Configuring the LSI SAS2 Integrated RAID Controller

Information about LSI Integrated RAID

The LSI Integrated RAID solution includes the following RAID features:

• Integrated Mirroring, which provides RAID 1 features.

• Integrated Mirroring and Striping, which provides RAID 10 features.

• Integrated Mirroring Enhanced, which provides RAID 1 Enhanced (RAID 1E) features.

• Integrated Striping, which provides RAID 0 features.

For more information, see

The LSI Fusion-MPT firmware supports Integrated Mirroring volumes, Integrated Mirroring and Striping volumes, Integrated Mirroring Enhanced volumes, and Integrated Striping volumes. You can create up to two Integrated RAID volumes on each LSI SAS2 controller.

The LSI Integrated RAID firmware uses the same device drivers as the standard LSI Fusion-MPT-based controllers, which eliminates the need for complex backup software or expensive RAID hardware. To conserve system resources, the Integrated RAID firmware operates independently from the operating system.

The LSI SAS2 BIOS Configuration Utility makes it easy to configure mirrored and striped volumes. The Integrated RAID solution is currently available as an optional component of the Fusion-MPT architecture on LSI SAS2 controllers.

The LSI Integrated RAID solution has the following features:

- Support for up to ten disks per Integrated RAID volume, with one or two volumes on each SAS2 controller. Each controller can support 14 volume drives, including one or two hot spare disks

- Support for two-disk Integrated Mirroring volumes (RAID 1).

- Support for online capacity expansion (OCE) for RAID 1 volumes. OCE allows you to increase the size of a RAID 1 volume by replacing the disk drives with higher-capacity drives.

> **Note** OCE is not supported with the 1064E-based controller.

- RAID volume creation, which meets the needs of most internal RAID installations.

- Easy installation and configuration.

- Support for booting from any kind of Integrated RAID volume.

- Ability to operate without special operating system-specific software.

- High reliability and data integrity as follows:

    - Nonvolatile write journaling.

    - Physical disks in a volume are not visible to the operating system (OS) or to application software.

- Low host CPU and PCI bus utilization

- Processing power provided by Fusion-MPT architecture:

    - Shared-memory architecture that minimizes external memory requests.

    - Device hardware and firmware that contain the Fusion-MPT architecture functionality.

The Integrated RAID host interface uses the message-passing interface that gives the host OS access to the RAID volumes and to additional non-RAID physical disks.

The Integrated RAID firmware supports metadata, which describes the logical drive configuration stored on each member disk of a volume. After initialization, the firmware queries each member disk to read the metadata and verify the configuration. The firmware reduces the usable disk space for each member disk when it creates the volume, which makes room for the metadata.

The Self-Monitoring Analysis and Reporting Technology (SMART) monitors disk drives for signs of future disk failure and generates an alert if it detects such signs. The Integrated RAID firmware polls each physical disk in the volume at regular intervals. If the firmware detects a SMART code on a physical disk in the volume, it processes the SMART data and stores it in a log. The volume does not support SMART directly because it is only a logical representation of the physical disks in the volume.

The Integrated RAID BIOS uses the LSI Fusion-MPT interface to communicate to the SAS2 controller and firmware, which includes reading the Fusion-MPT configuration to access the parameters that define behavior between the SAS2 controller and the devices that connect to it. The Fusion-MPT drivers for all supported operating systems implement the Fusion-MPT interface to communicate with the controller and firmware.

Mirrored Volumes

The mirroring features of LSI Integrated RAID provide data protection for the system boot volume, which safeguards the operating system and other critical information on servers and high-performance workstations.

The Integrated RAID solution supports the following types of mirrored arrays:

- Integrated Mirroring, which provides RAID 1 features.

- Integrated Mirroring and Striping, which provides RAID 10 features.

- Integrated Mirroring Enhanced, which provides RAID 1 Enhanced (RAID 1E) features.

These three mirroring solutions provide a robust, high-performance, fault-tolerant solution to data storage needs at a lower cost than a dedicated RAID controller.

Mirrored volumes can have from two to ten disks to provide fault-tolerant protection for critical data. Mirrored volumes also support one or two global hot spare drives, with a maximum of 14 drives on each LSI SAS2 controller.

Note Fourteen drives is the upper limit for a single LSI SAS2 controller, although the controller may support fewer than 14 drives. You can also configure one mirrored volume and one Integrated Striping volume on the same LSI SAS controller.

Each SAS2 controller can have two global hot spare disks available to automatically replace a failed disk in the one or two mirrored volumes configured on the controller. The hot spares make the mirrored volumes even more fault tolerant.

Operation of Mirrored Volumes

LSI Integrated RAID supports one or two mirrored volumes on each LSI SAS2 controller (or one mirrored volume and one Integrated Striping volume). Typically, one of these volumes is the boot volume. Boot support is available through the firmware of the LSI SAS2 controller that supports the standard Fusion-MPT interface. The runtime mirroring of the boot disk is transparent to the BIOS, the drivers, and the operating system.

Host-based status software monitors the state of the mirrored disks and reports any error conditions. The below image shows an Integrated Mirroring volume in which the second disk is a mirrored copy of the data on the first (primary) disk.
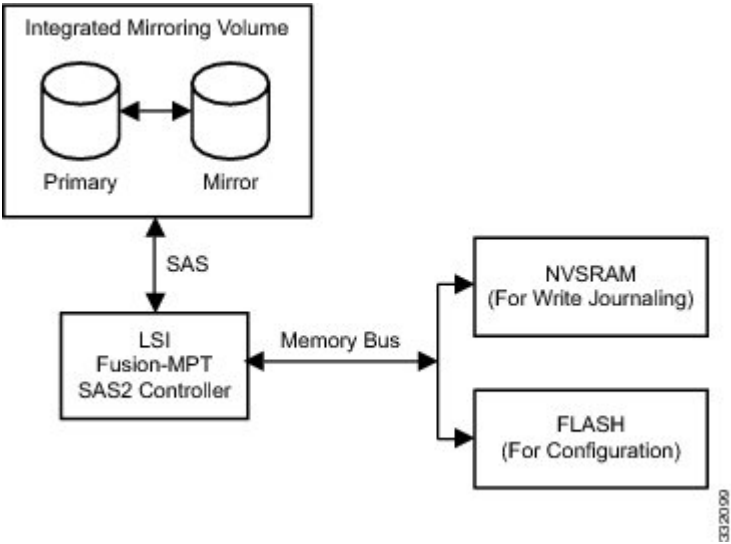
The below image shows the logical view and physical view of an Integrated Mirroring volume. Each logical block address (LBA) is mirrored on the second disk.
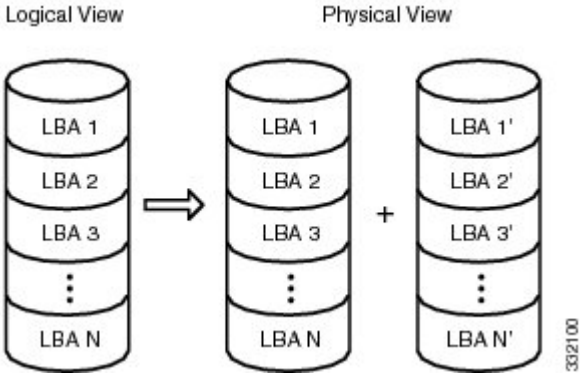
You can configure an Integrated Mirroring Enhanced volume with up to ten mirrored disks. The below image shows the logical view and physical view of an Integrated Mirroring Enhanced volume with three mirrored disks. The firmware writes each mirrored stripe to a disk and mirrors it to an adjacent disk. RAID 1E is another term for this type of mirrored configuration.
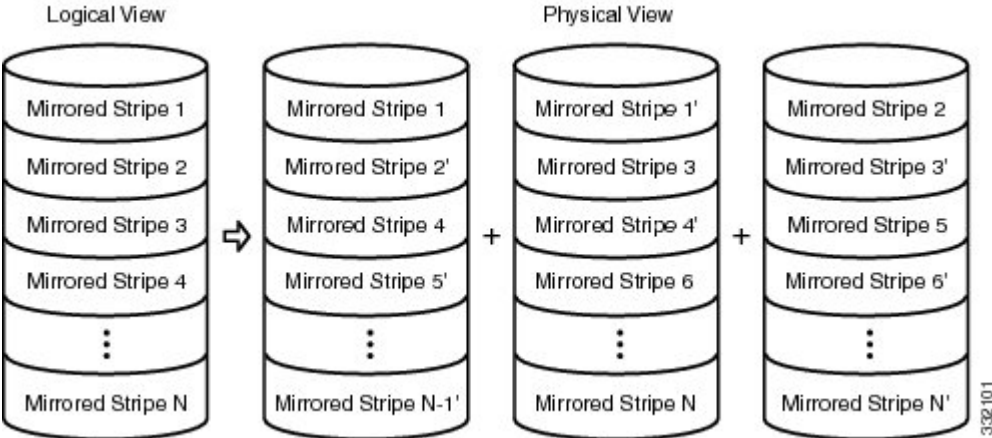
You can configure an Integrated Mirroring and Striping volume with an even number of disks, ranging from a minimum of four to a maximum of ten. Figure 4-4 shows the logical and physical views of an Integrated Mirroring and Striping volume with four mirrored disks. The firmware writes each mirrored stripe to a disk and mirrors it to an adjacent disk. RAID 10 is another term for this type of mirrored/striped configuration.
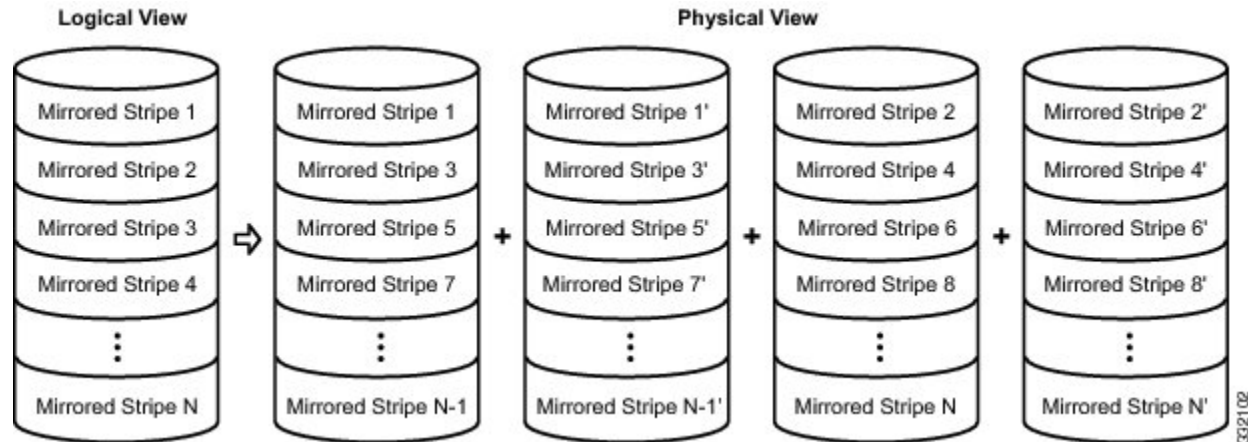
The LSI SAS2 BIOS Configuration Utility enables you to create mirrored volumes during initial setup and to reconfigure them in response to hardware failures or changes in the environment.

Note   The LSI SAS2 BIOS Configuration Utility deletes all existing data from the disks drives when you choose to use the drives for a mirrored volume.

Mirrored Volume Features

This section lists the features of Integrated Mirroring, Integrated Mirroring and Striping, and Integrated Mirroring Enhanced volumes. You can configure one or two mirrored volumes on each LSI SAS2 controller.

- Resynchronization with Concurrent Host I/O Operation

    The Integrated RAID firmware allows host I/O transactions to continue on a mirrored volume while it resynchronizes the volume in the background. The firmware automatically starts resynchronizing data after a disk failure activates a hot spare or after a disk in a mirrored volume has been hot swapped.

- Hot Swapping

    The Integrated RAID firmware supports hot swapping, and it automatically resynchronizes the hot-swapped disk in the background without any host or user intervention. The firmware detects hot-swap removal and disk insertion.

    Following a hot-swap event, the firmware verifies that the new physical disk has enough capacity for the mirrored volume. The firmware resynchronizes all replaced hot-swapped disks, even if the same disk is reinserted. In a mirrored volume with an even numbers of disks, the firmware marks the hot-swapped disk as a secondary disk and the other disk with data as the primary disk. The firmware resynchronizes all data from the primary disk onto the new secondary disk. In a mirrored volume with an odd number of disks, primary and secondary sets include three disks instead of two.

- Hot Spare Disk

You can configure two disks as global hot spare disks to protect data on the mirrored volumes configured on the SAS2 controller. If the Integrated RAID firmware fails one of the mirrored disks, it automatically replaces the failed disk with a hot spare disk and resynchronizes the mirrored data. The firmware automatically receives a notification when a hot spare replaces the failed disk, and it then designates that disk as the new hot spare.

- Online Capacity Expansion

The online capacity expansion (OCE) feature enables you to expand the capacity of an existing two-disk Integrated Mirroring (RAID 1) volume by replacing the original disk drives withvhigher-capacity drives that have the same protocol (SAS or SATA).

> **Note** The OCE feature is not supported with the 1064E-based controller.

> **Note** The new drives must have at least 50 GB more capacity than the original drives of the volume.

After you replace the disk drives and run the OCE command, you must use a commercial tool that is specific to the operating system to move or increase the size of the partition on the volume.

- Media Verification

The Integrated RAID firmware supports a background media verification feature that runs at regular intervals when the mirrored volume is in the Optimal state. If the verification command fails for any reason, the firmware reads the other disk's data for this segment and writes it to the failing disk in an attempt to refresh the data. The firmware periodically writes the current media verification logical block address to nonvolatile memory so that the media verification can continue from where it stopped prior to a power cycle.

- Disk Write Caching

By default, the Integrated RAID firmware disables disk write caching for mirrored volumes to ensure that the write journal entry stored in the nonvolatile static RAM (NVSRAM) is always valid. If you enable disk write caching (not recommended), you might cause the disk write log to be invalid.

- NVSRAM Usage

The Integrated RAID firmware requires at least a 32-KB NVSRAM to perform write journaling for mirrored volumes on LSI SAS2 controllers. The NVSRAM also preserves configuration information across reboots. The firmware uses write journaling to verify that the disks in the mirrored volume are synchronized with each other.

- Background Initialization

Background initialization (BGI) is the process of copying data from primary to secondary disks in a mirrored volume. The Integrated RAID firmware starts BGI automatically as a background task when it creates a volume. The volume remains in the Optimal state while BGI is in progress.

- Consistency Check

A consistency check is a background process that reads data from primary and secondary disks in a mirrored volume and compares it to make sure that the data is identical on both disks. You can use the LSI SAS2 BIOS Configuration Utility to run a consistency check on a mirrored volume.

• Make Data Consistent Process

If enabled in the Integrated RAID firmware, the make data consistent (MDC) process starts automatically and runs in the background when you move a redundant volume from one SAS controller to another SAS controller. MDC compares the data on the primary and secondary disks. If it finds inconsistencies, it copies data from the primary disk to the secondary disk.

Mirroring and Mirroring Enhanced Features

Integrated Mirroring, Integrated Mirroring and Striping, and Integrated Mirroring Enhanced volumes support the following features:

• Configurations of one or two mirrored volumes on each LSI SAS2 controller. Each volume can consist of two mirrored disks for an Integrated Mirroring volume; three to ten mirrored disks for an Integrated Mirroring Enhanced volume; or four, six, eight, or ten mirrored disks for an Integrated Mirroring and Striping volume.

• Two optional global hot spare disks per LSI SAS2 controller to automatically replace failed disks in mirrored volumes.

• Ability of mirrored volumes to run in optimal mode or in degraded mode if one mirrored disk in an Integrated Mirroring volume fails or if one or more mirrored disks fail in an Integrated Mirroring and Striping volume or Integrated Mirroring Enhanced volume.

• Support for hot swapping.

• Support for online capacity expansion (OCE) for RAID1 volumes. OCE allows you to increase the size of a RAID1 volume by replacing the existing disk drives with higher-capacity disk drives. Data is protected during the expansion process, and the RAID1 volume remains online.

Note The OCE feature is not supported with the 1064E-based controller.

• Presentation of a single, virtual drive to the operating system for each mirrored volume.

• Support for both SAS and SATA disks, although you cannot combine the two types of disks in the same volume. However, an LSI SAS2 controller can support one volume with SATA disks and a second volume with SAS disks.

• Automatic background initialization after volume creation.

• Consistency checking.

• Fusion-MPT architecture.

• Menu-driven, BIOS-based configuration utility.

• Error notification, in which the drivers update an OS-specific event log.

• Support for SCSI Enclosure Services (SES) status LED.

- Write journaling, which allows automatic synchronization of potentially inconsistent data after unexpected power-down situations.

- Use of metadata to store volume configuration on disks in a mirrored volume.

- Automatic background resynchronization while host I/Os continue.

- Background media verification, which ensures that data on mirrored volumes is always accessible.

Integrated Striping

This section provides an overview of the LSI Integrated RAID features that support the creation of striped arrays.

The LSI Integrated RAID solution enables you to create Integrated Striping volumes for applications that require the faster performance and increased storage capacity of striping. The low-cost Integrated Striping feature has many of the advantages of a more expensive RAID striping solution. You can configure an Integrated Striping volume as the boot disk or as a data disk.

The Integrated Striping solution provides better performance and more capacity than individual disks, without burdening the host CPU. The firmware distributes host I/O transactions over multiple disks and presents the disks as a single, logical drive. Striping is transparent to the BIOS, the drivers, and the operating system.

You can use the LSI SAS2 BIOS CU to configure Integrated Striping volumes. These volumes canconsist of two to ten disks.

On Integrated Striping volumes, the firmware writes data across multiple disks instead of onto one disk by partitioning the storage space of each disk into 64-KB stripes. The firmware interleaves the stripes round-robin so that the combined storage space consists alternately of stripes from each disk.

The below image shows an example of integrated striping: the firmware writes segment 1 to disk 1, segment 2 to disk 2, segment 3 to disk 3, and so on. When the firmware reaches the end of the disk list, it continues writing data at the next available segment of disk 1.
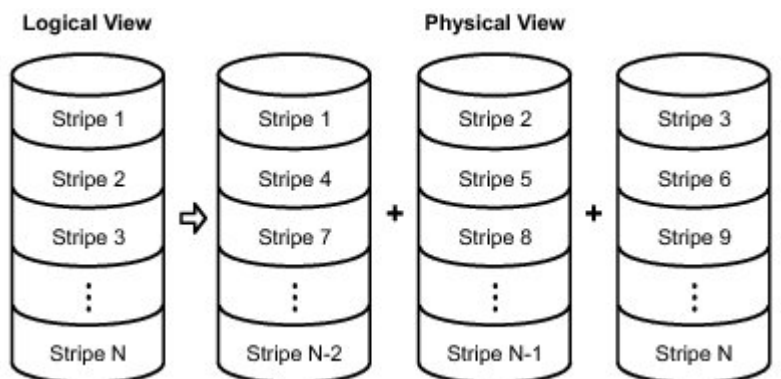
Speed is the primary advantage of the Integrated Striping solution because it transfers data to or from multiple disks simultaneously. However, there is no data redundancy. You should back up the data on other media to avoid losing unsaved data if one disk fails.

Integrated Striping Features

Integrated Striping supports the following features:

- Support for volumes with two to ten disks.

- Support for two Integrated Striping volumes with up to 14 drives total on a SAS2 controller.

- Support for combining one Integrated Striping volume and one Integrated Mirroring, Integrated Mirroring and Striping, or Integrated Mirroring Enhanced volume on a single controller.

- Support for both SAS and SATA drives, although you cannot combine the two types of drives in one volume.

- Fusion-MPT architecture.

- Easy-to-use SAS BIOS configuration utility.

- Error notification.

- Disk write caching, which is enabled by default on all Integrated Striping volumes.

- Use of metadata to store volume configurations on disks.

- OS-specific event log.

- Error display inside the Fusion-MPT BIOS.

- SCSI Enclosure Services (SES) status LED support for drives used in Integrated Striping volumes.

Creating Mirrored Volumes

The LSI SAS2 BIOS Configuration Utility is a menu-driven utility program that enables you to easily configure and manage Integrated RAID volumes. You can use the LSI SAS2 BIOS Configuration Utility to create one or two mirrored volumes on each LSI SAS2 controller, with up to two optional global hot spare disks. You must connect all disks in a mirrored volume to the same LSI SAS2 controller.

Although you can use different sized disks in mirrored volumes, the smallest disk in the volume determines the logical size of all disks in the volume. The volume does not use the excess space of the higher-capacity member disks. For example, if you create an Integrated Mirroring Enhanced volume with two 100-GB disks and two 120-GB disks, the volume uses only 100 GB on each of the 120-GB disks.

See Mirrored Volumes for more information about the features of Integrated Mirroring, Integrated Mirroring and Striping, and Integrated Mirroring Enhanced volumes.

Launching the LSI SAS2 BIOS Configuration Utility

To alter the RAID configurations on your hard drives, you can use your host-based utilities that youinstall on top of your host OS, or you can use the LSI option ROM-based utilities that are installed on the server.

When you boot the server and you have quiet boot disabled, information about your controller is displayed with the prompts for the key combination to launch the option ROM-based utilities for your controller.

To know more about quiet boot disabled, see .

Watch for the prompt for your controller during verbose boot:

- The prompt for LSI controller card utility is **Ctrl-H**.

- The prompt for the mezzanine-style controller cards is **Ctrl-C**.

- The prompt for the onboard Intel ICH10R controller utility is **Ctrl-M**.

Note Cisco has also developed the Cisco Server Configuration Utility for C-Series servers, which can assist you in setting up some RAID configurations for your drives. This utility is shipped with new servers on CD. You can also download the ISO from Cisco.com. See the user documentation for this utility at the following URL: http://www.cisco.com/en/US/docs/unified_computing/ucs/sw/ucsscu/user/guide/20/SCUUG20.html

Creating Mirrored Volumes

You can configure one or two Integrated Mirroring, Integrated Mirroring and Striping, and Integrated Mirroring Enhanced volumes on each LSI SAS2 controller. You can also configure one mirrored volume and one Integrated Striping volume on the same controller, which means that you can configure up to a maximum of 14 disk drives for the two volumes. This number includes one or two optional hot spare disks for the mirrored volume.

- All physical disks in a volume must be either SATA (with extended command set support) or SAS (with SMART support).

  Note You cannot combine SAS and SATA disks in the same volume. However, you can create one volume with SAS disks and a second volume with SATA disks on the same controller.

- Disks must have 512-B blocks and must not have removable media.

- Integrated mirroring volumes must have two disks, Integrated Mirroring Enhanced volumes can have three to ten disks, and Integrated Mirroring and Striping volumes can have an even number of disks ranging from four to ten disks.

Note We strongly recommend that you create global hot spare disks for all mirrored volumes to increase the level of data protection. If a disk in a mirrored volume fails, the Integrated RAID firmware rebuilds it by using one of the global hot spares, and the data is safe. If you create two mirrored volumes on an LSI SAS2 controller, either of the two mirrored volumes can use the global hot spares if a disk fails.

Creating an Integrated Mirroring Volume

Step 1 Start the SAS2 BIOS CU as shown in

Step 2   In the Adapter List window, use the arrow keys to choose an LSI SAS adapter and press Enter.

The Adapter Properties window appears.

Step 3   Use the arrow keys to choose RAID Properties, and press Enter.

The Create Array window appears.

Step 4   Choose Create RAID 1 Volume.

The Create New Array window appears.

Step 5   Move the cursor to the RAID Disk column and choose a line that has a No entry in this column, indicating that the disk is not already part of the volume that you are creating. To add the disk to the new array, press Spacebar to change No to Yes.

This is the Primary disk in the array.

Note   The SAS2 BIOS CU deletes all existing data from the disks drives when you choose them to use in a mirrored volume.

Step 6   To add the second disk to the array, move the cursor to another line and press Spacebar.

This is the Secondary disk in the array.

Step 7   To create the array, press C.

A menu window appears.

Step 8   From the menu options, choose Save changes then exit this menu.

A processing message appears briefly, and the SAS2 BIOS CU returns to the Adapter Properties window. Initialization of the new array continues in the background.

Note   To create a second Integrated Mirroring volume, repeat these instructions starting with Step 3. To create an Integrated Mirroring Enhanced or Integrated Mirroring and Striping volume, follow the steps in

Note   To create one or two global hot spares, follow the steps in

Creating an Integrated Mirroring Enhanced or Integrated Mirroring and Striping Volume

Integrated Mirroring Enhanced volumes can have from three to ten physical disks. Data is written to a disk and mirrored on an adjacent disk. Integrated Mirroring and Striping volumes can have a minimum of four and a maximum of ten physical disks, in even numbers. In an Integrated Mirroring Enhanced or Integrated Mirroring and Striping volume, the data is both mirrored and striped.

Step 1   Start the SAS2 BIOS CU as shown in

Step 2   In the Adapter List window, use the arrow keys to choose an LSI SAS adapter and press Enter.

The Adapter Properties window appears.

Step 3   Use the arrow keys to choose RAID Properties and press Enter.

The Create Array window appears.

Step 4   Choose Create RAID 1E Volume.

The Create New Array window appears.

Step 5   Move the cursor to the RAID Disk column and choose a line that has a No entry in this column, indicating that the disk is not already part of the volume that you are creating. To add the disk to the new array, press Spacebar to change No to Yes.

Caution   The SAS2 BIOS CU deletes all existing data from the disk drives when you choose the drives to use for a mirrored volume.

Step 6   Move the cursor to another line and press Spacebar to add another disk to the array:
   a)   If you choose an odd number of disks, the SAS2 BIOS CU creates an Integrated Mirroring Enhanced array.
   b)   If you choose an even number of disks, it creates an Integrated Mirroring and Striping array. As you add disks, the Array Size field changes to reflect the size of the new array.

Step 7   To create the array, press C.

A menu window appears.

Step 8   From the menu options, choose Save changes then exit this menu.

A processing message appears briefly, and the SAS2 BIOS CU returns to the Adapter Properties window. Initialization of the new array continues in the background.

Note   To create a second Integrated Mirroring Enhanced or Integrated Mirroring and Striping volume, repeat the instructions above starting with Step 3.

Note   To create one or two global hot spares, follow the steps in

Expanding an Integrated Mirroring Volume with OCE

You can use the online capacity expansion (OCE) feature to expand the capacity of a two-disk Integrated Mirroring (RAID1) volume by replacing the original disks with two higher-capacity disk drives while the volume remains online. This process maintains data integrity at all times, even if one of the disks fails during the replacement process. The new disks must have at least 50 GB more capacity than the disks they are replacing, and they must use the same protocol (SAS or SATA) as the disks they are replacing.

Note   The OCE feature is not supported with the 1064E-based controller.

Step 1   Physically replace one of the two volume disk drives with a drive that has at least 50 GB more capacity.

If necessary, you can identify the disks in the volume by following the instructions in

Step 2   Wait until synchronization completes on the new disk and the volume returns to the Optimal state, as indicated in the Adapter Properties window.

Step 3   Physically replace the other volume disk drive with a drive that has at least 50 GB more capacity.

Step 4   Wait until synchronization completes on the new disk and the volume returns to the Optimal state.

Step 5   In the Adapter List window of the SAS2 BIOS CU, use the arrow keys to choose the LSI SAS adapter with the RAID 1 volume and press Enter.

The Adapter Properties window appears.

Step 6   Use the arrow keys to choose RAID Properties, and press Enter.

The Select New Array Type window appears.

Step 7   Choose View Existing Array.

The View Array window appears. If necessary, press Alt-N to switch to the RAID 1 volume with the new, higher-capacity disk drives.

Step 8   Choose Manage Array.

The Manage Array window appears.

Step 9   Choose Online Capacity Expansion.

A menu window appears with a warning message and with options to start the expansion process or quit.

Step 10   To start the expansion, press Y.

When the expansion process completes, the RAID Properties window appears.

Run a commercial tool that is specific to the operating system to move or increase the size of the partition on the newly expanded RAID 1 volume.

Managing Hot Spare Disks

You can create one or two global hot spare disks to protect the data on mirrored volumes on an LSI SAS2 controller. You can also delete hot spare disks.

Creating Hot Spare Disks

Step 1   Start the **LSI SAS2 BIOS Configuration Utility** as shown in the **Launching the LSI SAS2 BIOS Configuration Utility** section.

Step 2   In the **Adapter List** window, use the arrow keys to choose an **LSI SAS adapter** and press **Enter**.

The **Adapter Properties** window appears.

Step 3   Use the arrow keys to choose **RAID Properties**, and press **Enter**.

The **Select New Array Type** window appears.

Step 4   Choose **View Existing Array**.

The **View Array** window appears. If necessary, press Alt-N to switch to another array on this adapter.

Step 5   Choose **Manage Array**.

The **Manage Array** window appears.

Step 6   Choose **Manage Hot Spares**, which is the first option.

The **Manage Hot Spares** window appears.

Step 7   Identify a disk that is not part of a RAID volume (that is, the value in the **Drive Status** column is not RAID) and that is not already identified as a hot spare disk.

A global hot spare disk must have 512-byte blocks and nonremovable media. The disk type must be either SATA with extended command set support or SAS with SMART support.

Step 8   Choose the **Hot Spr (Hot Spare)** field for this disk and press **Spacebar**.

The **Hot Spare** status changes to Yes.

Step 9   (Optional) Repeat Step 8 to choose a second global hot spare disk.

Step 10   To create the hot spare disk, press **C**.

A menu window appears. An error message appears if the chosen disk is not at least as large as the smallest disk used in the existing volume. An error message also appears if you try to add a SATA disk as a hot spare for volumes that use SAS disks, or if you try to add a SAS disk as a hot spare for volumes that use SATA disks.

Step 11   Choose **Save changes**, then exit this menu to create the hot spare disk.

The **SAS2 BIOS CU** pauses while it configures the global hot spares.

Deleting Hot Spare Disks

Step 1   Access the **Manage Hot Spares** window by performing the steps in **Expanding an Integrated Mirroring Volume with OCE** section.

Step 2   Choose a hot spare disk for deletion, and press **C**.

Step 3   Choose **Save changes**, then exit this menu to commit the changes.

The SAS2 BIOS CU pauses while it removes the global hot spare.

Other Configuration Tasks

This section describes how to perform other configuration and maintenance tasks for mirrored volumes.

Viewing Volume Properties

Step 1   In the **SAS2 BIOS CU**, choose an **LSI SAS2** adapter from the **Adapter List**.

The **Adapter Properties** window appears.

Step 2   Choose **RAID Properties**.

The **Select New Array Type** window appears.

Step 3   Choose **View Existing Array**.

The **View Array** window appears, showing information about the array and each disk in it. The window includes global hot spare information, if any exists.

> **Note**   If you create one volume using SAS disks, another volume using SATA disks, and one or two global hot spare disks, the hot spare disks only appear when you view the mirrored volume that uses the same type of disks as the hot spare disks.

Step 4   If the currently displayed array is not the one you want, press **Alt-N** to view another array on the adapter.

Running a Consistency Check

Use the **Consistency Check** command to verify that the data is synchronized in the mirrored disks in the volume.

Step 1   In the Adapter List window, use the arrow keys to choose an LSI SAS adapter.

The Adapter Properties window appears.

Step 2   Use the arrow keys to choose RAID Properties, and press Enter.

The Select New Array Type window appears.

Step 3   Choose View Existing Array.

The View Array window appears. If necessary, press Alt-N to switch to another array on this adapter.

Step 4   Choose Manage Array.

The Manage Array window appears.

Step 5   Choose Consistency Check in the Manage Array window.

A menu window appears.

Step 6   Press Y to start the consistency check.

The consistency check runs a read-read-compare algorithm in the background. If it encounters any data miscompares, it stores the information in a bad block table.

Activating an Array

A volume (array) can become inactive if, for example, you remove it from one controller or computer and install it on a different one. The Activate Array option allows you to reactivate an inactive volume. This option is available only when the chosen volume is currently inactive.

Step 1   In the **Adapter List** window, use the arrow keys to choose an **LSI SAS adapter** and press Enter.

The **Adapter Properties** window appears.

Step 2   Choose **RAID Properties**, and press Enter.

The **Select New Array Type** window appears.

Step 3   Choose **View Existing Array**.

The **View Array** window appears. If necessary, press **Alt-N** to switch to another array on this adapter.

Step 4   Choose **Manage Array**.

The **Manage Array** window appears.

Step 5   Choose **Activate Array** in the **Manage Array** window.

A menu window appears.

Step 6   Press **Y** to activate the array.

The array becomes active after a pause.

Deleting an Array

Before you delete an array, be sure to back up the data on the array that you want to keep..

Step 1   In the **Adapter List** window, use the arrow keys to choose an LSI SAS adapter.

The **Adapter Properties** window appears.

Use the arrow keys to choose RAID Properties, and press **Enter**.

The **Select New Array Type** window appears.

Step 2   Choose **View Existing Array**.

The **View Array** window appears. If necessary, press Alt-N to switch to another array on this adapter.

Step 3   Choose **Manage Array**.

The **Manage Array** window appears.

Step 4   Choose **Delete Array**.

A menu window appears.

Step 5   Press **Y** to delete the array, or press **N** to cancel the deletion process.

After a pause, the utility deletes the array. If there is another remaining array and one or two hot spare disks, the BIOS checks the hot spare disks to determine if they are compatible with the remaining volume. If they are not compatible (too small or wrong disk type), the BIOS deletes them also.

Locating Disk Drives in a Volume

You can use the SAS2 BIOS CU to locate and identify a specific physical disk drive in a disk enclosure by flashing the drive's LED. You can also flash the LEDs of all the disk drives in a RAID volume, if they are in a disk enclosure.

When you add a disk drive to a new mirrored volume, the LED on the disk drive starts flashing. The LED stops flashing when you finish creating the volume.

Step 1 Choose the desired SAS2 controller in the **Adapter List** window and press **Enter**.

The **Adapter Properties** window appears.

Step 2 Highlight **SAS Topology** and press **Enter**.

The **SAS Topology** window appears.

Step 3 Choose the disk in the **Device Identifier** column and press Enter.

The LED on the disk flashes until you press a key to stop it.

Step 4 Choose the volume in the left column of the **SAS Topology** window and press **Enter** to identify all the disk drives in a volume.

The LEDs flash on all disk drives in the volume until you press a key to stop them.

Note The LEDs on the disk drives flash, as previously described, if the firmware configuration is correct and the drives are in a disk enclosure.

Choosing a Boot Disk

You can choose a boot disk in the SAS Topology window. The next time you boot the computer, the firmware moves this disk to scan ID 0, making it the new boot disk, which makes it easier to set BIOS boot device options and to keep the boot device constant during device additions and removals. You can also choose an alternative boot device. If the BIOS cannot find the preferred boot device when it loads, it attempts to boot from the alternate device.

Step 1 In the **SAS2 BIOS CU**, choose an adapter from the **Adapter List**.

Step 2 Choose the **SAS Topology** option. If a device is currently designated as the boot device, the **Device Info** column in the SAS Topology window lists the word *Boot*.

```
LSI Corp Config Utility   vXX.XX.XX.XX
SAS Topology — SAS2008
                      Device Identifier              Device
SAS2008 (06:00)                                      Info
    |- Controller       Direct Attach Devices        Controller
       |- PHY 1         Some Disk Model X             SAS
       |- PHY 2         Some Disk Model X             SAS-SSD
    |- Expander         LSILOGICSASx12 A.0            Expander
       |- PHY 1         RAID Physical Disk            SATA-SSD
       |- PHY 2         RAID Physical Disk            SATA-SSD
       |- PHY 3         Some Disk Model X             SATA, Alt
       |- PHY 4         RAID Physical Disk            SATA-SSD
    |- Enclosure        Unknown                       Enclosure
       |- SLOT 0        Some Disk Model Z             SATA
       |- SLOT 6        Some Disk Model Z             SATA
       |- SLOT 7        Some Disk Model Z             SATA
    |- IR VOL           LSI Logical Volume 3000       Boot    <===
       |- PHY 1         Some Disk Model Y             RAID
       |- PHY 2         Some Disk Model Y             RAID
       |- PHY 4         Some Disk Model X             Hot Spare

Esc = Exit      F1 = Help
Alt+D = Device Properties    Alt+M = More Keys
```

If a device is currently designated as the alternate boot device, the Device Info column shows the word **Alt**.

Step 3   Move the cursor to the disk and press **Alt-B** to choose the preferred boot disk.

Step 4   Move the cursor to the current boot disk and press **Alt-B** to remove the boot designator.

This controller no longer has a disk designated as boot.

Step 5   Move the cursor to the new boot disk and press **Alt-B** to change the boot disk.

The **Boot** designator moves to this disk.

Step 6   Move the cursor to the disk and press **Alt-A** to choose an alternate boot disk.

Note   Perform the steps Step 4 and Step 5 in this task to change the alternate boot device from one disk to another, but use **Alt-A** instead of **Alt-B**.

Creating Integrated Striping Volumes

This section describes how to create Integrated Striping volumes using the LSI SAS2 BIOS Configuration Utility (SAS2 BIOS CU).

The LSI SAS2 BIOS CU is a menu-driven utility program that enables you to easily configure and manage Integrated RAID volumes. You can use the SAS2 BIOS CU to create one or two Integrated Striping volumes on each LSI SAS2 controller. Each volume can have from two to ten drives. All disks in an Integrated Striping volume must be connected to the same LSI SAS2 controller.

Although you can use disks of different sizes in Integrated Striping volumes, the smallest disk in the

volume determines the logical size of all disks in the volume. The firmware does not use the excess space of the higher-capacity member disk. For example, if you create an Integrated Striping volume with two 100-GB disks and two 120-GB disks, the firmware uses only 100 GB on each of the 120-MB disks for the volume. The supported stripe size is 64 KB.

See Integrated Striping for more information about Integrated Striping volumes.

You can configure one or two Integrated RAID volumes on each LSI SAS2 controller. For a two-volume configuration, you can have two Integrated Striping (RAID 0) volumes, two mirrored volumes, or one volume of each type. The two volumes can have a maximum of 14 disk drives, which includes one or two hot spare disks for mirrored volumes.

The following guidelines apply when creating an Integrated Striping volume:

- All physical disks in an Integrated Striping volume must be either SATA (with extended command set support) or SAS (with SMART support). You cannot combine SAS and SATA disks in the same volume. However, you can create one volume with SAS disks and a second volume with SATA disks on the same controller.

- Disks must have 512-B blocks and must not have removable media.

- Integrated Striping volumes must have at least two disks and no more than ten disks. Integrated Striping volumes do not support hot spare disks.

Steps:

1. In the Adapter List window, choose an LSI SAS adapter and press Enter.

   The Adapter Properties window appears.

2. Choose RAID Properties and press Enter.

   The Create Array window appears.

3. Choose Create RAID 0 Volume.

   The Create New Array window appears.

4. Move the cursor to the RAID Disk column and choose a line that has a No entry in this column, which indicates that the disk is not already part of the volume you are creating.

   To add the disk to the new array, press Spacebar to change the No to Yes.

5. Move the cursor to another line and press Spacebar to add another disk to the array.

6. Continue adding disks in this way until you have added the desired number of disks.

7. Press C to create the array.

   A menu appears.

8. From the menu options, choose Save changes then exit this menu.

   A processing message appears briefly, and the SAS2 BIOS CU returns to the Adapter Properties window. Initialization of the new array continues in the background.

✎

| Note | Repeat the previous instructions to create a second Integrated Striping volume, if desired, and if enough additional disks are available. |

Other Configuration Tasks

This section describes how to perform other configuration and maintenance tasks for Integrated Striping volumes.

Viewing Volume Properties

Step 1 In the **SAS2 BIOS CU**, choose an **LSI SAS2** adapter from the **Adapter List**.

The **Adapter Properties** window appears.

Step 2 Choose **RAID Properties**.

The **Select New Array Type** window appears.

Step 3 Choose **View Existing Array**.

The **View Array** window appears, showing information about the array and each disk in it.

Step 4 If the currently displayed array is not the one you want, press **Alt-N** to view another array on the adapter.

Activating an Array

A volume (array) can become inactive if, for example, you remove it from one controller or computer and install it on a different one. The Activate Array option allows you to reactivate an inactive volume. This option is available only when the chosen volume is currently inactive.

Step 1 In the **Adapter List** window, use the arrow keys to choose an **LSI SAS adapter** and press **Enter**.

The **Adapter Properties** window appears.

Step 2 Choose **RAID Properties**, and press Enter.

The **Select New Array Type** window appears.

Step 3 Choose **View Existing Array**.

The **View Array** window appears. If necessary, press **Alt-N** to switch to another array on this adapter.

Step 4 Choose **Manage Array**.

The **Manage Array** window appears.

Step 5 Choose **Activate Array** in the **Manage Array** window.

A menu window appears.

Step 6   Press **Y** to activate the array.

The array becomes active after a pause.

Deleting an Array

Before you begin

Before you delete an array, be sure to back up the data.

Step 1   In the **Adapter List** window, use the arrow keys to choose an LSI SAS adapter.

The **Adapter Properties** window appears.

Use the arrow keys to choose RAID Properties, and press **Enter**.

The **Select New Array Type** window appears.

Step 2   Choose **View Existing Array**.

The **View Array** window appears. If necessary, press Alt-N to switch to another array on this adapter.

Step 3   Choose **Manage Array**.

The **Manage Array** window appears.

Step 4   Choose **Delete Array**.

A menu window appears.

Step 5   Press **Y** to delete the array, or press **N** to cancel the deletion process.

After a pause, the utility deletes the array.

Locating Disk Drives in a Volume

You can use the LSI SAS2 BIOS Configuration Utility to locate and identify a specific physical disk drive in a disk enclosure by flashing the drive's LED. You can also flash the LEDs of all the disk drives in a RAID volume, if they are in a disk enclosure.

When you add a disk drive to a new mirrored volume, the LED on the disk drive starts flashing. The LED stops flashing when you finish creating the volume.

Step 1   Choose the desired SAS2 controller in the **Adapter List** window and press Enter.

The **Adapter Properties** window appears.

Step 2   Highlight **SAS Topology** and press **Enter**.

The **SAS Topology** window appears.

Step 3   Choose the disk in the **Device Identifier** column and press Enter.

The LED on the disk flashes until you press a key to stop it.

Step 4 Choose the volume in the left column of the SAS Topology window and press **Enter** to identify all the disk drives in a volume.

The LEDs flash on all disk drives in the volume until you press a key to stop them.

Note The LEDs on the disk drives flash, as previously described, if the firmware configuration is correct and the drives are in a disk enclosure.

Choosing a Boot Disk

You can choose a boot disk in the SAS Topology window. The next time you boot the computer, the firmware moves this disk to scan ID 0, making it the new boot disk, which makes it easier to set BIOS boot device options and to keep the boot device constant during device additions and removals. You can also choose an alternative boot device. If the BIOS cannot find the preferred boot device when it loads, it attempts to boot from the alternate device.

Step 1 In the **LSI SAS2 BIOS Configuration Utility**, choose an adapter from the **Adapter List**.

Step 2 Choose the **SAS Topology** option. If a device is currently designated as the boot device, the **Device Info** column in the SAS Topology window lists the word *Boot*.

If a device is currently designated as the alternate boot device, the **Device Info** column shows the word **Alt**.

Step 3 Move the cursor to the disk and press **Alt-B** to choose the preferred boot disk.

Step 4 Move the cursor to the current boot disk and press **Alt-B** to remove the boot designator.

This controller no longer has a disk designated as boot.

Step 5 Move the cursor to the new boot disk and press **Alt-B** to change the boot disk.

The **Boot** designator moves to this disk.

Step 6 Move the cursor to the disk and press **Alt-A** to choose an alternate boot disk.

To change the alternate boot device from one disk to another, perform the steps Step 4 and Step 5 in this task, but use **Alt-A** instead of **Alt-B**.

Determining Which Controller is in Your Server

Supported RAID controllers for all models are listed in

If you do not have a record of which device is used in the server, you can read the on-screen messages that are displayed during system bootup. These messages display information about the devices that are installed in your server.

- Information about the models of card installed are displayed as part of the verbose boot. You are also prompted to press Ctrl-H to launch configuration utilities for those cards. For servers running CIMC

firmware earlier than release 1.2(1), see also .

- If a mezzanine-style card is enabled, you are prompted to press **Ctrl-C** to launch the configuration for these cards.

- If no models of card are displayed but there is a RAID configuration, your server is using the onboard ICH10R controller. You are also prompted to press **Ctrl-M** to launch the configuration utilities for this controller.

Disabling Quiet Boot for CIMC Firmware Earlier than Release 1.2(1)

For CIMC firmware and BIOS release 1.2(1) and later releases, Quiet Boot has been removed and is not required. If you are running CIMC firmware and BIOS earlier than release 1.2(1), you can use the following procedure to disable Quiet Boot.

Step 1   Boot the server and watch for the F2 prompt during bootup.

Step 2   Press F2 when prompted to enter the BIOS Setup utility.

Step 3   On the Main page of the BIOS Setup utility, set Quiet Boot to Disabled, which allows non-default messages, prompts, and POST messages to display during bootup instead of the Cisco logo window.

Step 4   Press F10 to save your changes and exit the utility.

Launching Option ROM-Based Controller Utilities

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Restoring RAID Configuration After Replacing a RAID Controller

When you replace a RAID controller, the RAID configuration that is stored in the controller is lost. Use the following procedure to restore your RAID configuration to your new RAID controller.

Step 1   Replace your RAID controller.

Step 2   If this was a full chassis swap, replace all drives into the drive bays, in the same order that they were installed in the old chassis.

Step 3   If Quiet Boot is enabled, disable it in the system BIOS. See Disabling Quiet Boot for CIMC Firmware Earlier than Release 1.2(1), on page 23.

Step 4   Reboot the server and watch for the prompt to press F.

Step 5   Press F when you see the following on-screen prompt:

```
Foreign configuration(s) found on adapter.
Press any key to continue or 'C' load the configuration utility,
or 'F' to import foreign configuration(s) and continue.
```

Step 6   Press any key (other than C) to continue when you see the following message:

```
Foreign configuration(s) found on adapter.
All of the disks from your previous configuration are gone. If this is
an unexpected message, then please power of your system and check your cables
to ensure all disks are present.
Press any key to continue, or 'C' to load the configuration utility.
```

Step 7   Watch the subsequent windows for confirmation that your RAID configuration was imported correctly.

- If you see the following message, your configuration was successfully imported. The LSI virtual drive is also listed among the storage devices.

  N Virtual Drive(s) found on host adapter.

- If you see the following message, your configuration was not imported which can happen if you do not press F quickly enough when prompted. In this case, reboot the server and try the import operation again when you are prompted to press F.

  0 Virtual Drive(s) found on host adapter.