	*	-----	---	None	00000000
010	T	-	Enabled	-	*	-----	---	None	00000000
011	T	-	Enabled	-	*	-----	---	None	00000000
012	T	-	Enabled	6.0	*	5000c500176a1ff5	000	End	00000010
013	T	-	Enabled	6.0	*	5000c500176cf39d	000	End	00000010
014	T	-	Enabled	6.0	*	5000c500176cb0f1	000	End	00000010
015	T	-	Enabled	6.0	*	5000c500176e7165	000	End	00000010
016	T	-	Enabled	-	*	-----	---	None	00000000
017	T	-	Enabled	-	*	-----	---	None	00000000
018	T	-	Enabled	-	*	-----	---	None	00000000
019	T	-	Enabled	-	*	-----	---	None	00000000
020	T	-	Enabled	-	*	-----	---	None	00000000
021	T	-	Enabled	-	*	-----	---	None	00000000
022	T	-	Enabled	-	*	-----	---	None	00000000
023	T	-	Enabled	-	*	-----	---	None	00000000
024	S	-	Enabled	-	*	-----	---	None	00000000
025	S	-	Enabled	-	*	-----	---	None	00000000
026	S	-	Enabled	-	*	-----	---	None	00000000
027	S	-	Enabled	-	*	-----	---	None	00000000
028	T	-	Enabled	6.0	*	5000c50017689651	000	End	00000010
029	T	-	Enabled	6.0	*	5000c5001765e50d	000	End	00000010

4.3.10 show zonegroup <name>

SDMCLI> show zonegroup ZoneOne#001

```
Zone Group
  Member Alias/SAS Address: Phy List
-----
ZoneOne#001:
Lincoln      : 00 01 02 03
```

4.3.11 show zoneset active

SDMCLI> show zoneset active

```
Zone Set
  Zone Group: Permitted Zone Group List
  Member Alias/SAS Address: Phy List
-----
ZoneOne:
  ZoneOne#001: ZoneOne#002
Lincoln      : 00 01 02 03
  ZoneOne#002: ZoneOne#001
Lincoln      : 08 09 10 11
```

4.3.12 show zoneset data <name>

SDMCLI> show zoneset data ZoneOne

```
Zone Set
  Zone Group: Permitted Zone Group List
  Member Alias/SAS Address: Phy List
-----
ZoneOne:
  ZoneOne#001: ZoneOne#002
Lincoln      : 00 01 02 03
  ZoneOne#002: ZoneOne#001
Lincoln      : 08 09 10 11
```


Chapter 5

Troubleshooting

This chapter contains troubleshooting information for the LSISAS6160 SAS switch.

The following table lists several common issues related to the SAS6160 switch and the remedies for them.

Table 1: Common Troubleshooting Issues and Remedies

Issue	Remedy
The password for the admin account is lost and you cannot access the switch-management capabilities.	Reset the switch to factory defaults by pressing the reset switch and power cycling the switch. This process resets both the admin and user account passwords to their default values, clears all alias and zoning data, and clears the event log.
When trying to log in to the SDM-GUI utility from a Microsoft Windows Server 2003 system, the system stalls at the loading screen.	In Internet Explorer, select Tools-->Internet Options--> Security . Click the Trusted Sites icon, then click Sites... Add the IP address of the SAS6160 switch to the list of trusted websites.
You have changed the default IP address of the SAS6160 switch, but you forgot the address and you can no longer access the switch through the Ethernet.	To retrieve the IP address through an in-band connection, use the Xip utility supplied on the CD that ships with the SAS6160 switch. To list the available expanders in your topology, run the command: <pre>xip -i get avail</pre> This lists all expanders in your topology with the switch IP address next to each switch SAS address. Alternately, you can query information (including IP address) from an individual expander by using its SAS address. For example, if the SAS address is 500062b15555557f, to list information specific to that expander, use the command: <pre>xip -i 500062b15555557f get exp</pre>
All ports are showing yellow LEDs, but you still have SAS traffic.	This could be caused by either the master controller or slave controller failing. The switch functions at half performance. Contact your vendor to replace the switch.



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