IBM Installation Guide

ServeRAID-8i, ServeRAID-8k, ServeRAID-8k-l, and ServeRAID-8s Serial-Attached SCSI Controllers

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Note: Before using this information and the product it supports, be sure to read the general information in Appendix D, "IBM Statement of Limited Warranty Z125-4753-0908/2006" on page 77 and Appendix E, "Notices" on page 97.

Third Edition (August 2007)

Safety

Before installing this product, read the Safety Information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الآمنية

Antes de instalar este produto, leia as Informações de Segurança.

在安装本产品之前，请仔细阅读 Safety Information (安全信息)。

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

Ennen kuin asennat tämän tuotteen, lue turvaohjeet kohdasta Safety Information.

Avant d'installer ce produit, lisez les consignes de sécurité.

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

Πριν εγκαταστήσετε το προϊόν αυτό, διαβάστε τις πληροφορίες ασφάλειας (safety information).

.לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

Prima di installare questo prodotto, leggere le Informazioni sulla Sicurezza.

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

Пред да се инсталира овој продукт, прочитајте информацијата за безбедност.

Les sikkerhetsinformasjonen (Safety Information) før du installerer dette produktet.

Przed zainstalowaniem tego produktu, należy zapoznać się z książką "Informacje dotyczące bezpieczeństwa" (Safety Information).

Antes de instalar este produto, leia as Informações sobre Segurança.

Перед установкой продукта прочтите инструкции по технике безопасности.

Pred inštaláciou tohto zariadenia si pečítaje Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

Antes de instalar este producto, lea la información de seguridad.

Läs säkerhetsinformationen innan du installerar den här produkten.

Statement 1:

DANGER

Electrical current from power, telephone, and communication cables is hazardous.

To avoid a shock hazard:

- **Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.**
- **Connect all power cords to a properly wired and grounded electrical outlet.**
- **Connect to properly wired outlets any equipment that will be attached to this product.**
- **When possible, use one hand only to connect or disconnect signal cables.**
- **Never turn on any equipment when there is evidence of fire, water, or structural damage.**
- **Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.**
- **Connect and disconnect cables as described in the following table when installing, moving, or opening covers on this product or attached devices.**

To Connect:	**To Disconnect:**
1. Turn everything OFF.	1. Turn everything OFF.
2. First, attach all cables to devices.	2. First, remove power cords from outlet.
3. Attach signal cables to connectors.	3. Remove signal cables from connectors.
4. Attach power cords to outlet.	4. Remove all cables from devices.
5. Turn device ON.	

Statement 2:

CAUTION:
When replacing the lithium battery, use only IBM Part Number 25R8118 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

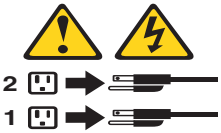
Do not:

- **Throw or immerse into water**
- **Heat to more than 100°C (212°F)**
- **Repair or disassemble**

Dispose of the battery as required by local ordinances or regulations.

Statement 5:

CAUTION:
The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



WARNING: Handling the cord on this product or cords associated with accessories sold with this product will expose you to lead, a chemical known to the State of California to cause cancer, and birth defects or other reproductive harm. ***Wash hands after handling.***

ADVERTENCIA: El contacto con el cable de este producto o con cables de accesorios que se venden junto con este producto, pueden exponerle al plomo, un elemento químico que en el estado de California de los Estados Unidos está considerado como un causante de cancer y de defectos congénitos, además de otros riesgos reproductivos. ***Lávese las manos después de usar el producto.***

Contents

Figures

Chapter 1. Introduction

Thank you for purchasing an IBM® ServeRAID™ controller. This *Installation Guide* provides the information needed to:

- Install your controller
- Configure your controller
- Install device drivers and ServeRAID utility programs

Packaged with this *Installation Guide* is the *IBM ServeRAID Support* CD that helps you configure hardware, install device drivers, and install utility programs (except ServeRAID Manager). The *IBM ServeRAID Support* CD provides detailed information about this controller. See "ServeRAID Publications" on page 10 for more information.

Also included is the *IBM ServeRAID Applications* CD, which you can use to install the ServeRAID Manager application.

Your controller comes with a one-year limited warranty. If you have access to the World Wide Web, you can obtain up-to-date information about your controller model and other IBM xSeries™ server products from the IBM Web site at http://www.ibm.com/systems/x/

Controller Features

The standard features of the ServeRAID-8i, ServeRAID-8k, ServeRAID-8k-l, and ServeRAID-8s controllers are as follows.

Notes:

1. See the *IBM ServeRAID User's Reference* on the *IBM ServeRAID Support* CD for additional information about logical drives and RAID levels.

2. The number of logical drives varies according to the firmware level and stripe-unit size.

Feature	ServeRAID-8i	ServeRAID-8k	ServeRAID-8k-l	ServeRAID-8s
Battery-backup cache	Yes	Yes	No	Yes (optional)
Cache memory	256 MB	256 MB	32 MB (no I/O cache)	256 MB
Hard disk drives (max.)	64	64	64	128
Logical drives (max.)	24 **Note:** While the ServeRAID-8i supports 24 logical drives, it only supports 10 logical drives per physical drive. You would need 3 physical drives to create 24 logical drives.	24 **Note:** While the ServeRAID-8k supports 24 logical drives, it only supports 10 logical drives per physical drive. You would need 3 physical drives to create 24 logical drives.	24 **Note:** While the ServeRAID-8k-l supports 24 logical drives, it only supports 10 logical drives per physical drive. You would need 3 physical drives to create 24 logical drives.	24 **Note:** While the ServeRAID-8s supports 24 logical drives, it only supports 10 logical drives per physical drive. You would need 3 physical drives to create 24 logical drives.
Microprocessor	Intel IOP321 600MHz	n/a	n/a	Intel IOP333 800MHz
Channels/Ports	0	0	0	2 **Note:** Second internal port is not used.
Transfer speed (max.)	3 Gbps	3 Gbps	3 Gbps	3 Gbps
Supported RAID levels	0, 1, 1E, 5, 5EE, 6, 10, 50, 60	0, 1, 1E, 5, 6, 10	0, 1, 10	0, 1, 1E, 5, 6, 10, 50
Interface bus	PCIx: 64 bit at 66 to 133 MHz	DDR2: 64 bit at 533 MHz	DDR2: 64 bit at 533 MHz	PCIe x8 at 2.5 Gbps

ServeRAID-8i Serial-Attached SCSI (SAS) Controller

The ServeRAID-8i controller (Part Numbers 13N2227 and 39R8729) has no independent SAS ports. It must be used with an IBM xSeries server that contains an integrated SAS controller.

Note: In the event of a power outage or failure, the battery-backup cache protects the data stored in the ServeRAID cache memory when using the write-back setting of the write-cache mode.

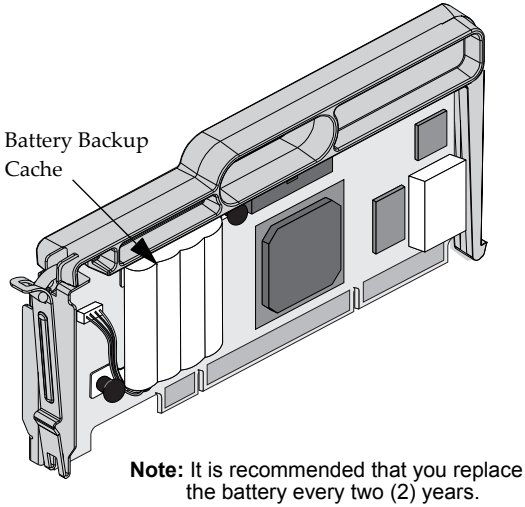


Figure 1. ServeRAID-8i controller

Note: The ServeRAID-8i controller uses the module containing a lithium battery.

WARNING:

The battery ships from the factory 30% charged. It takes 4 to 6 hours to initially charge the battery cell. The controller's cache will be set by the firmware to write-through mode until the battery is charged to an acceptable level. The user can set the cache mode manually using ACU or ServeRAID Manager, after the battery has been initially charged.

Statement 2:

CAUTION:
When replacing the lithium battery, use only IBM Part Number 25R8118 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- **Throw or immerse into water**
- **Heat to more than 100°C (212°F)**
- **Repair or disassemble**

Dispose of the battery as required by local ordinances or regulations.

ServeRAID-8k Serial-Attached SCSI (SAS) Controller

The ServeRAID-8k controller (Part Number 25R8064) is a Serial-Attached SCSI (SAS) device with a 256 megabye unbuffered DIMM that connects directly to specific IBM planar designs to provide full RAID capabilities. It is capable of supporting up to three (3) EXP3000 external enclosures.
The ServeRAID-8k controller comes with a battery-backup cache that connects to the server chassis.

Note: In the event of a power outage or failure, the battery-backup cache protects the data stored in the ServeRAID cache memory when using the write-back setting of the write-cache mode.

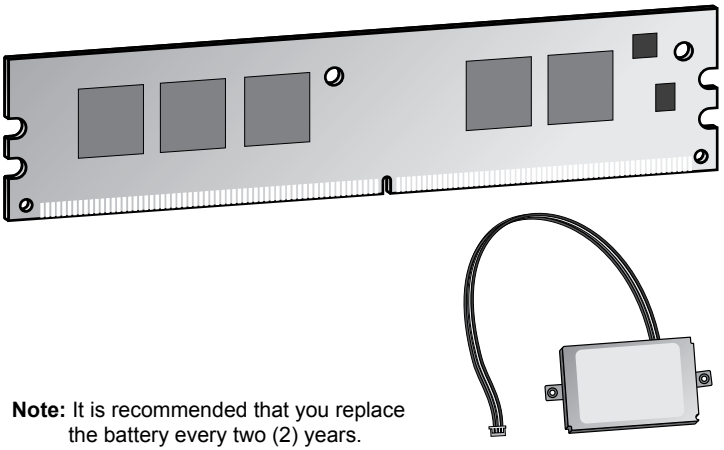


Figure 2. ServeRAID-8k controller and backup battery

Note: The ServeRAID-8k controller uses the module containing a lithium battery.

WARNING:

The battery ships from the factory 30% charged. It takes 4 to 6 hours to initially charge the battery cell. The controller's cache will be set by the firmware to write-through mode until the battery is charged to an acceptable level. The user can set the cache mode manually using ACU or ServeRAID Manager, after the battery has been initially charged.

Statement 2:

CAUTION:
When replacing the lithium battery, use only IBM Part Number 25R8088 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- **Throw or immerse into water**
- **Heat to more than 100°C (212°F)**
- **Repair or disassemble**

Dispose of the battery as required by local ordinances or regulations.

ServeRAID-8k-l Serial-Attached SCSI (SAS) Controller

The ServeRAID-8k-l controller is a Serial-Attached SCSI (SAS) device (standard on many systems) with a 32 megabyte unbuffered DIMM that connects directly to specific IBM planar designs to provide limited RAID capabilities..

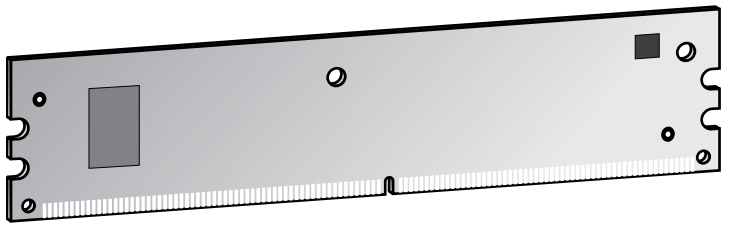


Figure 3. ServeRAID-8k-l controller

ServeRAID-8s Serial-Attached SCSI (SAS) Controller

The ServeRAID-8s controller (IBM Part Number 39R8812) is a Serial-Attached SCSI (SAS) controller with 256 MB DDR2, one internal SAS connector that can be direct-attached to SAS or SATA disk drives or attached to a backplane (the second internal SAS connector is not used), and one external mini-SAS connector to support up to three (3) EXP3000 expansion enclosures. A battery-backup module is available as an option.

Note: In the event of a power outage or failure, the battery-backup cache protects the data stored in the ServeRAID cache memory when using the write-back setting of the write-cache mode.

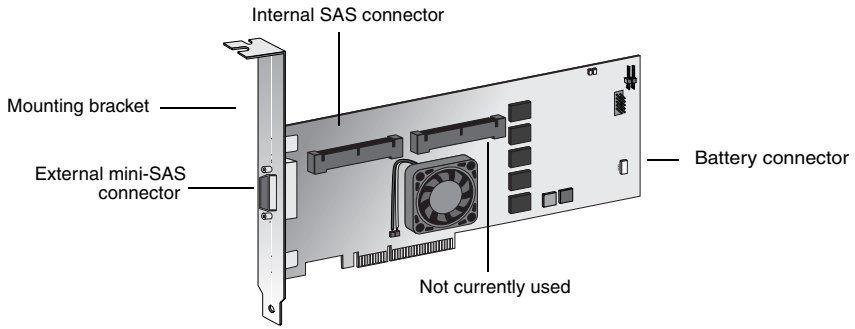


Figure 4. ServeRAID-8s controller

Note: The ServeRAID-8s controller has the option for a backup battery module containing a lithium battery. (The optional battery part number is IBM Part Number 39R8812. However, if you order a replacement battery, the replacement battery part number is IBM Part Number 25R8118.)

WARNING:

The battery ships from the factory 30% charged. It takes 4 to 6 hours to initially charge the battery cell. The controller's cache will be set by the firmware to write-through mode until the battery is charged to an acceptable level. The user can set the cache mode manually using ACU or ServeRAID Manager, after the battery has been initially charged.

Statement 2:

CAUTION:
When replacing the lithium battery, use only IBM Part Number 25R8118 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- **Throw or immerse into water**
- **Heat to more than 100°C (212°F)**
- **Repair or disassemble**

Dispose of the battery as required by local ordinances or regulations.

Notices and Statements Used in this Book

The caution and danger statements that appear in this book are also in the multilingual *Safety Information Book*, which is on the *IBM Documentation* CD that comes with your server. Each statement is numbered for reference to the corresponding statement in the *Safety Information Book*.

The following types of notices and statements are used in this book:

- **Note:** These notices provide important tips, guidance, or advice.
- **Important:** These notices provide information or advice that might help you avoid inconvenient or problem situations.
- **Attention:** These notices indicate possible damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage could occur.
- **Caution:** These statements indicate situations that can be potentially hazardous. A caution statement is placed just before the description of a potentially hazardous procedure step or situation.

- **Danger:** These statements indicate situations that can be potentially lethal or extremely hazardous. A danger statement is placed just before the description of a potentially lethal or extremely hazardous procedure step or situation.

Working Inside the Server with the Power On

Your server supports hot-plug, hot-add, and hot-swap devices and is designed to operate safely while turned on with the cover removed. Follow these guidelines when you work inside a server that is turned on:

- Avoid loose-fitting clothing on your forearms. Button long-sleeved shirts before working inside the server. Do not wear cuff links while you are working inside the server.
- Do not allow your necktie or scarf to hang inside the server.
- Remove jewelry, such as bracelets, necklaces, rings, and loose-fitting wrist watches.
- Remove items from your shirt pocket (such as pens or pencils) that could fall into the server as you lean over it.
- Avoid dropping any metallic objects, such as paper clips, hair pins, or screws, into the server.

Handling Static-Sensitive Devices

Attention: Static electricity can damage electronic devices, including your server. To avoid damage, keep static-sensitive devices in their static-protective packages until you are ready to install them.

To reduce the possibility of damage from electrostatic discharge, observe the following precautions:

- Limit your movement. Movement can cause static electricity to build up around you.
- Handle the device carefully, holding it by its edges or its frame.
- Do not touch solder joints, pins, or exposed circuitry.
- Do not leave the device where others can handle and damage it.
- While the device is still in its static-protective package, touch it to an unpainted metal part of the server for at least 2 seconds. This drains static electricity from the package and from your body.
- Remove the device from its package and install it directly into the server without setting down the device. If it is necessary to set down the device, place it back into its static-protective package. Do not place the device on your server cover or on a metal surface.

- Take additional care when handling devices during cold weather. Heating reduces indoor humidity and increases static electricity.

ServeRAID Publications

The following books are available in Portable Document Format (PDF) on the *IBM ServeRAID Support* CD in the BOOKS directory:

- *IBM ServeRAID User's Reference* (SRAID.PDF)
- *IBM Installation Guide: ServeRAID-8i, ServeRAID-8k, ServeRAID-8k-l, and ServeRAID-8s SAS Controllers* (INSTALL.PDF)

Note: Use Adobe Acrobat Reader to view these files.

Chapter 2. Installing and Configuring the ServeRAID-8i, ServeRAID-8k, ServeRAID-8k-l, and ServeRAID-8s Controllers

This chapter covers the following steps in the ServeRAID installation process:

Step 1. Obtaining ServeRAID updates
Step 2. Installing the ServeRAID-8i, ServeRAID-8k, ServeRAID-8k-l, or ServeRAID-8s controller
Step 3. Updating BIOS and firmware code
Step 4. Configuring the ServeRAID controller

Obtaining ServeRAID Updates

IBM periodically makes updated versions of the ServeRAID software available from the IBM Support page on the World Wide Web.

Note: If you download ServeRAID software, you must download and install *all* ServeRAID software at the same time. This will ensure that all levels of the software are compatible. The ServeRAID software includes:

- BIOS and firmware code
- Device drivers
- ServeRAID Manager program
- Command-line programs

Go to http://www-304.ibm.com/jct01004c/systems/support

If you do not have access to the World Wide Web, contact your place of purchase, your IBM reseller, or your IBM marketing representative for replacement CDs.

Installing the ServeRAID-8i Controller

Attention: If you plan to install a ServeRAID-8i controller in a server that contains data, back up the data first. When the ServeRAID-8i controller is installed, you will lose access to any data or applications on physical drives connected to the integrated SAS controller.

Review "Handling Static-Sensitive Devices" on page 9.

Installation Procedure

During the installation, you might need a small, flat-blade screwdriver and the documentation that comes with your server.

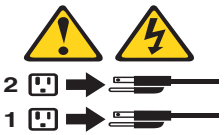
Complete the following steps to install the ServeRAID-8i controller:

1. Review "Safety" on page iii and the *Safety Information Book* provided with your server.
2. Turn off the server and disconnect all power cords and cables from the server.

   Statement 5:

   CAUTION:
   The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.

3. Remove the server cover and locate the PCI explansion slot on the motherboard. The expansion slot for the ServeRAID-8i card is located toward the back of the server, next to the Super I/O card.

   Note: You may need to remove one of the slot dividers for easy access to the expansion slot.

4. Touch the static-protective package containing the controller to an unpainted metal part of the server for at least 2 seconds. This discharges any static electricity from the package and your body.

5. Holding the controller by the edges, remove it from the static-protective package. Do not touch any exposed components on the controller.
6. Connect the battery cable to the power source on the controller (see Figure 5).

WARNING:

The battery ships from the factory 30% charged. It takes 4 to 6 hours to initially charge the battery cell. The controller's cache will be set by the firmware to write-through mode until the battery is charged to an acceptable level. The user can set the cache mode manually using ACU or ServeRAID Manager, after the battery has been initially charged.

7. Insert the controller into the PCI slot. Press the controller firmly into the slot so that it is fully seated.

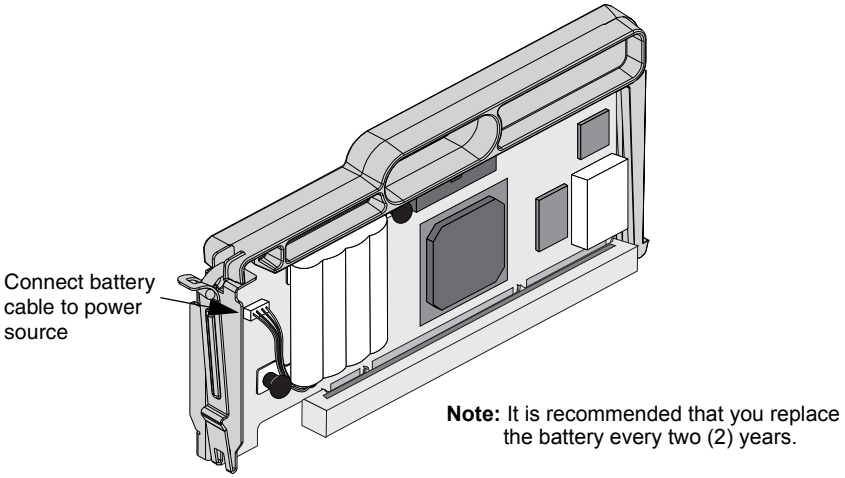


Figure 5. Inserting a ServeRAID-8i controller into the PCI expansion slot

8. If you have physical drives to install, install them now. See your server documentation for drive installation instructions.
9. Replace the server cover.
10. Reconnect the cables and cords. See your server documentation if you need detailed instructions.
11. Go to "Updating BIOS and Firmware Code" on page 20.

Installing the ServeRAID-8k Controller

Attention: If you plan to install a ServeRAID-8k controller in a server that contains data, back up the data first. When the ServeRAID-8k controller is installed, you will lose access to any data or applications on physical drives connected to the integrated SAS controller.

Review “Handling Static-Sensitive Devices” on page 9.

Installation Procedure

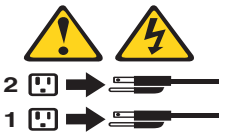
During the installation, you might need a small, flat-blade screwdriver and the documentation that comes with your server.

Complete the following steps to install the ServeRAID-8k controller:

1. Review “Safety” on page iii and the *Safety Information Book* provided with your server.
2. Turn off the server and disconnect all power cords and cables from the server.

Statement 5:

CAUTION:
The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



3. Remove the server cover and locate the memory slot on the motherboard..
4. Touch the static-protective package containing the controller to an unpainted metal part of the server for at least 2 seconds. This discharges any static electricity from the package and your body.
5. Holding the controller by the edges, remove it from the static-protective package. Do not touch any exposed components on the controller.

6. Insert the controller into the memory slot. Press the controller firmly into the slot so that it is fully seated.
7. Secure and connect the backup battery (refer to your server documentation for the battery installation procedure).

   Note: It is recommended that you replace the battery every two years.

   WARNING:

   The battery ships from the factory 30% charged. It takes 4 to 6 hours to initially charge the battery cell. The controller's cache will be set by the firmware to write-through mode until the battery is charged to an acceptable level. The user can set the cache mode manually using ACU or ServeRAID Manager, after the battery has been initially charged.
8. Replace the server cover.
9. Reconnect the cables and cords. See your server documentation if you need detailed instructions.
10. Go to "Updating BIOS and Firmware Code" on page 20.

Installing the ServeRAID-8k-l Controller

Attention: If you plan to install a ServeRAID-8k-l controller in a server that contains data, back up the data first. When the ServeRAID-8k-l controller is installed, you will lose access to any data or applications on physical drives connected to the integrated SAS controller.

Review "Handling Static-Sensitive Devices" on page 9.

Installation Procedure

During the installation, you might need a small, flat-blade screwdriver and the documentation that comes with your server.

Complete the following steps to install the ServeRAID-8k-l controller:

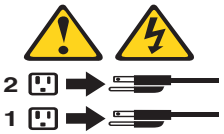
1. Review "Safety" on page iii and the *Safety Information Book* provided with your server.

2. Turn off the server and disconnect all power cords and cables from the server.

   Statement 5:

   CAUTION:
   The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.

3. Remove the server cover and locate the memory slot on the motherboard.
4. Touch the static-protective package containing the controller to an unpainted metal part of the server for at least 2 seconds. This discharges any static electricity from the package and your body.
5. Holding the controller by the edges, remove it from the static-protective package. Do not touch any exposed components on the controller.
6. Insert the controller into the memory slot. Press the controller firmly into the slot so that it is fully seated.
7. Replace the server cover.
8. Reconnect the cables and cords. See your server documentation if you need detailed instructions.
9. Go to “Updating BIOS and Firmware Code” on page 20.

Installing the ServeRAID-8s Controller

Attention: If you plan to install a ServeRAID-8s controller in a server that contains data, back up the data first. When the ServeRAID-8s controller is installed, you will lose access to any data or applications on physical drives connected to the integrated SAS controller.

Review “Handling Static-Sensitive Devices” on page 9.

Installation Procedure

During the installation, you might need a small, flat-blade screwdriver and the documentation that comes with your server.

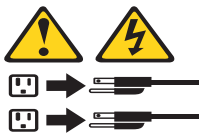
Complete the following steps to install the ServeRAID-8s controller:

1. Review “Safety” on page iii and the *Safety Information Book* provided with your server.
2. Turn off the server and disconnect all power cords and cables from the server.

   Statement 5:

   CAUTION:
   The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.

3. 

4. Remove the server cover and locate the PCIe x8 slot.
5. Remove the expansion slot cover, if applicable.
6. Touch the static-protective package containing the controller to an unpainted metal part of the server for at least 2 seconds. This discharges any static electricity from the package and your body.

7. Holding the controller by the edges, remove it from the static-protective package. Do not touch any exposed components on the controller.

8. If you are installing a backup battery, place and connect it now (see "Installing the Backup Battery for ServeRAID-8s" on page 19 for battery installation instructions).

   Note: It is recommended that the battery be replaced every two years.

   WARNING:

   The battery ships from the factory 30% charged. It takes 4 to 6 hours to initially charge the battery cell. The controller's cache will be set by the firmware to write-through mode until the battery is charged to an acceptable level. The user can set the cache mode manually using ACU or ServeRAID Manager, after the battery has been initially charged.

9. Insert the controller into the PCIe slot x8. Press the controller firmly into the slot so that it is fully seated.

10. Secure the controller by either tightening the expansion-slot screw on the top of the controller or closing the latch, depending on your server.

11. If you are connecting the controller either directly to SAS or SATA disk drives or to a backplane, connect the SAS cable to the SAS internal connector on the controller and connect the other end to the backplane or the SAS/SATA drives.

12. Replace the server cover.

13. Reconnect the cables and cords. See your server documentation if you need detailed instructions.

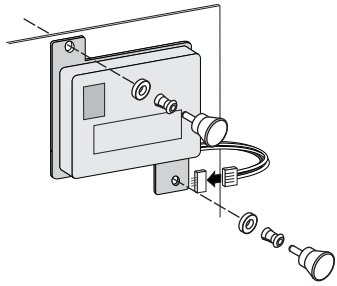
14. Go to "Updating BIOS and Firmware Code" on page 20.

Installing the Backup Battery for ServeRAID-8s

1. Using the appropriate static protection, remove the controller from your computer.

2. Position the battery module with the label facing towards you (that is, battery module facing away from the controller).

3. Align the battery module with the corresponding holes on the controller, and secure it in place using the fasteners provided (as shown at right).



4. Plug the connector cable into the battery connector on the controller.

5. Reinstall the controller.

6. Restart your computer.

   When you restart, your computer screen remains blank while the controller initializes the new battery module. This may take a few minutes. When initialization is complete, the boot process continues as expected.

   You must allow this initialization process to complete. If you do not, your battery module wil not work and your system may not boot. Note that this process occurs only once—it does not occur on subsequent restarts.

7. The battery module is now installed and automatically starts charging. It may take several hours to fully charge the battery.

   When the battery is fully charged, you may want to enable the option to write back cache only when the battery is charged. You can do so using the Adaptec RAID Controller utility or Adaptec Storage Manager. Refer to the IBM ServeRAID Manager User's Guide or the ServeRAID Manager online help for details.

Updating BIOS and Firmware Code

You must have the latest BIOS and firmware code installed on your server before configuring the ServeRAID controller

Complete the following steps to update the levels of BIOS and firmware code:

1. Insert the *IBM ServeRAID Support* CD into the server CD-ROM drive, and turn on the server.

   The IBM ServeRAID ROM (read-only memory) Update wizard automatically starts. The IBM ServeRAID ROM Update wizard is a program that updates the BIOS and firmware code on ServeRAID controllers. The wizard automatically identifies and scans each ServeRAID controller.

   If the BIOS and firmware code require updating, a report screen opens with the following information:

   - Controller types found.
   - Controller slot number, if known.
   - Firmware version.
   - BIOS version.
   - Update status. If a controller has outdated BIOS or firmware code, the IBM ServeRAID ROM Update wizard marks the controller as a candidate for update.

   The IBM ServeRAID ROM Update wizard asks if you want to update. You decide whether to update, but you must update all or none of the controllers in your server; you cannot selectively update.

2. If you want to update your ServeRAID controller, click **Update**. If the wizard detects an error, an error message appears and you are prompted to insert a diskette into your diskette drive. The wizard saves details about the error to a file on the diskette.

   If you do not want to update your ServeRAID controller, click **Cancel**.

3. ServeRAID automatically restarts the server after the update.

Upgrading SAS/SATA HostRAID to the ServeRAID Controller

Use the following procedures to import a RAID configuration from a HostRAID SAS/SATA controller to a ServeRAID-8i, ServeRAID-8k, ServeRAID-8k-l, or ServeRAID-8s controller.

Please note before you begin the upgrade:

- Only RAID level-0, RAID level-1, and Simple Volumes are supported.
- The verifying RAID level-1 will import and restart the Verify task.
- There is no hot spare support.
- Once a HostRAID configuration is merged or imported to a ServeRAID controller, it cannot return to HostRAID. All data stored on the array would be lost.
- Arrays that are clearing, degraded, rebuilding, or in a mixed state (one failed/degraded RAID level-1 and one optimal RAID level-1) cannot be imported.

Upgrading ServeRAID-8e SAS/SATA HostRAID to a ServeRAID-8i SAS Controller

To add a ServeRAID-8i controller to a server with an existing ServeRAID-8e HostRAID card, do the following:

1. Follow the instructions for "Installing the ServeRAID-8i Controller" on page 12 to install the ServeRAID-8i controller.

2. Power up the server. The BIOS will automatically detect and import the RAID as a "foreign array" and will display the following message:

```
"Following foreign arrays found".
    Array#0: RAIDxx
    Accept the configuration [Enter]
```

3. Press Enter to accept the configuration. The imported array configuration can be seen using the BIOS ACU utility, the bootable SeverRAID Manager, the OS-installed ServeRAID Manager, and the ARCCONF command line utility.

   Note: After you import the array, the OS will see the logical disk for the first time. You will need to follow your OS procedure for an imported array partition.

Configuring the ServeRAID Controller

This section provides information about starting and using the ServeRAID Manager program. You can use the ServeRAID Manager program to configure your ServeRAID controllers, view the ServeRAID configurations and associated devices, change controller settings, monitor your controllers, and more.

Using ServeRAID Manager

The ServeRAID Manager program operates in two ways:

- Bootable-CD mode
- As an installed software program

When you run the ServeRAID Manager program from the bootable *IBM ServeRAID Support* CD, you are using bootable-CD mode. Bootable-CD mode lets you configure your controller *before* you install your operating system. After you have configured the controller and installed the operating system, you also can use bootable-CD mode to change specific controller settings. For additional information, see "Fine-tuning your Configuration" on page 29.

To run the ServeRAID Manager program in bootable-CD mode, turn on the server; then, insert the *IBM ServeRAID Support* CD (or the CD that contains the ServeRAID Manager program that came with your server) into the CD-ROM drive.

If the ServeRAID Manager program detects unconfigured controllers and ready drives, the program automatically starts the Configuration wizard, and a window similar to the one shown in Figure 6 opens.

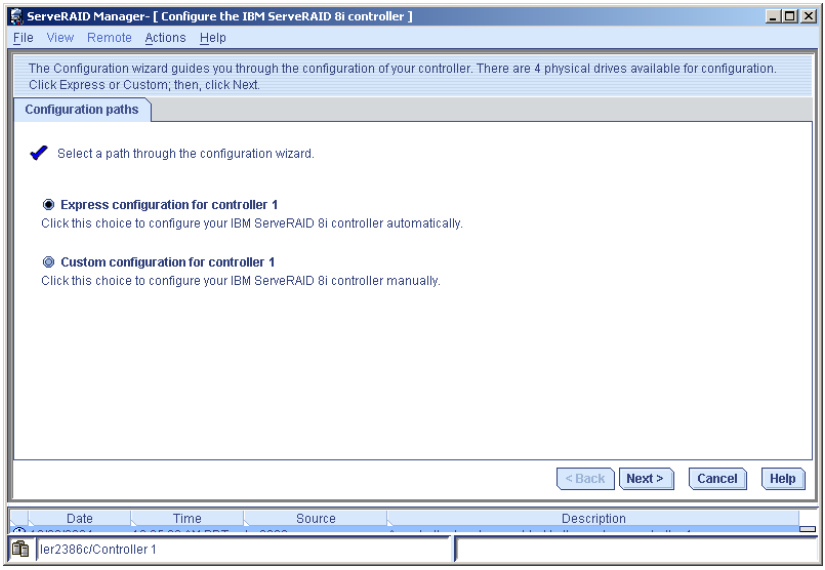


Figure 6. "Configuration wizard" window

You can use the Configuration wizard to create logical drives for your ServeRAID controller. The Configuration wizard provides two configuration options: Express and Custom. Express configuration automatically configures your ServeRAID controller. You can use Custom configuration to configure your controller manually. If you want to use RAID level-1E, level-5EE (ServeRAID-8i only), level-6, or level-x0, you must use Custom configuration. For more information about RAID levels, see "RAID technology overview" in the *IBM ServeRAID User's Reference* on the *IBM ServeRAID Support* CD.

Using Express Configuration

Express configuration automatically configures your ServeRAID controller. This feature:

- Creates logical drives by grouping together same-sized physical drives.
- Assigns a RAID level based on the number of physical drives in a logical drive:
  - A logical drive with two physical drives is assigned RAID level-1.
  - A logical drive with three or more physical drives is assigned RAID level-5.

Complete the following steps to use Express configuration:

1. In the ServeRAID Manager tree, click the ServeRAID controller that you want to configure.
2. From the toolbar, click  (`Create`).
3. Click **Express configuration**.
4. Click **Next**. The "Configuration summary" window opens.
5. Review the information that is displayed in the "Configuration summary" window. To change the configuration, click **Modify logical drives**.

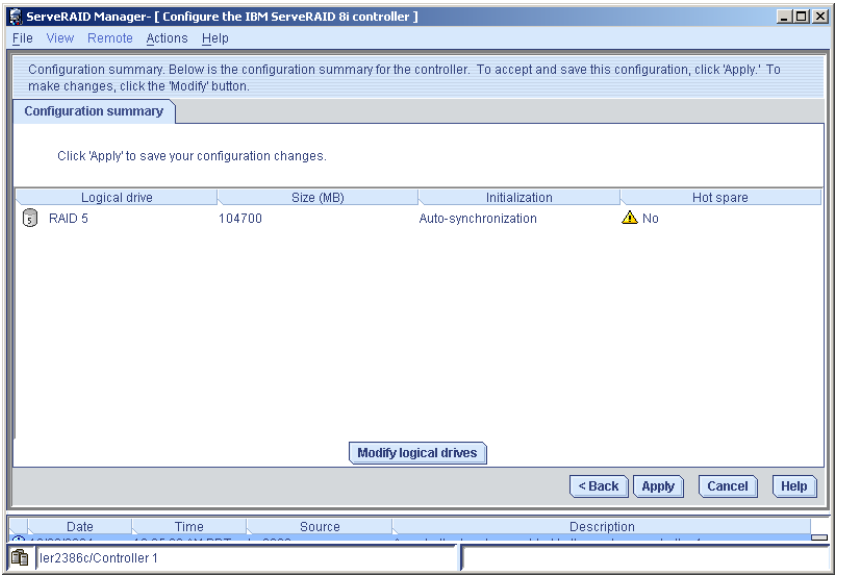


Figure 7. "Configuration summary" window (Express configuration)

Note: Some operating systems have size limitations for logical drives. Before you save the configuration, verify that the size of the logical drive is appropriate for your operating system.

6. Click **Apply**; then, click **Yes** when asked if you want to apply the new configuration. The configuration is saved in the ServeRAID controller and in the physical drives.
7. When you have completed configuring your controller, you can change certain controller settings. See "Fine-tuning your Configuration" on page 29 for more information. If you do not want to change any settings, exit from the ServeRAID Manager program, and remove the CD from the CD-ROM drive.
8. Restart the server.
9. Continue with Chapter 3. "Installing Device Drivers" on page 31.

   Note: If you are configuring your boot ServeRAID controller, you *must* install the device driver while installing the operating system.

Using Custom Configuration

Select Custom configuration to configure your controller manually. Complete the following steps to use Custom configuration:

1. In the ServeRAID Manager tree, click the ServeRAID-8i, ServeRAID-8k, ServeRAID-8k-l, or ServeRAID-8s controller.
2. From the toolbar, click  `(Create).`
3. Click **Custom configuration**.

4. Click **Next**. The “Create logical drives” window opens.

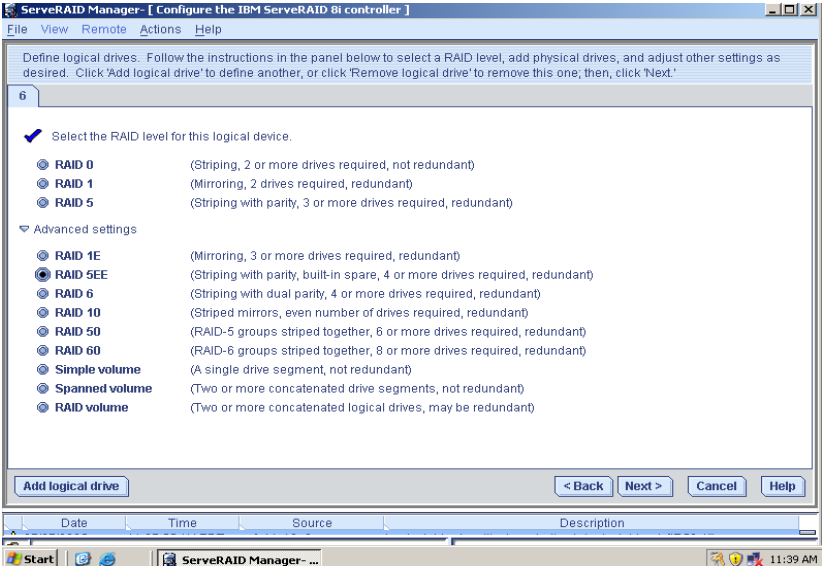


Figure 8. “Create logical drives” window

Note: The RAID levels shown in Figure 8 are for the ServeRAID-8i controller. Not all of these RAID levels are available for the ServeRAID-8k, ServeRAID-8k-l, or ServeRAID-8s.

5. Select a RAID level from the upper list or open the Advanced Settings menu to select a RAID level from the Advanced Settings list. (For more information, see “RAID technology overview” in the *IBM ServeRAID User’s Reference* on the *IBM ServeRAID Support* CD.)

   Note: If you are creating a RAID volume, you must create the individual drives first, then run the Configuration Wizard again to create the RAID volume. Redundant logical drives that auto synchronize must complete synchronization before they can be used to create a RAID volume.

6. Click Next to open the “Configure logical drives” window.

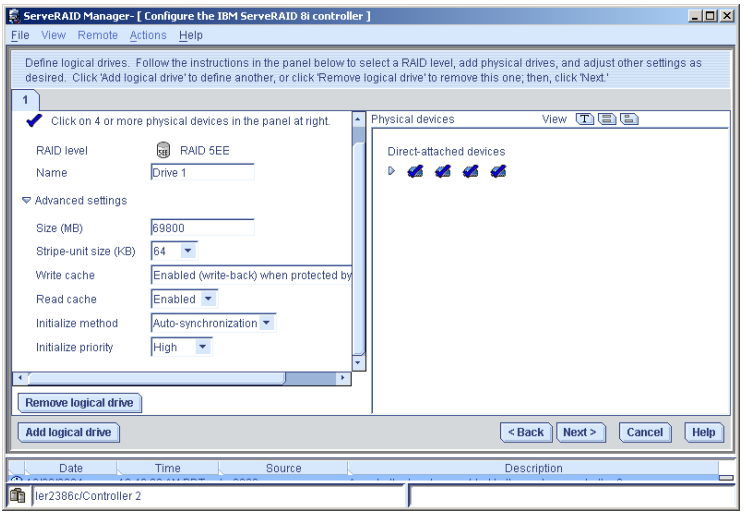


Figure 9. “Configure logical drives” window

7. Select the physical drives you want to include in the logical drive and modify the Advanced Settings as appropriate.

   Notes:

   a. Some operating systems have size limitations for logical drives. Before you save the configuration, verify that the size of the logical drive is appropriate for your operating system. For more detailed information, see your operating-system documentation.

   b. Typically, the first logical drive defined on the first ServeRAID controller found by system BIOS during startup will be your boot drive.

8. If you have free space available and want to create additional logical drives, click **Add logical drive**.

9. Repeat steps 5 through 7 for each logical drive that you want to define.

10. Click **Next**. The “Configuration summary” window opens.

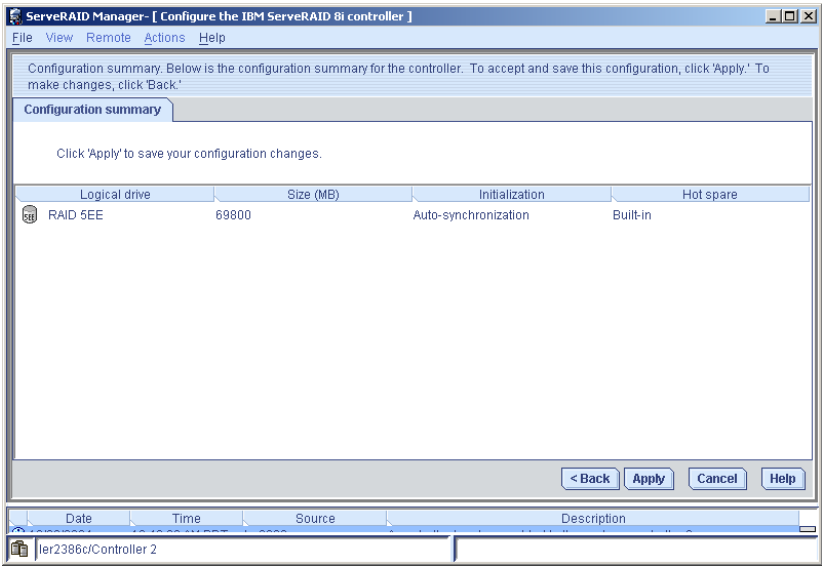


Figure 10. “Configuration summary” window (Custom configuration)

11. Review the information that is displayed in the “Configuration summary” window. To change the configuration, click **Back**.

12. Click **Apply**; then, click **Yes** when asked if you want to apply the new configuration. The configuration is saved in the ServeRAID controller and in the physical drives.

13. When you have completed configuring your controller, you can change certain controller settings. See “Fine-tuning your Configuration” on page 29 for more information. If you do not want to change any settings, exit from the ServeRAID Manager program, and remove the CD from the CD-ROM drive.

14. Restart the server.

15. Continue with Chapter 3. “Installing Device Drivers” on page 31.

    Note: If you are configuring your startup (boot) ServeRAID controller, you *must* install the device driver while installing the operating system.

Fine-tuning your Configuration

Before you store data on the controller, you might need to change the stripe-unit size and write-cache mode.

Changing the Stripe-Unit Size

The stripe-unit size determines the amount of data written to one segment of a logical drive before the next segment is used for subsequent data. Stripe-unit size is configured while creating the logical drive (see Figure 8). The ServeRAID-8i, ServeRAID-8k, ServeRAID-8k-l, andServeRAID-8s controllers support stripe-unit sizes of 16 KB, 32 KB, 64 KB, 128 KB, 256 KB, 512 KB, and 1024 KB (default is 256 KB). You can change the stripe-unit size of an existing logical drive by expanding or migrating the drive.

Note: The maximum supported stripe size for RAID 6 and RAID 60 is dependent on the number of drives in the array. In general, the more drives in the array the smaller the stripe size.

Complete the following steps to change the stripe-unit size:

1. In the Logical Devices view, right-click the logical drive you want to modify.
2. Click **Expand or change logical drive** to open the Configuration wizard.
3. Click **Next**. Expand **Advanced Settings** and select the new stripe-unit size for your logical drive

   Note: Consider your server application environment when you select the controller stripe-unit size setting.

Environment	Stripe-unit size
Groupware (such as Lotus® Notes® or Exchange)	128 KB
Transaction processing database	128 KB
Decision support database	128 KB
Thin client environments	128 KB
File server (Windows 2000, Windows 2003, Novell NetWare)	64 KB
File server (other)	64 KB
Web server	64 KB
Other	64 KB

Setting the Write-Cache Mode

Set the write-cache mode according to the planned use of each logical drive. For logical drives where read and write performance is important and data can be recovered, set the write-cache mode to write-back. For logical drives where read

and write performance is less important but data integrity is a high priority, set the write-cache mode to write-through.

To change the write-cache mode on a logical drive, complete the following steps:

1. In the ServeRAID Manager tree, right-click the logical drive.
2. Click **Configure write-cache**.

Setting the Read-Cache Mode

The read-cache mode enables and disables read caching. When read-caching is enabled, the controller monitors read access to the logical drive. If it detects a pattern, it pre-loads the cache with the data that seems most likely to be read next. The default is enabled.

To change the read-cache mode on a logical drive, complete the following steps:

1. In the ServeRAID Manager tree, right-click the logical drive.
2. Click **Configure read-cache**.

Chapter 3. Installing Device Drivers

This chapter contains information about the device drivers available for the ServeRAID-8i, ServeRAID-8k, ServeRAID-8k-l, or ServeRAID-8s controller and provides instructions for installing the device drivers on the following operating systems:

- Microsoft Windows 2000 Server and Advanced Server
- Microsoft Windows Server 2003 Standard Edition and Enterprise Edition
- Microsoft Windows Server 2003 for EM64T
- Microsoft Windows PE
- Novell NetWare 6.5
- Red Hat Enterprise Linux 3 AS/ES/WS for 32-bit kernels
- Red Hat Enterprise Linux 3 AS/ES for EM64T 64-bit kernels
- Red Hat Enterprise Linux 4 AS/ES/WS for 32-bit kernels
- Red Hat Enterprise Linux 4 AS/ES for EM64T 64-bit kernels
- Red Hat Enterprise Linux 5 AS/ES/WS for 32-bit kernels
- Red Hat Enterprise Linux 5 AS/ES for EM64T 64-bit kernels
- SuSE Linux Enterprise Server 9 for 32-bit kernels
- SuSE Linux Enterprise Server 9 for EM64T kernels
- SuSE Linux Enterprise Server 10 for 32-bit kernels
- SuSE Linux Enterprise Server 10 for EM64T kernels
- SuSE Linux Standard Desktop 9.0 (ServeRAID-8s only)
- SCO OpenServer 5.0.7
- SCO OpenServer 6.0
- SCO UnixWare 7.1.3
- SCO UnixWare 7.1.4
- Sun Solaris 10

The device drivers are contained on operating system-specific diskettes. You must create the diskettes using the *IBM ServeRAID Support* CD. For instructions for creating the diskettes, see "Creating Installation Diskettes" on page 32.

Important:
Verify that all levels of ServeRAID software installed on your server are compatible. In addition to device drivers, the ServeRAID software includes the following:

- BIOS and firmware code
- ServeRAID Manager program
- Command-line programs

If you download ServeRAID software from the World Wide Web, download and install *all* ServeRAID software at the same time.

When using:	Go to:
Windows	"Installing Device Drivers for Windows 2000 or Windows Server 2003" on page 34.
NetWare	"Installing Device Drivers for NetWare" on page 36.
Red Hat Linux	"Installing Device Drivers for Red Hat Linux" on page 38.
SuSE Linux	"Installing Device Drivers for SuSE Linux" on page 39.
SCO OpenServer	"Installing Device Drivers while Installing SCO OpenServer" on page 40
SCO UnixWare	"Installing Device Drivers while Installing SCO UnixWare" on page 43
Solaris	"Installing Drivers For Sun Solaris" on page 44

Creating Installation Diskettes

Use the instructions in this section to create installation diskettes for ServeRAID SAS controllers.

Diskette Images for ServeRAID-8i, ServeRAID-8k, ServeRAID-8k-l, and ServeRAID-8s SAS Controllers

Images for the diskettes are in the \DISKETTE\SAS directory of the *IBM ServeRAID Support* CD. You can find the specific diskette image names in the *readme.txt* file in the DISKETTE foler on the CD. Use these images to install the ServeRAID-8i, ServeRAID-8k, ServeRAID-8k-l, and ServeRAID-8s SAS controllers on the supported operating systems.

Creating Diskettes on Windows

Complete the following steps to create a diskette:

1. Insert the *IBM ServeRAID Support* CD into the CD-ROM drive.
2. Insert a blank diskette into the diskette drive.
3. Open a DOS window.
4. At the command prompt, type the following and press Enter:

   `e:\diskette\tools\rawrite32 e:\diskette\diskettetype\disketteimage a:`

   where
   - *e* is the drive letter for the CD-ROM drive.
   - *diskettetype* is sas.
   - *disketteimage* is the name of the diskette image.
   - *a* is the drive letter for the diskette drive.
5. Remove the CD from the CD-ROM drive.
6. Remove the diskette from the diskette drive and label the diskette appropriately.

Creating Diskettes on Linux or UNIX

Complete the following steps to create a diskette:

1. Insert the *IBM ServeRAID Support* CD into the CD-ROM drive.
2. Insert a blank diskette into the diskette drive.
3. At a command prompt, mount the CD-ROM drive by typing one of the following:

For Linux	`mount -t iso9660 /dev/cdromdevicefile /mountpoint`
For OpenServer	`mount -r -f ISO9660 /dev/cdromdevicefile /mountpoint`
For UnixWare	`mount -f cdfs /dev/cdromdevicefile /mountpoint`
For Solaris	`mount -F hsfs -o ro/dev/dsk/cdromdevicefile /mountpoint`

   where *cdromdevicefile* is the specific device file for the CD-ROM block device, and *mountpoint* is the mountpoint of the CD-ROM drive.
4. Press Enter.

5. At the command prompt, type the following:

   ```
   dd if=/mountpoint/diskette/diskettetype/disketteimage
   of=/dev/diskettedevicefile bs=32k
   ```

   where

   - *mountpoint* is the mountpoint of the CD-ROM drive.
   - *diskettetype* is sas.
   - *disketteimage* is the name of the diskette image.
   - *diskettedevicefile* is the specific device file for the diskette block device.
6. Press Enter.
7. Unmount the CD-ROM drive. Type the following and press Enter:

   ```
   umount /mountpoint
   ```

   where *mountpoint* is the mointpoint of the device file used in step .
8. Remove the CD from the CD-ROM drive.
9. Remove the diskette from the diskette drive and label the diskette appropriately.

Installing Device Drivers for Windows 2000 or Windows Server 2003

Use the following instructions to:

- Install device drivers while installing Windows 2000 or Windows Server 2003
- Update device drivers after installing Windows 2000 or Windows Server 2003

Installing Device Drivers while Installing Windows 2000 or Windows Server 2003

Complete these steps to install the ServeRAID device driver for ServeRAID-8i, ServeRAID-8k, ServeRAID-8k-l, and ServeRAID-8s controllers while installing Windows 2000 or Windows Server 2003:

1. Insert the appropriate *Windows* CD into the CD-ROM drive; then, restart the server.
2. A few seconds after restarting the server, when the message

   ```
   Press F6 if you need to install a third party SCSI or RAID driver...
   ```

   is displayed, press F6.

   Note: This message is displayed immediately after the screen changes from black to blue. You have only a few seconds to press F6.

3. After loading some files, Windows will display a screen where you can manually specify a controller. When this screen is displayed, press the S key to specify additional devices.
4. When prompted to insert the manufacturer-supplied hardware support disk, insert the appropriate ServeRAID support diskette into the diskette drive; then, press Enter.
5. From the menu, select the appropriate controller and operating system; then, press Enter. A message similar to the following displays:

   ```
   Setup is loading files (IBM ServeRAID 8i Controller (Windows Server 2003
   Servers))...
   ```

6. When prompted, press Enter to continue.
7. Follow the instructions provided by Windows to complete the normal installation process.
8. After you complete the installation, install the latest operating system service pack.

Updating Device Drivers after Installing Windows 2000 or Windows Server 2003

Complete these steps to update the ServeRAID device driver after installing Windows 2000 or Windows Server 2003:

1. Insert the appropriate ServeRAID support diskette into the diskette drive.
2. Click **Start → Programs → Administrative Tools → Computer Management**. The Computer Management window opens.
3. In the left pane, click **Device Manager**.
4. In the right pane, click the SCSI adapters and RAID controllers to display all the controllers in the server.
5. (Windows 2000 only) Right-click the ServeRAID controller in the tree; then, click **Properties**. The Properties window opens. Do the following:

   a. Click the **Driver** tab; then, click **Update Driver**. The Update Device Driver Wizard opens.

   b. Click **Next**.

   c. Select **Display a list of the known drivers**; then, click **Next**. Continue with step 7.

6. (Windows Server 2003 only) Right-click the ServeRAID controller in the tree; then, click **Update Driver**. The Update Device Driver Wizard opens. Do the following:

   a. Select **Install from a list or specific location**; then, click **Next**.

   b. Select **Don't search, I will choose driver to install**; then, click **Next**. Continue with step 7.

7. Click **Have Disk**.
8. In the **Copy manufacturer's files from** field, type:

   a:\

   where *a* is the diskette drive letter.
9. Click **OK**; the Select a Device Driver window opens.
10. In the **Models** list box, select the appropriate ServeRAID controller; then, click **Next**.
11. The Start Device Driver Installation window opens; click **Next**.
12. After the device driver is installed, remove the diskette or the CD from the drive, and restart the server.

Installing Device Drivers for NetWare

Use the following instructions to:

- Install device drivers while installing NetWare
- Install *or* update device drivers after installing NetWare

For information about creating the NetWare diskette, see "Creating Installation Diskettes" on page 32.

Installing Device Drivers while Installing NetWare

Complete these steps to install the ServeRAID device driver while installing NetWare:

1. Use the instructions provided in the NetWare manual to begin the installation.
2. When the `Choose the Server Drivers - Disk Driver` prompt appears during the installation process, select **Storage adapters**; then, press Enter.
3. If the list contains the ServeRAID SAS driver (aac-netware.img), select the driver; then, press the Delete key to delete it.
4. Press the Insert key twice to **Add an unlisted driver**.
5. Insert the support diskette for Novell NetWare.

6. Press F3 to specify a path; then, type the following and press Enter:

   ```
   a:\
   ```

   where *a* is the diskette drive letter.

7. Verify that the driver name displays in the list of device drivers that appears in the window; then, select **Return to Driver Summary** and press Enter.
8. Select **Continue**; then, press Enter.
9. Follow the instructions in the NetWare manual to complete the installation.

Installing or Updating Device Drivers after Installing NetWare

Note: If the device driver is already installed, do the following before starting this procedure:

1. From the system console, type the following and press Enter:

   ```
   Unload driver_name
   ```

   where *driver_name* is the name of the SAS driver

   For example:

   ```
   Unload xxxRAID
   ```

   Warnings about mounted volumes may display in the console window. Type 'Y' for 'Yes" to unload the module anyway.

2. **Do not restart the system**; go to step 1 in the following instructions.

Complete these steps to install or update the ServeRAID device driver after installing NetWare 6.5:

1. Start the NetWare hdetect utility program. From the system console, type the following and press Enter:

   ```
   load hdetect
   ```

2. Insert the ServeRAID support diskette for Novell NetWare into the diskette drive.
3. When you see the prompt "Sys volume not mounted. Load driver anyway?", select **Yes**; then, press Enter to continue.
4. The device driver window opens, showing a list of storage adapters. Select **Modify**.
5. Press Enter to continue; then, select **Modify**.
6. Select the driver; then, press the Del (Delete) key to delete it.
7. When the next window opens, press the Ins (Insert) key twice to add a driver.
8. When the next window opens, press F3 to specify a different path.

9. In the **Specify a directory path** field, type the following and press Enter:

   ```
   a:\
   ```

   where *a* is the diskette drive letter.

10. After the installation program copies all the files, press Esc to exit the hdetect utility.

    Note: If you want NetWare to load the ServeRAID device driver automatically during startup, you must add the appropriate LOAD command to the NetWare startup command file (usually C:\NWSERVER\STARTUP.NCF). The command has the form:

    ```
    load [pathname]driver slot=number [options]
    ```

    For example:

    ```
    load c:\nwserver\ipsraid.ham slot=1
    ```

Installing Device Drivers for Red Hat Linux

Use the following instructions to:

- Install device drivers while installing Red Hat Linux
- Install *or* update ServeRAID SAS device drivers after installing Red Hat Linux

For information about creating the diskettes, see "Creating Installation Diskettes" on page 32.

Installing Device Drivers while Installing Red Hat Linux

Complete these steps to install the ServeRAID device driver while installing Red Hat Linux:

1. Insert the *Red Hat Installation* CD into the CD-ROM drive.
2. Turn on or restart the server.
3. Type:

   ```
   linux dd
   ```

   and any other options for your installation (for example, if you are installing to an x366 server, you may need to type `acpi=noirq` in addition to the boot command); then, press Enter.

4. Follow the prompts to complete the installation. Insert the ServeRAID driver diskette when prompted.

Installing or Updating Device Drivers after Installing Red Hat Linux

Complete these steps to install or update device drivers after installing Red Hat Linux:

Note: You must use the ServeRAID support CD to update the driver; you cannot update the driver from diskette.

1. Insert the *IBM ServeRAID Support* CD into the CD-ROM drive.
2. Mount the CD-ROM drive.
3. Type the following and press Enter:

   Note: ServeRAID rpm files have an embedded version string in the file name. The string may differ from the example below, so be sure to check the file name on the CD. To avoid typing a specific verison number in the `rpm` command, use a wildcard in the version string field:

   ```
   rpm -U /mountpoint/linux/sas/driver/aacraid*.rpm
   ```

Installing Device Drivers for SuSE Linux

Use the following instructions to:

- Install device drivers while installing SuSE Linux Enterprise Server
- Install *or* update ServeRAID SAS device drivers after installing SuSE Linux Enterprise Server

For information about creating the diskette, see "Creating Installation Diskettes" on page 32.

Installing Device Drivers while Installing SuSE Linux Enterprise Server

Complete these steps to install the ServeRAID device driver while installing SuSE Linux Enterprise Server:

1. Insert the SuSE Enterprise Linux installation CD 1 into the CD-ROM drive.
2. Turn on or restart the server.
3. At the installation screen:
   a. Choose Installation.
   b. Press the F6 key for Driver Update.
   c. Press Enter.

4. Follow the prompts to complete the installation, inserting the ServeRAID driver diskette when prompted.

Installing or Updating Device Drivers after Installing SuSE Linux

Complete these steps to install or update device drivers after installing SuSE Linux:

Note: You must use the ServeRAID support CD to update the driver; you cannot update the driver from diskette.

1. Insert the *IBM ServeRAID Support* CD into the CD-ROM drive.
2. Mount the CD-ROM drive.
3. Type the following and press Enter:

   Note: ServeRAID rpm files have an embedded version string in the file name. The string may differ from the example below, so be sure to check the file name on the CD. To avoid typing a specific verison number in the `rpm` command, use a wildcard in the version string field:

   ```
   rpm -U /mountpoint/linux/sas/driver/aacraid*.rpm
   ```

   ```
   Installing device drivers while installing SuSE Linux Desktop
   ```

Installing Device Drivers for SCO OpenServer

Use the following instructions when you do one of the following:

- Install device drivers while installing SCO OpenServer
- Install *or* update device drivers after installing SCO OpenServer

You will need the *IBM ServeRAID Support for SCO OpenServer* diskette. For information about creating the diskette, see "Creating Installation Diskettes" on page 32.

Installing Device Drivers while Installing SCO OpenServer

Adding AACRAID at Startup Time

Complete the following steps to install the ServeRAID device driver for SCO OpenServer 5.0.7:

1. At the `BOOT` prompt, type the following and press Enter:

   ```
   link
   ```

2. After the kernel loads but before it runs, the `link` program prompts you to insert the *IBM ServeRAID Support for SCO OpenServer* diskette.

   Keep the *IBM ServeRAID Support for SCO OpenServer* diskette available. You will need it to configure the device driver into the link kit.

3. When prompted, insert the *IBM ServeRAID Support for SCO OpenServer* diskette. When prompted for the name of the package, type the following and press Enter:

   ```
   aacraid
   ```

   For additional information about adding a boot-time loadable driver at boot time, refer to "Using Boot-Time Loadable Drivers" in the *SCO OpenServer Handbook*.

4. Use the instructions provided in the SCO manual to complete the installation process.

Installing or Updating Device Drivers after Installing SCO OpenServer

Complete the following steps to install or update device drivers after installing SCO OpenServer:

1. Start the server in system maintenance mode, and log in as `ROOT`.

2. Type the following and press Enter:

   ```
   installpkg
   ```

3. Select the diskette drive into which you will insert the installation diskette.

4. When prompted, insert the *IBM ServeRAID Support for SCO OpenServer* diskette.

5. When prompted for the name of the package, type the following and press Enter:

   ```
   aacraid
   ```

6. To relink the kernel (as described in "Relinking the kernel" in the *SCO OpenServer Handbook*), type the following command and press Enter:

   ```
   cd /etc/conf/cf.d
   ```

7. Type the following and press Enter:

   ```
   ./link_unix
   ```

8. After the kernel rebuilds, the following message appears:

   ```
   The UNIX kernel has been rebuilt.
   Do you want this kernel to boot by default?
   ```

   To continue, type `y`

   The system backs up the old kernel by moving /unix to /unix.old.

9. When the system asks for the kernel environment to be rebuilt, type `y`

   The system will respond with a message.

10. Remove the *IBM ServeRAID Support for SCO OpenServer* diskette from the diskette drive.

11. Shut down the server; then, restart the server.

Installing Device Drivers for SCO UnixWare

Use the following instructions when you do one of the following:

- Install device drivers while installing SCO UnixWare
- Install *or* update device drivers after installing SCO UnixWare

You will need the *IBM ServeRAID Support for SCO UnixWare and Open UNIX* diskette. For information about creating the diskette, see "Creating Installation Diskettes" on page 32.

Installing the Device Drivers while Installing SCO UnixWare

Complete the following steps to install the ServeRAID device drivers while installing SCO UnixWare:

1. Use the instructions provided with SCO UnixWare to begin the installation.

2. When a message appears asking if you want to install any HBA diskettes, insert the *IBM ServeRAID Support for SCO UnixWare and Open UNIX* diskette; then, select **Install HBA diskette**.

3. Use the instructions provided in the SCO manual to complete the normal installation process.

Installing or Updating Device Drivers after Installing SCO UnixWare

Use the following instructions when you do one of the following:

- Use the UnixWare Pkgadd to install or upgrade the ServeRAID device drivers after installing UnixWare.
- Use the UnixWare SCOAdmin utility program to install or upgrade the ServeRAID device drivers after installing UnixWare.

Using Pkgadd to Install Device Drivers

Complete the following steps to install or upgrade ServeRAID device drivers using the Pkgadd utility program:

1. Insert the *IBM ServeRAID Support for SCO UnixWare and Open UNIX* diskette into the diskette drive.

2. Type the following and press Enter:

   ```
   pkgadd –d /dev/dsk/f0t
   ```

3. When the message `Insert diskette into Floppy Drive 1` appears, press Enter.

4. When the message `Installation of IBM ServeRAID SCSI IHV HBA (ips) was successful` appears, type the following and press Enter:

   ```
   q
   ```

5. After the device driver is installed, shut down and restart the server.

Using SCOAdmin to Install Device Drivers

Complete the following steps to install or upgrade ServeRAID device drivers using the SCOAdmin utility program:

1. Insert the *IBM ServeRAID Support for SCO UnixWare and Open UNIX* diskette into the diskette drive.

2. Start the SCOAdmin utility program by typing `SCOADMIN` at the system prompt.

3. Click **Software_Management**.

4. Click **Application Installer**.

5. Click the **Install From** tab.

6. Click **Disk_A**.

7. If nothing appears in the window, click **Update View**.

8. When the icon labeled "aac" appears in the window, click **Install**.

After the device driver is installed, remove the diskette from the diskette drive; then, shut down and restart the server.

Installing Drivers For Sun Solaris

Use the following instructions to:

- Install device drivers while installing Sun Solaris
- Install *or* update ServeRAID SAS device drivers after installing Sun Solaris

For information about creating the diskettes, see "Creating Installation Diskettes" on page 32.

Installing Device Drivers while Installing Sun Solaris

Complete the following steps to install ServeRAID device drivers while installing Sun Solaris:

1. Boot from the Sun Solaris Installation CD.

2. When the menu displays, press **5** for *5. Apply driver updates*.

3. Insert the *IBM ServeRAID Support for Sun Solaris* diskette into the floppy disk drive and press **f** for *Floppy.*

4. After the driver has loaded, press **e**, then Enter to continue the installation.

Installing or Updating Device Drivers after Installing Sun Solaris

Complete the following steps to install or update ServeRAID device drivers after installing Sun Solaris:

1. Boot the system, and insert the *IBM ServeRAID Support for Sun Solaris* diskette into the floppy disk drive.

2. Mount the floppy.

   a. If Volume Management is active (it should be), you can mount the floppy with the following command:

      ```
      volcheck /mointpoint
      ```

      where *mountpoint* is usually /floppy/floppy0.

   b. If Volume Management is not active, you can mount the floppy using the following command:

      ```
      mount –F pcfs /dev/diskettedevicefile  /mountpoint
      ```

      where *diskettedevicefile* is usually diskette0 and *mountpoint* is usually /floppy/floppy0.

3. Go to:

   ```
   /mountpoint/DU/sol_210/i86pc/Tools
   ```

4. Install the driver with the following command:

   ```
   ./install.sh –i
   ```

   This should overwrite the older in-box driver.

5. To check that the right driver is installed, type:

   ```
   pkginfo –l SUNWaac
   ```

6. Reboot system to activate the new driver.

Chapter 4. Installing and Starting the ServeRAID Manager Program

After installing the operating system and device drivers on your server, you can install the ServeRAID Manager program. The ServeRAID Manager program provides a graphical interface that you can use while your server is running. You can use the interface to perform the following tasks:

- Monitor ServeRAID configuration changes
- Perform configuration functions, including create a logical drive, delete a logical drive, change the RAID level, dynamically increase the logical drive size, and rebuild a logical drive.

For information about using the ServeRAID Manager program, see the ServeRAID Manager online help or "Configuring the ServeRAID Controller" on page 22.

Installing the ServeRAID Manager Program

This section provides instructions for installing the ServeRAID Manager program.

When using:	Go to:
Windows	"Installing ServeRAID Manager on Windows 2000 or Windows Server 2003" on page 48.
NetWare	"Installing ServeRAID Manager on NetWare" on page 50.
Linux	"Installing ServeRAID Manager on Red Hat Linux or SuSE Linux" on page 50.
OpenServer	"Installing ServeRAID Manager on OpenServer" on page 51
UnixWare	"Installing ServeRAID Manager on UnixWare" on page 52
Solaris	"Installing ServeRAID Manager on Solaris" on page 54
VMWare	"Installing ServeRAID Manager on VMWare" on page 54

Installing ServeRAID Manager on Windows 2000 or Windows Server 2003

Notes:

1. When installed on Windows 2000 or Windows Server 2003, this version of the ServeRAID Manager program supports up to 16 ServeRAID controllers.

2. If a previous version of the ServeRAID Manager program is installed on your server, you must remove that version before upgrading to the new version. All customization files (such as the Managed tree system nodes and the Notification list) are saved and used in the upgrade. To remove the ServeRAID Manager program from the Windows operating system on your server, use the Add/Remove Programs wizard.

Complete the following steps to install the ServeRAID Manager program on Windows 2000 or Windows Server 2003:

1. Insert the *IBM ServeRAID Applications* CD into the CD-ROM drive.
2. When the installation program starts, follow the instructions on the screen to install the program.

Windows Unattended Installation

Use the following procedure to perform an unattended (“silent”) installation under the Windows operating system. An unattended installation uses command line parameters to complete the installation without messages or user interaction.

1. Insert the *IBM ServeRAID Applications* CD into the CD-ROM drive.
2. Open a command prompt window and change to the CD-ROM directory.
3. Install ServeRAID Manager using the following command line string:

```
windows\manager\setup.exe /s /v"/qn ADDLOCAL=[option(s)] USERNAME=[specific
username] PASSWORD=[password] INSTALLDIR=[path] REBOOT=[option]"
```

The command line options are described in the following table:

Command	Description and Options
ADDLOCAL=	Specifies the features to install. Options include: **ALL** (Default. Installs all features) **Manager,ConsoleAndAgent,AACFilterDriver,AACSupport,ASMFiles,IBMFiles,HelpFiles,JRE32,SNMPSupport** (Installs ServeRAID Manager. All components of this string are required for ServeRAID Manager except SNMPSupport, which is optional.) **SRMReadme** (Installs the readme file) **ManagementStation** (not applicable) **FlashCopy,FlashCopyAgent,FlashCopyCli** (Installs FlashCopy. All components of this string are required.)
USERNAME=	Specifies the username to login to the Management Station (required only when Management Station is installed).
PASSWORD=	Specifies the password to login to the Management Station (required only when Management Station is installed).
INSTALLDIR=	Specifies the installation directory (required only if you want to install ServeRAID Manager to a directory other than the default). If you choose to set a path, it must be enclosed in parentheses (for example, INSTALLDIR="\C:\my path with spaces\").
REBOOT=	Determines if the setup will reboot the system upon completion. Options include: **Force** (Default. Forces a reboot upon completion of installation) **Supress** (suppresses a reboot when any files that were in use during installation could not be overwritten) **ReallySuppress** (completely suppresses any reboot actions)

Example command strings:

- The user wants to install the ServeRAID Manager with SNMP support and Readme:

```
windows\manager\setup.exe /s /v"/qn
ADDLOCAL=Manager,ConsoleAndAgent,AACFilterDriver,AACSupport,ASMFiles,IBMF
iles,HelpFiles,JRE32,SNMPSupport,SRMReadme"
```

- The user wants to install all available features and suppress the reboot at the end of installation:

```
windows\manager\setup.exe /s /v"/qn ADDLOCAL=ALL REBOOT=ReallySupress"
```

After a minute or two the silent install should be complete and the ServeRAID Manager icons should be accessible.

Installing ServeRAID Manager on NetWare

Note: The NetWare version of the ServeRAID Manager program supports up to 16 ServeRAID controllers.

Complete the following steps to install the ServeRAID Manager program on Novell NetWare:

1. Insert the *IBM ServeRAID Applications* CD into the CD-ROM drive.
2. From the command-line prompt, type the following command and press Enter:

   ```
   load cdrom
   ```

3. To determine the CD-ROM volume, from the command-line prompt, type the following command and press Enter:

   ```
   volumes
   ```

4. To start the installation, from the command-line prompt, type the following command and press Enter:

   ```
   [volume]\netware\manager\install
   ```

   where [*volume]* is the CD-ROM volume identified in Step 3..

   The installation program starts.

5. Follow the instructions on the screen to install ServeRAID Manager.

Installing ServeRAID Manager on Red Hat Linux or SuSE Linux

Notes: 1. The ServeRAID Manager program comes with the Sun Java Runtime Environment (JRE).

2. If the ServeRAID Manager program has previously been installed on your server, you must remove that version before upgrading. All customization files (such as Managed system tree nodes and the Notification list) are saved and used in the upgrade. To remove the ServeRAID Manager program from Linux, type the following command:

   ```
   rpm --erase RaidMan
   ```

3. When installed on Linux, this version of the ServeRAID Manager program supports up to 12 ServeRAID controllers.

Complete the following steps to install the ServeRAID Manager program on Red Hat Linux or SuSE Linux:

1. Insert the *IBM ServeRAID Applications* CD into the CD-ROM drive.
2. If your CD-ROM drive automounts, type the following command and go to step 6. Otherwise, go to step 3.

   ```
   rpm --install /mnt/cdrom/linux/manager/RaidMan-v.rr.i386.rpm
   ```

   where *v* is the ServeRAID version number, and *rr* is the ServeRAID release number.
3. If your CD-ROM drive does *not* automount, type the following command and press Enter:

   ```
   mount -r -t iso9660 /dev/cdromdevicefile /mountpoint
   ```

   where *cdromdevicefile* is the specific device file for the CD-ROM block device, and *mountpoint* is the mount point of the CD filesystem.
4. Type the following command and press Enter:

   ```
   rpm --install /mountpoint/linux/manager/RaidMan-v.rr.i386.rpm
   ```

   where *mountpoint* is the mount point used in step 3, *v* is the ServeRAID version number, and *rr* is the ServeRAID release number.
5. When the installation is complete, type the following command:

   ```
   umount /mountpoint
   ```

   where *mountpoint* is the mount point of the Linux system.
6. Press Enter. You can now remove the CD from the CD-ROM drive.

Installing ServeRAID Manager on OpenServer

Notes:

1. When installed in OpenServer, this version of the ServeRAID Manager program supports up to 12 ServeRAID controllers.
2. To install or remove the ServeRAID Manager package, you *must* have root privileges.
3. If ServeRAID Manager is installed on your system, you must remove the old version before upgrading. All customization files (such as Managed system tree nodes and the Notification list) are saved and used in the upgrade. To remove the ServeRAID Manager program from OpenServer, type the following command:

   ```
   pkgrm RaidMan
   ```

Complete the following steps to install the ServeRAID Manager program in OpenServer.

Note: The ServeRAID Manager program requires that you install either the Java Development Kit (JDK) for SCO operating systems or the Java Runtime Environment (JRE) for SCO operating systems, version 1.3.1. You can download the JDK and JRE from the Caldera Web site at http://www.caldera.com/download/.

1. Insert the *IBM ServeRAID Applications* CD into the CD-ROM drive.
2. Type the following command and press Enter:

   ```
   mount -r -f HS,lower /dev/cd0 /mnt
   ```

3. Type the following command and press Enter:

   ```
   cd /mnt/openserv6/manager
   ```

4. Type the following command and press Enter:

   ```
   sh ./mgr_inst
   ```

5. When the installation is complete, type the following command and press Enter:

   ```
   cd /
   ```

6. Unmount the CD-ROM drive. Type the following command and press Enter:

   ```
   umount /mnt
   ```

You can now remove the CD from the CD-ROM drive.

Installing ServeRAID Manager on UnixWare

Notes:

1. The ServeRAID Manager program requires that you install either the JDK for SCO operating systems, versions 1.1.7b or 1.1.3u, or the JRE for SCO UNIX operating systems, version 1.3.0. You can download the JDK and JRE from the SCO Web site at http://www.caldera.com/download/.
2. To install or remove the ServeRAID Manager package, you *must* have root privileges.
3. If the ServeRAID Manager program has previously been installed on your server, you must remove that version before upgrading. All customization files (such as Managed system tree nodes and the

Notification list) are saved and used in the upgrade. To remove the ServeRAID Manager program from UnixWare, type the following command:

```
pkgrm RaidMan
```

4. When installed in UnixWare, the current version of the ServeRAID Manager program supports up to 12 ServeRAID controllers.

Complete the following steps to install the ServeRAID Manager program for UnixWare:

1. Insert the *IBM ServeRAID Applications* CD into the CD-ROM drive.

2. Type the following command and press Enter:

   ```
   mount -r -F cdfs /dev/cdrom/cdromdevicefile /mnt
   ```

   where `cdromdevicefile` is the specific device file for the CD-ROM block device. Look in the /dev/cdrom directory to determine what *cdromdevicefile* is on your server, for example, c0b0t010.

3. Type the following command and press Enter:

   ```
   cd /mnt/unixware/manager
   ```

4. Type the following command and press Enter:

   ```
   ./mgr_inst
   ```

5. When the installation is complete, type the following command and press Enter:

   ```
   cd /
   ```

6. Unmount the CD-ROM drive. Type the following command and press Enter:

   ```
   umount /mnt
   ```

You can now remove the CD from the CD-ROM drive.

Installing ServeRAID Manager on Solaris

Note: If a previous version of ServeRAID Manager is installed on your system, you must remove it before beginning this installation. Any customization files you created with the previous version are saved and used in the upgrade. To remove ServeRAID Manager, type `pkgrm RaidMan` .

1. Insert the *IBM ServeRAID Applications* CD.

   The CD mounts automatically. (If it doesn't, manually mount the CD using a command similar to the one shown below. Refer to your operating system documentation for detailed instructions.)

   ```
   mount -F hsfs -o ro/dev/dsk/c1t0d0s2/mnt
   ```

2. Install ServeRAID Manager:

   ```
   pkgadd -d/<mount point>/solaris/manager/RaidMan.ds
   ```

3. Follow the on-screen instructions to complete the installation.

4. Eject or unmount the *IBM ServeRAID Applications* CD. Refer to your operating system documentation for detailed instructions.

Installing ServeRAID Manager on VMWare

Complete the following steps to install the ServeRAID Manager program on VMWare:

1. Insert the *IBM ServeRAID Applications* CD into the CD-ROM drive.
2. Type the following command to install the 32-bit Linux ServeRAID Manager on the VMWare ESX Server:

   ```
   rpm -ivh RaidMan-8.40.i386.rpm
   ```

3. Once installation is complete, navigate to the `/usr/RaidMan` directory and locate a script called `tweak.pl`. Use this script to disable the security of the ServeRAID Manager agent so that ServeRAID Manager running on a client can connect remotely. To turn off the local agent's security, type:

   ```
   tweak.pl auth false
   ```

4. Install ServeRAID Manager on a Windows or Linux client.
5. From the client, connect to the ServeRAID Manager agent on the VMWare ESX Server using the management client.
6. When the configuration is finished, remember to reenable the security for the ServeRAID agent on the VMWare ESX Server using the management client.

   Note: The ServeRAID agent on the VMWare ESX Server cannot be monitored from a guest operating system.

Starting the ServeRAID Manager Program

After you have configured your ServeRAID controller, installed the device drivers, installed the operating system, and installed the ServeRAID Manager program on your server, you can administer and monitor your ServeRAID controllers, as well as modify the ServeRAID controller configuration.

Starting the ServeRAID Manager program in Windows 2000 or Windows Server 2003

To start the ServeRAID Manager program in the Windows 2000 or Windows Server 2003 operating system, click **Start → Programs → ServeRAID Manager → ServeRAID Manager**.
The ServeRAID Manager program opens, and a window similar to the one in the following illustration appears.

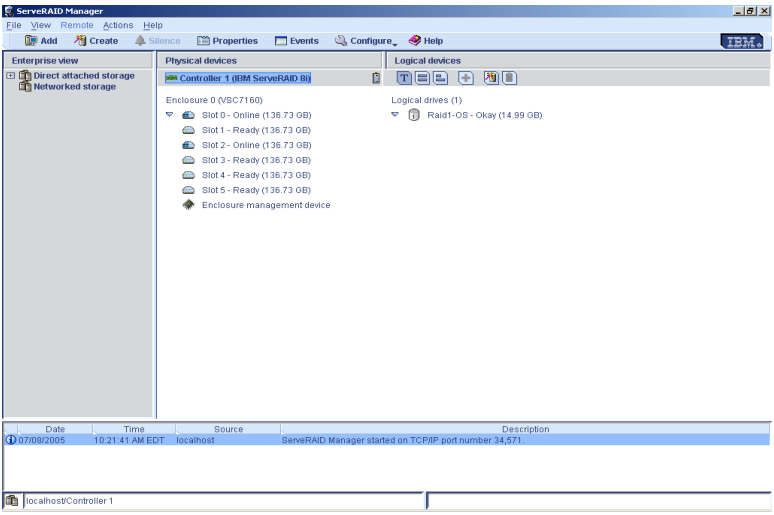


Figure 11. ServeRAID Manager window

Starting the ServeRAID Manager Program in NetWare

To start the ServeRAID Manager program in NetWare, type the following command from the NetWare console and press Enter:

```
LOAD RAIDMAN
```

The ServeRAID Manager program opens, and a window similar to the one shown in Figure 11 appears.

Starting the ServeRAID Manager Program in Linux, OpenServer, and UnixWare

Complete the following steps to start the ServeRAID Manager program in Linux, OpenServer, and UnixWare:

Note: Ensure that you have superuser privileges before starting these procedures.

1. To change to the directory where you installed the ServeRAID Manager program, type one of the following commands and press Enter.

For Linux	`cd /usr/RaidMan`
For OpenServer	`cd /opt/RaidMan`
For UnixWare	`cd /opt/RaidMan`

2. Type the following command and press Enter:

   ```
   sh RaidMan.sh
   ```

3. The ServeRAID Manager program opens, and a window similar to the one shown in Figure 11 on page 55 appears.

Note: (UnixWare only) When installed on UnixWare, the ServeRAID Manager program might list the installed ServeRAID controllers in a different order than the ServeRAID Manager program in bootable-CD mode. To identify a specific controller, refer to its physical slot number.

Starting the ServeRAID Manager Program in Solaris

1. Change to the directory where ServeRAID Manager is installed:

   ```
   cd /usr/RaidMan
   ```

2. Launch the ServeRAID Manager script:

   ```
   sh RaidMan.sh
   ```

Chapter 5. Solving ServeRAID Problems

This section provides basic troubleshooting information to help you resolve some common problems that might occur while setting up your ServeRAID controller.

If you cannot locate and correct the problem using the information in this section, see the "Solving ServeRAID problems" chapter of the *IBM ServeRAID User's Reference* on the *IBM ServeRAID Support* CD.

IBM ServeRAID Support CD Warning Message while Starting

If you start a server with the *IBM ServeRAID Support* CD in the CD-ROM drive, the following warning message might display:

```
You passed an undefined mode number.
Press <RETURN> to see video modes available,
<SPACE> to continue or wait 30 secs
```

Press the Spacebar to continue starting the *IBM ServeRAID Support* CD. Then, the following message displays and the CD starts:

```
Uncompressing Linux... Ok, booting the kernel.
```

ServeRAID Controller Messages

This section lists the ServeRAID messages that might appear during system startup.

All physical drives contain unique identifiers, such as the drive serial number and manufacturer. During configuration, the ServeRAID controller stores this information.

The following table lists messages associated with the ServeRAID subsystem in alphabetical order.

Message	Explanation	Action
No INT 13h device Found	Drives are not seen by the BIOS, although they are connected.	Either the drives are not powered or the cables are not intact. You must check the power and data cable connections

Message	Explanation	Action
The Disk Monitoring System has detected that the following drive(s) are operating outside of normal specification. It is advisable to immediately back up your data and replace your hard-disk drive(s) by calling your IBM service representative.	SMART failure reported.	Since the drive may fail anytime, it is recommended that you take a back up of the data and replace the drive.
Following SAS device(s) are not present or responding: Port#n WARNING!!! Configuration Change(s) detected!!! Press <Enter> to accept the current configuration or power off the system and check the drive connections.	When one or more drives in a logical drive is missing in the current boot, but was present during the previous boot, this message will be displayed	If you intentionally remove the drives, you can press <Enter> and accept the change. Otherwise it is advisable to power off the system and check the drive connections.
A logical drive that was connected to this port is missing. However a different drive is connected to the same port: Port#n WARNING!!! Configuration Change(s) detected!!! Press <Enter> to accept the current configuration or power off the system and check the drive connections.	When one or more drives are missing, but replaced with a different drive in place of a missing drive.	If you intentionally remove the drives, you can press <Enter> and accept the change. Otherwise it is advisable to power off the system and check the drive connections
Following SAS drive(s) are moved to different port(s) Port#m to Port#n	When one or more drives are moved around the system. For example, if the drive in port#0 is moved to port#1.	It is just a notification message and the BIOS automatically updates the configuration. No user interaction needed.
BIOS is Disabled	If the BIOS Int 13h support is disabled in the <Ctrl><A>, you will not be able to see any drives.	You have to enable the INT13h support inside the **<Ctrl><A>—>Serial Select —>Controller** configuration menu. NOTE: This message will only appear with supported platforms.

General Problems

The following tables describe general problems you might encounter, along with suggested solutions.

Problem	Suggested Solution
System does not boot from SAS controller.	Check the system basic input/output system (BIOS) configuration for PCI interrupt assignments. Make sure a unique interrupt is assigned for the RAID controller. Initialize the logical drive before installing the operating system.
One of the hard drives in the logical drive fails.	1. Check the SAS cables. 2. If the SAS Cables are OK, replace the drive.
A drive at a specific SAS ID fails repeatedly.	Replace the SAS cable.
After pressing **<Ctrl><A>** during bootup and trying to make a new configuration, the system hangs.	Replace the drive cable.
Pressing **<Ctrl><A>** does not display a menu.	A color monitor is required to display the BIOS utility menus.
At system POST (Power On Self Test) with the RAID controller installed, the BIOS banner display is garbled or does not appear at all.	Remove power from the system and verify that the RAID controller cache memory is properly installed. If the symptom persists, contact your IBM service representative for further assistance.
The logical drive status is displayed as Degraded. This is displayed next to the logical drive name during the POST. This could be due to one of the following: -- One of the members is failed (meaning IO failed). -- One of the member drives is missing. -- User forcibly failed a member in the OS application.	The logical drive can be turned back to online in any one of these ways: -- Enter the ACU by pressing **<Ctrl><A>** and then assign a spare if the member is missing or failed. This will automatically start a Rebuild operation. -- Insert the member back if it is missing. This will automatically start a Rebuild operation.

Problem	Suggested Solution
Two degraded logical drives are seen during the POST display along with the following message: "Warning!!! A configuration change detected!!! Following Arrays have Missing or Rebuilding or Failed Members and are critical". This error is shown when the controller does not detect some of the logical drive members because they are either missing or failed.	-- If the drives are missing, re-insert the missing drives. -- If the drives have failed, replace them. -- Or, assign a hotspare to the degraded drive (either missing or failed).

Operating System Problems

The following table describes operating system problems you might encounter, along with suggested solutions.

Problem	Suggested Solution
Driver does not appear in Device Manager	The Windows operating system may already be listing the controller under **Other Devices** instead of the **SCSI and RAID Controllers** section. 1. In **Device Manager**, look under **Other Devices** to see if it lists a PCI card or RAID controller. 2. If so, highlight this listing and click on the **Properties** button then click on the **Driver** tab. 3. Depending on your version of Windows, choose either **Change Driver** or **Update Driver**. 4. Follow the on-screen prompts to complete installation of the driver. If Windows asks if you want to test if the device can be removed safely, click on **Cancel**. 5. Reboot the system to complete installation of the driver.

Problem	Suggested Solution
"No Hard Drives Found" Message Appears During a CD Installation of the Windows operating system.	The **<F6>** key was not pressed at the appropriate time during installation. 1. Reboot the computer from the Windows Operating System CD. 2. When the message `Press F6 if you need to install third party SCSI or RAID driver` appears, press **<F6>**. 3. Follow the on-screen instructions to continue with the installation. If this does not correct the problem, verify device connectivity and logical device configuration.

Recovering from Problems Starting the ServeRAID Manager

Problem	Explanation	Action
The ServeRAID Manager program hangs on the splash screen.	You might be using an old version of the ServeRAID device driver.	Upgrade the ServeRAID device driver to the latest version. See the *IBM ServeRAID Device Driver Installation Instructions* on the *IBM ServeRAID Support* CD for more information.
When starting the ServeRAID Manager in NetWare, the following error message is displayed: `Unable to find load file RAIDMAN`	The ServeRAID Manager program was not installed to the root directory of the SYS volume.	Reinstall the ServeRAID Manager. If the installation is completed properly, there will be a directory called RAIDMAN under the root directory of the SYS volume.
When starting the ServeRAID Manager in NetWare, the following error message is displayed: `-autounload is an invalid parameter`	You are using an old version of the Java Virtual Machine (JVM) for Novell NetWare.	Download and install the latest JVM from the Novell Web site: http://developer.novell.com/ndk/download.htm

Problem	Explanation	Action

The ServeRAID Manager program fails to start, and the following error message is displayed:
 	
`Can't find class com.ibm.sysmgt.raidmgr .mgtGUI.Launch`
	Your TCP/IP hosts file is not configured for the local server hostname.	Configure your TCP/IP hosts file for the local server hostname.
		1. Open the /etc/hosts file.
		2. If TCP/IP networking is configured, do the following:
		a. If the hostname of the server is identified on the line starting with 127.0.0.1, remove the hostname from this line.
		b. On a new line, type the IP address of the server.
		c. Press the Tab key to the second column and type the fully qualified hostname.
		d. Press the Tab key to the third column and type the nickname for the server.
		Note: The following is an example of a completed line:
		`1.1.1.1 matrix.localdoma in matrix`
		where 1.1.1.1 is the IP address of the server and matrix is the hostname of the server.
		3. If TCP/IP networking is not configured, type the server name in the third column of the line that starts with 127.0.0.1.
		Note: The following is an example of a completed line:
		`127.0.0.1 localhost matrix`
		where matrix is the server name.
		4. Restart the server for these changes to take effect.

Chapter 6. Getting Help and Technical Assistance

If you need help, service, or technical assistance or just want more information about IBM products, you will find a wide variety of sources available from IBM to assist you. This chapter contains information about where to go for additional information about IBM and IBM products, what to do if you experience a problem with your xSeries or IntelliStation® system, and whom to call for service, if it is necessary.

Before You Call

Before you call, make sure that you have taken these steps to try to solve the problem yourself:

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system and any optional devices are turned on.
- Charge the RAID controller battery four to six hours.
- Use the troubleshooting information in your system documentation, and use the diagnostic tools that come with your system.
- Go to the IBM Support Web site at http://www.ibm.com/systems/support/ to check for technical information, hints, tips, and new device drivers.

You can solve many problems without outside assistance by following the troubleshooting procedures that IBM provides in the online help or in the publications that are provided with your system and software. The information that comes with your system also describes the diagnostic tests that you can perform. Most systems, operating systems, and programs come with information that contains troubleshooting procedures and explanations of error messages and error codes. If you suspect a software problem, see the information for the operating system or program.

Using the Documentation

Information about your IBM system and preinstalled software, if any, is available in the documentation that comes with your system. That documentation includes printed books, online books, README files, and help files. See the troubleshooting information in your system documentation for instructions for using the diagnostic programs. The troubleshooting information or the diagnostic programs might tell you that you need additional or updated device drivers or other software. IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates. To access these pages, go to http://www.ibm.com/systems/support/ and follow the

instructions. Also, some documents are available through the IBM Publications Center at http://www.ibm.com/shop/publications/order/.

Getting Help and Information from the World Wide Web

On the World Wide Web, the IBM Web site has up-to-date information about IBM systems, optional devices, services, and support. The address for IBM System x™ and xSeries® information is http://www.ibm.com/systems/x/. The address for IBM BladeCenter information is http://www.ibm.com/systems/bladecenter/. The address for IBM IntelliStation information is http://www.ibm.com/intellistation/.

You can find service information for your IBM products, including supported options, at http://www.ibm.com/systems/support/.

Software Service and Support

Through IBM Support Line, you can get telephone assistance, for a fee, with usage, configuration, and software problems with System x and xSeries servers, BladeCenter products, IntelliStation workstations, and appliances. For information about which products are supported by Support Line in your country or region, go to http://www.ibm.com/services/sl/products/.

For more information about Support Line and other IBM services, go to http://www.ibm.com/services/, or go to http://www.ibm.com/planetwide/ for support telephone numbers. In the U.S. and Canada, call 1-800-IBM-SERV (1--800-426-7378).

Hardware Service and Support

You can receive hardware service through IBM Services or through your IBM reseller, if your reseller is authorized by IBM to provide warranty service. Go to http://www.ibm.com/planetwide/ for support telephone numbers. In the U.S. and Canada, call 1-800-IBM-SERV (1--800-426-7378).

In the U.S. and Canada, hardware service and support is available 24 hours a day, 7 days a week. In the U.K., these services are available Monday through Friday, from 9 a.m. to 6 p.m.

IBM Taiwan product service

台灣 IBM 產品服務聯絡方式：
台灣國際商業機器股份有限公司
台北市松仁路 7 號 3 樓
電話：0800-016-888

IBM Taiwan product service contact information:

IBM Taiwan Corporation
3F, No 7, Song Ren Rd.
Taipei, Taiwan

Telephone: 0800-016-888

Appendix A. Compiling the ServeRAID Device Driver for a Red Hat Linux Kernel

Follow these instructions to use the latest ServeRAID device driver with a Red Hat Linux kernel version that is not included on the Red Hat Linux drivers diskette.

Note: Before you upgrade the kernel or driver, make sure you have a bootable system disk. To build a bootable system disk, insert a diskette into the floppy drive; then, type the following command and press Enter:

```
mkbootdisk --device /dev/fd0 <kernel-version>
```

If you are using a USB floppy, consult the documentation for your operating system.

Confirm that you can restart the server with this diskette.

Complete the following steps to compile the ServeRAID device driver for a Red Hat Linux kernel:

1. Login as root; then, make sure that the kernel source is installed:

   ```
   rpm -q kernel-source
   ```

2. If it is not installed, install it now.

3. Insert the IBM ServeRAID Support CD into the CD-ROM drive. Mount the CD-ROM drive:

   ```
   mount /mnt/cdrom
   ```

4. Type the following and press Enter:

   Note: ServeRAID rpm files have an embedded version string in the file name. The string may differ from the example below, so be sure to check the file name on the CD. To avoid typing a specific verison number in the `rpm` command, use a wildcard in the version string field:

   ```
   rpm --noscripts --force -i /mnt/linux/sas/driver/aacraid*.rpm
   ```

5. Change to the directory with the kernel source:

   ```
   cd /usr/src/<kernel-version>/drivers/scsi/aacraid
   ```

6. Extract the updated sources:

   ```
   tar -zxf /opt/Adaptec/aacraid/aacraid_source.tgz
   ```

7. Change back to the base directory for this kernel version and prepare the source tree:

```
cd /usr/src/<kernel-version>
make clean mrproper
```

8. Copy the appropriate config file from the /usr/src/<*kernel-version*>/configs directory to "config" :

```
cp configs/kernel-<x.x.x><-platform><-type>.config .config
```

Where <*x.x.x*> is the kernel version, <-*platform*> is -i686, -athlon, etc., and <-*type*> is the kernel type; for example, -smp or -bigmem (if any).

9. Run the kernel configuration utility:

```
make menuconfig
```

10. Select **SCSI Support → SCSI Low Level Drivers**. Scroll to the Adaptec AACRAID option; select **M**.

Note: If the server is configured with symmetric multi-processors (SMP), verify that the symmetric multi-processing support option is enabled in the Processor Type and Features menu.

11. Save the changes and exit.

12. Update the Makefile to reflect the kernel version you are running. Use any text editor to load /usr/src/<*kernel-version*>/Makefile; then, change the text on the EXTRAVERSION line to match the extraversion value of your kernel.

For example:

- The extraversion value of 2.4.9-34 is "-34".
- The extraversion of kernel 2.4.9-34smp is "-34smp".

Save the updated Makefile.

13. Build the SCSI modules; type the following commands:

For 2.4 kernels:

```
make dep
make SUBDIRS=drivers/scsi modules
```

For 2.6 kernels:

```
make dep
make all modules
```

14. After the compilations are finished, rename the old driver. Be sure you enter all of the following commands on the same line!

    For 2.4 kernels:

    ```
    mv /lib/modules/<kernel-version>/kernel/drivers/scsi/aacraid/aacraid.o
       /lib/modules/<kernel-version>/kernel/drivers/scsi/aacraid/aacraid.orig
    ```

    For 2.6 kernels:

    ```
    mv /lib/modules/<kernel-version>/kernel/drivers/scsi/aacraid/aacraid.ko
       /lib/modules/<kernel-version>/kernel/drivers/scsi/aacraid/aacraid.orig
    ```

15. Copy the newly compiled driver to the modules directory:

    For 2.4 kernels:

    ```
    cp drivers/scsi/aacraid/aacraid.o /lib/modules/<kernel-version>
    /kernel/drivers/scsi/aacraid/aacraid.o
    ```

    For 2.6 kernels:

    ```
    cp drivers/scsi/aacraid/aacraid.ko /lib/modules/<kernel-version>
    /kernel/drivers/scsi/aacraid.ko
    ```

16. Rename your current initial ramdisk:

    ```
    mv /boot/initrd-<kernel-version>.img /boot/initrd-<kernel-version>.old-img
    ```

17. Build a new initial ramdisk; type the following command and press Enter:

    ```
    mkinitrd /boot/initrd-<kernel-version>.img <kernel-version>
    ```

    (lilo users only) Restart lilo to ensure that it detects the new initial ramdisk:

    ```
    /sbin/lilo -v
    ```

18. Restart the operating system; the ServeRAID software displays the device driver version.

    Note: You can also examine /var/log/message or browse the directory of /proc/scsi/aacraid to determine the current version of the ServeRAID device driver.

Appendix B. Compiling the ServeRAID Device Driver for a SuSE Linux Kernel

Use the following instructions to use the latest ServeRAID device driver with a SuSE Linux kernel version that is not included on the SuSE Linux drivers diskette.

Note: Before you upgrade the kernel or driver, make sure you have a bootable system disk. To build a bootable system disk, insert a diskette into the floppy drive; then, type one of the following commands and press Enter:

For SuSE Linux Enterprise Server 9 SP3:

```
/sbin/yast2 bootfloppy &
```

For all other SuSE Linux versions:

```
/sbin/yast2 bootdisk &
```

Select **Standard boot floppy**; then, follow the instructions to complete the procedure. Confirm that you can restart the server with this diskette.

Complete the following steps to compile the ServeRAID device driver for a SuSE Linux kernel:

1. Login as root; then, make sure that kernel-source and ncurses-devel are installed:

   ```
   rpm -q kernel-source
   rpm -q ncurses-devel
   ```

   If these components are not installed, install them now.

2. Insert the IBM ServeRAID Support CD into the CD-ROM drive. Mount the CD-ROM drive:

   ```
   mount /media/cdrom
   ```

3. Type one of the following and press Enter:

   Note: ServeRAID rpm files have an embedded version string in the file name. The string may differ from the example below, so be sure to check the file name on the CD. To avoid typing a specific verison number in the `rpm` command, use a wildcard in the version string field:

   For SuSE Linux Enterprise Server 9 SP3:

   ```
   rpm --noscripts --force -i /mountpoint/linux/sas/driver/aacraid*.rpm.
   ```

For all other SuSE Linux versions:

```
rpm -noscripts -force -i /mountpoint/linux/sas/driver/aacraid*.rpm.
```

4. Change to the directory with the kernel source:

   ```
   cd /usr/src/<kernel-version>/drivers/scsi/aacraid
   ```

5. Extract the updated sources:

   For SuSE Linux Enterprise Server 9 SP3:

   ```
   tar -zvxf /opt/Adaptec/aacraid/aacraid_source.tgz
   ```

   For all other SuSE Linux versions:

   ```
   tar -zvf /opt/Adaptec/aacraid/aacraid_source.tgz
   ```

6. Change back to the base directory for this kernel version and prepare the source tree:

   ```
   cd /usr/src/<kernel-version>

   make clean
   ```

7. Prepare the kernel configuration:

   ```
   make cloneconfig
   ```

8. Run the kernel configuration utility:

   ```
   make menuconfig
   ```

9. Save the changes and exit.

10. Build the SCSI modules by typing the following commands:

    For 2.4 kernels

    ```
    make dep
    make SUBDIRS=drivers/scsi modules
    ```

    For 2.6 kernels

    ```
    make dep
    make all modules
    ```

Notes:

1. The `make dep` command may be unnecessary for SLES 9 SP3.
2. This module building process may take up to 30 minutes.

11. After the compilations are finished, rename the old driver. Be sure you enter all of the following commands on the same line!

    For 2.4 kernels:

    ```
    mv /lib/modules/<kernel-version>/kernel/drivers/scsi/aacraid/aacraid.o
       /lib/modules/<kernel-version>/kernel/drivers/scsi/aacraid/aacraid.orig
    ```

    For 2.6 kernels (SuSE Linux Enterprise Server 9 SP3):

    ```
    mv /lib/modules/<kernel-version>/kernel/drivers/scsi/aacraid.ko
       /lib/modules/<kernel-version>/kernel/drivers/scsi/aacraid.orig
    ```

    For 2.6 kernels (All other SuSE Linux versions):

    ```
    mv /lib/modules/<kernel-version>/kernel/drivers/scsi/aacraid/aacraid.ko
       /lib/modules/<kernel-version>/kernel/drivers/scsi/aacraid/aacraid.orig
    ```

12. Copy the newly compiled driver to the modules directory:

    For 2.4 kernels

    ```
    cp drivers/scsi/aacraid/aacraid.o /lib/modules/<kernel-
    version>/kernel/drivers/scsi/aacraid/aacraid.o
    ```

    For 2.6 kernels

    ```
    cp drivers/scsi/aacraid/aacraid.ko /lib/modules/<kernel-
    version>/kernel/drivers/scsi/aacraid.ko
    ```

13. Rename your current initial ramdisk:

    ```
    mv /boot/initrd /boot/initrd.old
    ```

14. Build a new initial ramdisk by typing the following command and pressing Enter:

    ```
    mk_initrd
    ```

    (lilo users only) Restart lilo to ensure that it detects the new initial ramdisk:

    ```
    lilo -v
    ```

15. Restart the operating system; the ServeRAID software displays the device driver version.

    Note: You can also examine /var/log/message or browse the directory of /proc/scsi/aacraid to determine the current version of the ServeRAID device driver.

Appendix C. Creating a Windows PE CD

To create a customized Windows Preinstallation Environment (WinPE) CD with IBM's ServeRAID drivers integrated into it, refer to the IBM ServerGuide Scripting Toolkit, version 1.3.04 - Servers at http://www-304.ibm.com/jct01004c/systems/support/supportsite.wss/docdisplay?lndocid=MIGR-53564&brandind=5000016.

Appendix D. IBM Statement of Limited Warranty Z125-4753-0908/2006

Part 1 - General Terms

Part 1 - General Terms

This Statement of Limited Warranty includes Part 1 - General Terms, Part 2 - Country-unique Terms, and Part 3 - Warranty Information. The terms of Part 2 replace or modify those of Part 1.

The warranties provided by IBM in this Statement of Limited Warranty apply only to Machines you purchase for your use, and not for resale. The term "Machine" means an IBM machine, its features, conversions, upgrades, elements, or accessories, or any combination of them. The term "Machine" does not include any software programs, whether pre-loaded with the Machine, installed subsequently or otherwise. **NOTHING IN THIS STATEMENT OF LIMITED WARRANTY AFFECTS ANY STATUTORY RIGHTS OF CONSUMERS THAT CANNOT BE WAIVED OR LIMITED BY CONTRACT.**

This Statement of Limited Warranty is available, in multiple languages, at the following IBM Internet website:
http://www.ibm.com/servers/support/machine_warranties/.

What this Warranty Covers

IBM warrants that each Machine is free from defects in materials and workmanship and conforms to its Specifications. "Specifications" is information specific to a Machine in a document entitled "Official Published Specifications" which is available upon request.

During the warranty period, IBM provides repair and exchange service for the Machine under the type of warranty service IBM designates for the Machine. The warranty period for the Machine is a fixed period starting on its original Date of Installation. The date on your purchase invoice or sales receipt is the Date of Installation unless IBM or your reseller informs you otherwise. The warranty period, type of warranty, and service level that apply to your Machine are designated in Part 3.

Many features, conversions, or upgrades involve the removal of parts and their return to IBM. An IBM part that replaces a removed part will assume the warranty service status of the removed part. An IBM part that is added to a Machine without replacing a previously-installed part is subject to warranty effective on its Date of Installation. Unless IBM specifies otherwise, the warranty period, type of warranty, and service level of such part is the same as the Machine on which it is installed.

Unless IBM specifies otherwise, these warranties apply only in the country or region in which you purchased the Machine.

THESE WARRANTIES ARE YOUR EXCLUSIVE WARRANTIES AND REPLACE ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. SOME STATES OR JURISDICTIONS DO NOT ALLOW THE EXCLUSION OF EXPRESS OR IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION MAY NOT APPLY TO YOU. IN THAT EVENT, SUCH WARRANTIES ARE LIMITED IN DURATION TO THE WARRANTY PERIOD. NO WARRANTIES APPLY AFTER THAT PERIOD. SOME STATES OR JURISDICTIONS DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

What this Warranty Does not Cover

This warranty does not cover the following:

1. failure or damage resulting from misuse (including but not limited to use of any Machine capacity or capability, other than that authorized by IBM in writing), accident, modification, unsuitable physical or operating environment, or improper maintenance by you;
2. failure caused by a product for which IBM is not responsible;
3. any non-IBM products, including those provided with, or installed on, an IBM Machine at your request;
4. accessories, supply items and consumables (e.g. batteries and printer cartridges), and structural parts (e.g. frames and covers);
5. service of Machine alterations; and
6. service of a Machine on which you are using capacity or capability, other than that authorized by IBM in writing.

The warranty is voided by removal or alteration of identification labels on the Machine or its parts.

IBM does not warrant uninterrupted or error-free operation of a Machine.

Any technical or other support provided for a Machine under warranty, such as assistance with "how-to" questions and those regarding Machine set-up and installation, is provided **WITHOUT WARRANTIES OF ANY KIND**.

How to Obtain Warranty Service

If the Machine does not function as warranted during the warranty period, contact IBM or your reseller to obtain warranty service. Contact information for IBM is provided in Part 3. If you do not register the Machine with IBM, you may be required to present proof of purchase as evidence of your entitlement to warranty service.

What IBM Will Do to Correct Problems

IBM will attempt to diagnose and resolve your problem over the telephone or electronically by access to an IBM Internet website. Certain Machines contain remote support capabilities for direct problem reporting, remote problem determination and resolution with IBM. When you contact IBM for service, you must follow the problem determination and resolution procedures that IBM specifies. Following problem determination, if IBM determines on-site service is required, a service technician will be scheduled for service at your location.

You are responsible for downloading or obtaining from IBM, and installing designated Machine Code (microcode, basic input/output system code (called "BIOS"), utility programs, device drivers, and diagnostics delivered with an IBM Machine) and other software updates in a timely manner from an IBM Internet website or from other electronic media, and following the instructions that IBM provides. You may request IBM to install Machine Code changes, however, you may be charged for that service.

Some parts of IBM Machines are designated as Customer Replaceable Units ("CRUs"). If your problem can be resolved with a CRU (e.g., keyboard, memory, hard disk drive), IBM will ship the CRU to you for you to install.

If the Machine does not function as warranted during the warranty period and your problem cannot be resolved over the telephone or electronically, through your application of Machine Code or software updates, or with a CRU, IBM or its subcontractor or a reseller that has been approved by IBM to provide warranty service, will either, at its discretion, 1) repair it to make it function as warranted, or 2) replace it with one that is at least functionally equivalent. If IBM or its subcontractor or the reseller is unable to do either, you may return the Machine to your place of purchase and your money will be refunded.

IBM or its subcontractor or the reseller will also manage and install selected engineering changes that apply to the Machine.

Exchange of a Machine or Part

When the warranty service involves the exchange of a Machine or part, the item IBM or its subcontractor or the reseller replaces becomes IBM's property and the replacement becomes yours. You represent that all removed items are genuine and unaltered. The replacement may not be new, but will be in good working order and at least functionally equivalent to the item replaced. The replacement assumes the warranty service status of the replaced item.

Your Additional Responsibilities

You agree:

1. before IBM or its subcontractor or the reseller exchanges a Machine or part, to remove all features, parts, options, alterations, and attachments not under warranty service and ensure that the Machine is free of any legal obligations or restrictions that prevent its exchange;
2. to obtain authorization from the owner to have IBM or its subcontractor or the reseller service a Machine that you do not own;

3. where applicable, before service is provided:
   a. follow the service request procedures that IBM or its subcontractor or its reseller provides;
   b. backup and secure all programs, data, and funds contained in the Machine; and
   c. inform IBM or its subcontractor or the reseller of changes in the Machine's location;
4. to provide IBM or its subcontractor or the reseller with sufficient and safe access to your facilities to permit IBM to fulfill its obligations;
5. to allow IBM or its subcontractor or the reseller to install mandatory engineering changes, such as those required for safety;
6. when the type of warranty service requires that you deliver a failing Machine to IBM, you agree to ship it suitably packaged, as IBM specifies, to a location IBM designates. After the Machine has been repaired or exchanged, IBM will return the repaired Machine or provide a replacement Machine to you at its expense, unless IBM specifies otherwise. IBM is responsible for loss of, or damage to, your Machine only while it is 1) in IBM's possession or 2) in transit in those cases where IBM is responsible for the transportation charges; and
7. to securely erase from any Machine you return to IBM for any reason all programs not provided by IBM with the Machine, and data, including without limitation the following: 1) information about identified or identifiable individuals or legal entities (“Personal Data”) and 2) your confidential or proprietary information and other data. If removing or deleting Personal Data is not possible, you agree to transform such information (e.g., by making it anonymous or encrypting it) so that it no longer qualifies as Personal Data under applicable law. You also agree to remove all funds from Machines returned to IBM. IBM is not responsible for any funds, programs not provided by IBM with the Machine, or data contained in a Machine that you return to IBM. You acknowledge that, to perform its responsibilities under this Statement of Limited Warranty, IBM may ship all or part of the Machine or its software to other IBM or third party locations around the world, and you authorize IBM to do so.

Limitation of Liability

Circumstances may arise where, because of a default on IBM's part or other liability, you are entitled to recover damages from IBM. In each such instance, regardless of the basis on which you are entitled to claim damages from IBM (including fundamental breach, negligence, misrepresentation, or other contract or tort claim), except for any liability that cannot be waived or limited by applicable laws, IBM is liable for no more than:

1. damages for bodily injury (including death) and damage to real property and tangible personal property; and
2. the amount of any other actual direct damages, up to the charges (if recurring, 12 months' charges apply) for the Machine that is subject of the claim. For purposes of this item, the term “Machine” includes Machine Code and Licensed Internal Code (“LIC”).

This limit also applies to IBM's suppliers, subcontractors, and resellers. It is the maximum for which IBM and its suppliers, subcontractors and resellers are collectively responsible.

UNDER NO CIRCUMSTANCES IS IBM OR ITS SUPPLIERS, SUBCONTRACTORS, OR RESELLERS LIABLE FOR ANY OF THE FOLLOWING EVEN IF INFORMED OF THEIR POSSIBILITY: 1) THIRD PARTY CLAIMS AGAINST YOU FOR DAMAGES (OTHER THAN THOSE UNDER THE FIRST ITEM LISTED ABOVE); 2) LOSS OF, OR DAMAGE TO, DATA; 3) SPECIAL, INCIDENTAL, OR INDIRECT DAMAGES OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES; OR 4) LOST PROFITS, BUSINESS REVENUE, GOODWILL OR ANTICIPATED SAVINGS. SOME STATES OR JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

Governing Law

Both you and IBM consent to the application of the laws of the country in which you acquired the Machine to govern, interpret, and enforce all of your and IBM's rights, duties, and obligations arising from, or relating in any manner to, the subject matter of this Statement of Limited Warranty, without regard to conflict of law principles.

THESE WARRANTIES GIVE YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE OR JURISDICTION TO JURISDICTION.

Jurisdiction

All of our rights, duties, and obligations are subject to the courts of the country in which you acquired the Machine.

Part 2 - Country-unique Terms

AMERICAS

Jurisdiction: *The following sentence is added to this section as it applies to countries in bold print below:*

Any litigation arising from this Statement of Limited Warranty will be settled exclusively by 1) in **Argentina**; the Ordinary Commercial Court of the city of Buenos Aires; 2) in **Bolivia**; the courts of the city of La Paz; 3) in **Brazil**; court of Rio de Janeiro, RJ; 4) in **Chile**; the Civil Courts of Justice of Santiago; 5) in **Colombia**; the Judges of the Republic of Colombia; 6) in **Equador**; the civil judges of Quito for executory or summary proceedings (as applicable); 7) in **Mexico**; the courts located in Mexico City, Federal District; 8) in **Paraguay**; the courts of the city of Asuncion; 9) in **Peru**; the judges and tribunals of the judicial district of Lima, Cercado; 10) in **Uruguay**; the courts of the city of Montevideo; 11) in **Venezuela**; the courts of the metropolitan area of the city of Caracas.

BRAZIL

Exchange of a Machine or Part: *Delete the last sentence:*

The replacement assumes the warranty service status of the replaced item.

CANADA

What this Warranty Covers: *The following replaces the 2nd paragraph to this section:*

During the warranty period, IBM provides repair and exchange service for the Machine under the type of warranty service IBM designates for the Machine. The warranty period for the Machine is a fixed period starting on its original Date of Installation. The date on your purchase invoice or sales receipt is the Date of Installation unless IBM informs you otherwise. The warranty period, type of warranty, and service level that apply to your Machine are designated in Part 3.

Limitation of Liability: *The following replaces item 1 and item 2 of this section:*

1. damages for bodily injury (including death) or physical harm to real property and tangible personal property caused by IBM's negligence; and
2. the amount of any other actual direct damages, up to the greater of $100,000.00 or the charges (if recurring, 12 months' charges apply) for the Machine that is subject of the claim. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code ("LIC").

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:*

laws in the Province of Ontario.

PERU

Limitation of Liability: *The following is added at the end of this section:*

In accordance with Article 1328 of the Peruvian Civil Code the limitations and exclusions specified in this section will not apply to damages caused by IBM's willful misconduct ("dolo") or gross negligence ("culpa inexcusable").

UNITED STATES

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:*

laws of the State of New York

ASIA PACIFIC

AUSTRALIA

What this Warranty Covers: *The following paragraph is added to this section:*

The warranties specified in this Section are in addition to any rights you may have under the Trade Practices Act 1974 or other similar legislation and are only limited to the extent permitted by the applicable legislation.

Limitation of Liability: *The following is added to this section:*

Where IBM is in breach of a condition or warranty implied by the Trade Practices Act 1974 or other similar legislation, IBM's liability is limited to the repair or replacement of the goods or the supply of equivalent goods. Where that condition or warranty relates to right to sell, quiet possession or clear title, or the goods are of a kind ordinarily acquired for personal, domestic or household use or consumption, then none of the limitations in this paragraph apply.

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:*

laws of the State or Territory

CAMBODIA AND LAOS

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:*

laws of the State of New York, United States of America

CAMBODIA, INDONESIA, AND LAOS

Arbitration: *The following is added under this heading:*

Disputes arising out of or in connection with this Statement of Limited Warranty shall be finally settled by arbitration which shall be held in Singapore in accordance with the Arbitration Rules of Singapore International Arbitration Center ("SIAC Rules") then in effect. The arbitration award shall be final and binding for the parties without appeal and shall be in writing and set forth the findings of fact and the conclusions of law.

The number of arbitrators shall be three, with each side to the dispute being entitled to appoint one arbitrator. The two arbitrators appointed by the parties shall appoint a third arbitrator who shall act as chairman of the proceedings. Vacancies in the post of chairman shall be filled by the president of the SIAC. Other vacancies shall be filled by the respective nominating party. Proceedings shall continue from the stage they were at when the vacancy occurred.

If one of the parties refuses or otherwise fails to appoint an arbitrator within 30 days of the date the other party appoints its, the first appointed arbitrator shall be the sole arbitrator, provided that the arbitrator was validly and properly appointed.

All proceedings shall be conducted, including all documents presented in such proceedings, in the English language. The English language version of this Statement of Limited Warranty prevails over any other language version.

HONG KONG S.A.R.

As applies to transactions initiated and performed in Hong Kong S.A.R., phrases throughout this Agreement containing the word "country" (for example, "country of purchase" and "country of Installation") are replaced with "Hong Kong S.A.R."

INDIA

Limitation of Liability: *The following replaces items 1 and 2 of this section:*

1. liability for bodily injury (including death) or damage to real property and tangible personal property will be limited to that caused by IBM's negligence; and
2. as to any other actual damage arising in any situation involving nonperformance by IBM pursuant to, or in any way related to the subject of this Statement of Limited Warranty, the charge paid by you for the individual Machine that is the subject of the claim. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code ("LIC").

Arbitration: *The following is added under this heading:*

Disputes arising out of or in connection with this Statement of Limited Warranty shall be finally settled by arbitration which shall be held in Bangalore, India in accordance with the laws of India then in effect. The arbitration award shall be final and binding for the parties without appeal and shall be in writing and set forth the findings of fact and the conclusions of law.

The number of arbitrators shall be three, with each side to the dispute being entitled to appoint one arbitrator. The two arbitrators appointed by the parties shall appoint a third arbitrator who shall act as chairman of the proceedings. Vacancies in the post of chairman shall be filled by the president of the Bar Council of India. Other vacancies shall be filled by the respective nominating party. Proceedings shall continue from the stage they were at when the vacancy occurred.

If one of the parties refuses or otherwise fails to appoint an arbitrator within 30 days of the date the other party appoints its, the first appointed arbitrator shall be the sole arbitrator, provided that the arbitrator was validly and properly appointed.

All proceedings shall be conducted, including all documents presented in such proceedings, in the English language. The English language version of this Statement of Limited Warranty prevails over any other language version.

JAPAN

Governing Law: *The following sentence is added to this section:*

Any doubts concerning this Statement of Limited Warranty will be initially resolved between us in good faith and in accordance with the principle of mutual trust.

MACAU S.A.R.

As applies to transactions initiated and performed in Macau S.A.R., phrases throughout this Agreement containing the word "country" (for example, "country of purchase" and "country of Installation") are replaced with "Macau S.A.R."

MALAYSIA

Limitation of Liability: *The word "**SPECIAL**" in item 3 of the fifth paragraph is deleted.*

NEW ZEALAND

What this Warranty Covers: *The following paragraph is added to this section:*

The warranties specified in this section are in addition to any rights you may have under the Consumer Guarantees Act 1993 or other legislation which cannot be excluded or limited. The Consumer Guarantees Act 1993 will not apply in respect of any goods which IBM provides, if you require the goods for the purposes of a business as defined in that Act.

Limitation of Liability: *The following is added to this section:*

Where Machines are not acquired for the purposes of a business as defined in the Consumer Guarantees Act 1993, the limitations in this Section are subject to the limitations in that Act.

PEOPLE'S REPUBLIC OF CHINA (PRC)

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:*

laws of the State of New York, United States of America (except when local law requires otherwise).

PHILIPPINES

Limitation of Liability: *Item 3 in the fifth paragraph is replaced by the following:*

SPECIAL (INCLUDING NOMINAL AND EXEMPLARY DAMAGES), MORAL, INCIDENTAL, OR INDIRECT DAMAGES FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES; OR

Arbitration: *The following is added under this heading:*

Disputes arising out of or in connection with this Statement of Limited Warranty shall be finally settled by arbitration which shall be held in Metro Manila, Philippines in accordance with the laws of the Philippines then in effect. The arbitration award shall be final and binding for the parties without appeal and shall be in writing and set forth the findings of fact and the conclusions of law.

The number of arbitrators shall be three, with each side to the dispute being entitled to appoint one arbitrator. The two arbitrators appointed by the parties shall appoint a third arbitrator who shall act as chairman of the proceedings. Vacancies in the post of chairman shall be filled by the president of the Philippine Dispute Resolution Center, Inc. Other vacancies shall be filled by the respective nominating party. Proceedings shall continue from the stage they were at when the vacancy occurred.

If one of the parties refuses or otherwise fails to appoint an arbitrator within 30 days of the date the other party appoints its, the first appointed arbitrator shall be the sole arbitrator, provided that the arbitrator was validly and properly appointed.

All proceedings shall be conducted, including all documents presented in such proceedings, in the English language. The English language version of this Statement of Limited Warranty prevails over any other language version.

SINGAPORE

Limitation of Liability: *The words "**SPECIAL**" and "**ECONOMIC**" in item 3 in the fifth paragraph are deleted.*

EUROPE, MIDDLE EAST, AFRICA (EMEA)

THE FOLLOWING TERMS APPLY TO ALL EMEA COUNTRIES:

The terms of this Statement of Limited Warranty apply to Machines purchased from IBM or an IBM reseller.

How to Obtain Warranty Service:

*Add the following paragraph in **Western Europe** (Andorra, Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Monaco, Netherlands, Norway, Poland, Portugal, San Marino, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom, Vatican State, and any country subsequently added to the European Union, as from the date of accession):*

The warranty for Machines acquired in Western Europe shall be valid and applicable in all Western Europe countries provided the Machines have been announced and made available in such countries.

If you purchase a Machine in one of the Western European countries, as defined above, you may obtain warranty service for that Machine in any of those countries from either (1) an IBM reseller approved to perform warranty service or (2) from IBM, provided the Machine has been announced and made available by IBM in the country in which you wish to obtain service.

If you purchase a Machine in a Middle East or African country, you may obtain warranty service for that Machine from the IBM entity within the country of purchase, if that IBM entity provides warranty service in that country, or from an IBM reseller, approved by IBM to perform warranty service on that Machine in that country. Warranty service in Africa is available within 50 kilometers of an IBM approved service provider. You are responsible for transportation costs for Machines located outside 50 kilometers of an IBM approved service provider.

Governing Law: *The phrase "the laws of the country in which you acquired the Machine" is replaced by:*

1) "the laws of Austria" **in Albania, Armenia, Azerbaijan, Belarus, Bosnia-Herzegovina, Bulgaria, Croatia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, FYR Macedonia, Moldova, Montenegro, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan;** 2) "the laws of France" **in Algeria, Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Comoros, Congo Republic, Djibouti, Democratic Republic of Congo, Equatorial Guinea, French Guiana, French Polynesia, Gabon, Gambia, Guinea, Guinea-Bissau, Ivory Coast, Lebanon, Libya, Madagascar, Mali, Mauritania, Mauritius, Mayotte, Morocco, New Caledonia, Niger, Reunion, Senegal, Seychelles, Togo, Tunisia, Vanuatu, and Wallis & Futuna;** 3) "the laws of Finland" **in Estonia, Latvia, and Lithuania;** 4) "the laws of England" **in Angola, Bahrain, Botswana, Burundi, Egypt, Eritrea, Ethiopia, Ghana, Jordan, Kenya, Kuwait, Liberia, Malawi, Malta, Mozambique, Nigeria, Oman, Pakistan, Qatar, Rwanda, Sao Tome, Saudi Arabia, Sierra Leone, Somalia, Tanzania, Uganda, United Arab Emirates, the United Kingdom, West Bank/Gaza, Yemen, Zambia, and Zimbabwe;** and 5) "the laws of South Africa" **in South Africa, Namibia, Lesotho and Swaziland.**

Jurisdiction: *The following exceptions are added to this section:*

1) **In Austria** the choice of jurisdiction for all disputes arising out of this Statement of Limited Warranty and relating thereto, including its existence, will be the competent court of law in Vienna, Austria (Inner-City); 2) **in Angola, Bahrain, Botswana, Burundi, Egypt, Eritrea, Ethiopia, Ghana, Jordan, Kenya, Kuwait, Liberia, Malawi, Malta, Mozambique, Nigeria, Oman, Pakistan, Qatar, Rwanda, Sao Tome, Saudi Arabia, Sierra Leone, Somalia, Tanzania, Uganda, United Arab Emirates, United Kingdom, West Bank/Gaza, Yemen, Zambia, and Zimbabwe** all disputes arising out of this Statement of Limited Warranty or related to its execution, including summary proceedings, will be submitted to the exclusive jurisdiction of the English courts; 3) **in Belgium and Luxembourg**, all disputes arising out of this Statement of Limited Warranty or related to its interpretation or its execution, the law, and the courts of the capital city, of the country of your registered office and/or commercial site location only are competent; 4) **in France, Algeria, Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Comoros, Congo Republic, Djibouti, Democratic Republic of Congo, Equatorial Guinea, French Guiana, French Polynesia, Gabon, Gambia, Guinea, Guinea-Bissau, Ivory Coast, Lebanon, Libya, Madagascar, Mali, Mauritania, Mauritius, Mayotte, Morocco, New Caledonia, Niger, Reunion, Senegal, Seychelles, Togo, Tunisia, Vanuatu, and Wallis & Futuna** all disputes arising out of this Statement of Limited Warranty or related to its violation or execution, including summary proceedings, will be settled exclusively by the Commercial Court of Paris; 5) **in South Africa, Namibia, Lesotho and Swaziland**, both of us agree to submit all disputes relating to this Statement of Limited Warranty to the jurisdiction of the High Court in Johannesburg; 6) **in Turkey** all disputes arising out of or in connection with this

Statement of Limited Warranty shall be resolved by the Istanbul Central (Sultanahmet) Courts and Execution Directorates of Istanbul, the Republic of Turkey; 8) in each of the following specified countries, any legal claim arising out of this Statement of Limited Warranty will be brought before, and settled exclusively by, the competent court of a) Athens for **Greece**, b) Tel Aviv-Jaffa for **Israel**, c) Milan for **Italy**, d) Lisbon for **Portugal**, and e) Madrid for **Spain**; and 8) **in the United Kingdom**, both of us agree to submit all disputes relating to this Statement of Limited Warranty to the jurisdiction of the English courts.

Arbitration: *The following is added under this heading:*

In Albania, Armenia, Azerbaijan, Belarus, Bosnia-Herzegovina, Bulgaria, Croatia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Libya, FYR Macedonia, Moldova, Montenegro, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan all disputes arising out of this Statement of Limited Warranty or related to its violation, termination or nullity will be finally settled under the Rules of Arbitration and Conciliation of the International Arbitral Center of the Federal Economic Chamber in Vienna (Vienna Rules) by three arbitrators appointed in accordance with these rules. The arbitration will be held in Vienna, Austria, and the official language of the proceedings will be English. The decision of the arbitrators will be final and binding upon both parties. Therefore, pursuant to paragraph 598 (2) of the Austrian Code of Civil Procedure, the parties expressly waive the application of paragraph 595 (1) figure 7 of the Code. IBM may, however, institute proceedings in a competent court in the country of installation.

In Estonia, Latvia and Lithuania all disputes arising in connection with this Statement of Limited Warranty will be finally settled in arbitration that will be held in Helsinki, Finland in accordance with the arbitration laws of Finland then in effect. Each party will appoint one arbitrator. The arbitrators will then jointly appoint the chairman. If arbitrators cannot agree on the chairman, then the Central Chamber of Commerce in Helsinki will appoint the chairman.

EUROPEAN UNION (EU)

THE FOLLOWING TERMS APPLY TO ALL EU COUNTRIES:

The warranty for Machines acquired in EU countries is valid and applicable in all EU countries provided the Machines have been announced and made available in such countries.

DENMARK, FINLAND, GREECE, ITALY, NETHERLANDS, NORWAY, PORTUGAL, SPAIN, SWEDEN AND SWITZERLAND

Limitation of Liability: *The following replaces the terms of this section in its entirety:*

Except as otherwise provided by mandatory law:

1. IBM's liability for any damages and losses that may arise as a consequence of the fulfillment of its obligations under or in connection with this Statement of Limited Warranty or due to any other cause related to this Statement of Limited Warranty is limited to the compensation of only those damages and losses proved and actually arising as an immediate and direct consequence of

the non-fulfillment of such obligations (if IBM is at fault) or of such cause, for a maximum amount equal to the charges you paid for the Machine. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code ("LIC").

The above limitation shall not apply to damages for bodily injuries (including death) and damages to real property and tangible personal property for which IBM is legally liable.

2. **UNDER NO CIRCUMSTANCES IS IBM, OR ITS SUPPLIERS, SUBCONTRACTORS, OR RESELLERS LIABLE FOR ANY OF THE FOLLOWING, EVEN IF INFORMED OF THEIR POSSIBILITY: 1) LOSS OF, OR DAMAGE TO, DATA; 2) INCIDENTAL OR INDIRECT DAMAGES, OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES; 3) LOST PROFITS, EVEN IF THEY ARISE AS AN IMMEDIATE CONSEQUENCE OF THE EVENT THAT GENERATED THE DAMAGES; OR 4) LOSS OF BUSINESS, REVENUE, GOODWILL, OR ANTICIPATED SAVINGS.**

FRANCE AND BELGIUM

Limitation of Liability: *The following replaces the terms of this section in its entirety:*

Except as otherwise provided by mandatory law:

1. IBM's liability for any damages and losses that may arise as a consequence of the fulfillment of its obligations under or in connection with this Statement of Limited Warranty is limited to the compensation of only those damages and losses proved and actually arising as an immediate and direct consequence of the non-fulfillment of such obligations (if IBM is at fault), for a maximum amount equal to the charges you paid for the Machine that has caused the damages. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code ("LIC").

   The above limitation shall not apply to damages for bodily injuries (including death) and damages to real property and tangible personal property for which IBM is legally liable.

2. **UNDER NO CIRCUMSTANCES IS IBM, OR ITS SUPPLIERS, SUBCONTRACTORS, OR RESELLERS LIABLE FOR ANY OF THE FOLLOWING, EVEN IF INFORMED OF THEIR POSSIBILITY: 1) LOSS OF, OR DAMAGE TO, DATA; 2) INCIDENTAL OR INDIRECT DAMAGES, OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES; 3) LOST PROFITS, EVEN IF THEY ARISE AS AN IMMEDIATE CONSEQUENCE OF THE EVENT THAT GENERATED THE DAMAGES; OR 4) LOSS OF BUSINESS, REVENUE, GOODWILL, OR ANTICIPATED SAVINGS.**

THE FOLLOWING TERMS APPLY TO THE COUNTRY SPECIFIED:

AUSTRIA AND GERMANY

What this Warranty Covers: *The following replaces the first sentence of the first paragraph of this section:*

The warranty for an IBM Machine covers the functionality of the Machine for its normal use and the Machine's conformity to its Specifications.

The following paragraphs are added to this section:

The minimum warranty period for Machines is twelve months. In case IBM or your reseller is unable to repair an IBM Machine, you can alternatively ask for a price reduction as far as justified by the reduced value of the unrepaired Machine or ask for a cancellation of the respective agreement for such Machine and get your money refunded.

The second paragraph does not apply.

What IBM Will Do to Correct Problems: *The following is added to this section:*

During the warranty period, transportation for delivery of the failing Machine to IBM will be at IBM's expense.

Limitation of Liability: *The following paragraph is added to this section:*

The limitations and exclusions specified in the Statement of Limited Warranty will not apply to damages caused by IBM with fraud or gross negligence and for express warranty.

The following sentence is added to the end of item 2:

IBM's liability under this item is limited to the violation of essential contractual terms in cases of ordinary negligence.

IRELAND

What this Warranty Covers: *The following is added to this section:*

Except as expressly provided in these terms and conditions or Section 12 of the Sale of Goods Act 1893 as amended by the Sale of Goods and Supply of Services Act, 1980 (“the 1980 Act”), all conditions or warranties (express or implied, statutory or otherwise) are hereby excluded including, without limitation, any warranties implied by the Sale of Goods Act 1893 as amended by the 1980 Act (including, for the avoidance of doubt, section 39 of the 1980 Act).

Limitation of Liability: *The following replaces the terms of this section in its entirety:*

For the purposes of this section, a “Default” means any act, statement, omission, or negligence on the part of IBM in connection with, or in relation to, the subject matter of this Statement of Limited Warranty in respect of which IBM is legally liable to you, whether in contract or tort. A number of Defaults which together

result in, or contribute to, substantially the same loss or damage will be treated as one Default occurring on the date of occurrence of the last such Default.

Circumstances may arise where, because of a Default, you are entitled to recover damages from IBM.

This section sets out the extent of IBM's liability and your sole remedy.

1. IBM will accept unlimited liability for death or personal injury caused by the negligence of IBM.
2. Subject always to the **Items for Which IBM is Not Liable** below, IBM will accept unlimited liability for physical damage to your tangible property resulting from the negligence of IBM.
3. Except as provided in items 1 and 2 above, IBM's entire liability for actual damages for any one Default will not in any event exceed the greater of 1) EUR 125,000, or 2) 125% of the amount you paid for the Machine directly relating to the Default.

Items for Which IBM is Not Liable

Save with respect to any liability referred to in item 1 above, under no circumstances is IBM, its suppliers or resellers liable for any of the following, even if IBM or they were informed of the possibility of such losses:

1. loss of, or damage to, data;
2. special, indirect, or consequential loss; or
3. loss of profits, business, revenue, goodwill, or anticipated savings.

SOUTH AFRICA, NAMIBIA, BOTSWANA, LESOTHO AND SWAZILAND

Limitation of Liability: *The following is added to this section:*

IBM's entire liability to you for actual damages arising in all situations involving nonperformance by IBM in respect of the subject matter of this Statement of Warranty will be limited to the charge paid by you for the individual Machine that is the subject of your claim from IBM.

SWITZERLAND

Your Additional Responsibilities: *The following sentence is added to this section:*

Personal Data also includes information about you as a legal entity.

TURKEY

What this Warranty Covers: *The following is added to this section:*

The minimum warranty period for Machines is 2 years.

UNITED KINGDOM

Limitation of Liability: *The following replaces the terms of this section in its entirety:*

For the purposes of this section, a "Default" means any act, statement, omission, or negligence on the part of IBM in connection with, or in relation to, the subject matter of this Statement of Limited Warranty in respect of which IBM is legally liable to you, whether in contract or tort. A number of Defaults which together result in, or contribute to, substantially the same loss or damage will be treated as one Default.

Circumstances may arise where, because of a Default, you are entitled to recover damages from IBM.

This section sets out the extent of IBM's liability and your sole remedy.

1. IBM will accept unlimited liability for:
   a. death or personal injury caused by the negligence of IBM; and
   b. any breach of its obligations implied by Section 12 of the Sale of Goods Act 1979 or Section 2 of the Supply of Goods and Services Act 1982, or any statutory modification or re-enactment of either such Section.
2. IBM will accept unlimited liability, subject always to the **Items for Which IBM is Not Liable** below, for physical damage to your tangible property resulting from the negligence of IBM.
3. IBM's entire liability for actual damages for any one Default will not in any event, except as provided in items 1 and 2 above, exceed the greater of 1) Pounds Sterling 75,000, or 2) 125% of the total purchase price payable or the charges for the Machine directly relating to the Default.

These limits also apply to IBM's suppliers and resellers. They state the maximum for which IBM and such suppliers and resellers are collectively responsible.

Items for Which IBM is Not Liable

Save with respect to any liability referred to in item 1 above, under no circumstances is IBM or any of its suppliers or resellers liable for any of the following, even if IBM or they were informed of the possibility of such losses:

1. loss of, or damage to, data;
2. special, indirect, or consequential loss;
3. loss of profits, business, revenue, goodwill, or anticipated savings; or
4. third party claims against you for damages.

Part 3 - Warranty Information

IBM ServeRAID-8i SAS Controller
IBM ServeRAID-8k SAS Controller
IBM ServeRAID-8k-l SAS Controller
IBM ServeRAID-8s SAS Controller

Country or Region of Purchase	Warranty Period	Type of Warranty Service*	Service Level*
Worldwide	1 year	1	Not applicable
* See "Types of Warranty Service" and "Service Levels" for explanations of warranty-service types and service levels.			

Scheduling of a warranty service will depend upon the following: 1) the time your request for service is received, 2) Machine technology, and 3) availability of parts. Contact your local IBM representative or the subcontractor or reseller performing services on behalf of IBM for country and location specific information.

Types of Warranty Service

1. **Customer Replaceable Unit ("CRU") Service**

   IBM provides replacement CRUs to you for you to install. CRU information and replacement instructions are shipped with your Machine and are available from IBM at any time on your request. CRUs are designated as being either Tier 1 or a Tier 2 CRU. Installation of Tier 1 CRUs is your responsibility. If IBM installs a Tier 1 CRU at your request, you will be charged for the installation. You may install a Tier 2 CRU yourself or request IBM to install it, at no additional charge, under the type of warranty service designated for your Machine. IBM specifies in the materials shipped with a replacement CRU whether a defective CRU must be returned to IBM. When return is required, 1) return instructions and a container are shipped with the replacement CRU, and 2) you may be charged for the replacement CRU if IBM does not receive the defective CRU within 15 days of your receipt of the replacement.
2. **On-site Service**

   IBM or your reseller will either repair or exchange the failing Machine at your location and verify its operation. You must provide suitable working area to allow disassembly and reassembly of the IBM Machine. The area must be clean, well lit and suitable for the purpose. For some Machines, certain repairs may require sending the Machine to an IBM service center.
3. **Courier or Depot Service**

   You will disconnect the failing Machine for collection arranged by IBM. IBM will provide you with a shipping container for you to return your Machine to a designated service center. A courier will pick up your Machine and deliver it to the designated service center. Following its repair or exchange, IBM will

arrange the return delivery of the Machine to your location. You are responsible for its installation and verification.

4. **Customer Carry-In or Mail-In Service**

   You will deliver or mail as IBM specifies (prepaid unless IBM specifies otherwise) the failing Machine suitably packaged to a location IBM designates. After IBM has repaired or exchanged the Machine, IBM will make it available for your collection or, for Mail-in Service, IBM will return it to you at IBM's expense, unless IBM specifies otherwise. You are responsible for the subsequent installation of the Machine and verification of its operation.

5. **CRU and On-site Service***

   This type of Warranty Service is a combination of Type 1 and Type 2 (see above).

6. **CRU and Courier or Depot Service***

   This type of Warranty Service is a combination of Type 1 and Type 3 (see above).

7. **CRU and Customer Carry-In or Mail-In Service***

   This type of Warranty Service is a combination of Type 1 and Type 4 (see above).

8. **Machine Exchange Service**

   IBM will initiate shipment of a replacement Machine to your location. You are responsible for its installation and verification of its operation. You must pack the failing Machine into the shipping container that contained the replacement Machine and return the failing Machine to IBM. Transportation charges, both ways, are paid by IBM. You may be charged for the replacement Machine if IBM does not receive the failing Machine within 15 days of your receipt of the replacement Machine.

(*) When a 5, 6, or 7 type of warranty service is listed, IBM will determine which type of warranty service is appropriate for the repair.

Service Levels

Service levels specified below are response-time objectives only and are not guarantees. The specified service level may not be available in all worldwide locations. Charges may apply outside IBM's normal service area. Certain Machines with a Same Day On-site response-time objective may require the installation and use of remote connectivity tools and equipment for direct problem reporting, remote problem determination and resolution.

1. **Next Business Day (NBD), 9X5**

   After we receive your call, following problem determination, if IBM determines on-site service is required, a service technician will be scheduled to arrive at your location on the next business day. Service will be provided from 8:00 a.m. to 5:00 p.m. in your local time zone, Monday through Friday, excluding holidays.

2. **Same Business Day (SBD), 9X5**

   After we receive your call, following problem determination, if IBM determines on-site service is required, a service technician will be scheduled to arrive at your location within four hours. Service will be provided from 8:00 a.m. to 5:00 p.m. in your local time zone, Monday through Friday, excluding local IBM holidays. If after 1:00 p.m. it is determined that on-site service is required, a service technician will be scheduled to arrive the morning of the following business day.
3. **Same Day (SD), 24X7**

   After we receive your call, following problem determination, if IBM determines on-site service is required, a service technician will be scheduled to arrive at your location within four hours. This type of service will be provided 24 hours a day, every day, including holidays.

IBM Contact Information

For IBM in Canada or the United States, call 1-800-IBM-SERV (or 1-800-426-7378). For IBM in the European Union (EU), Asia Pacific, and Latin America countries, contact IBM in that country or visit the following IBM Internet website: http://www.ibm.com/servers/support/machine_warranties/.

Appendix E. Notices

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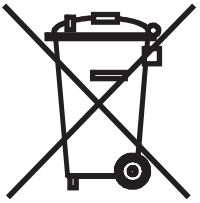

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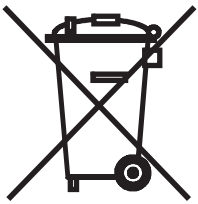

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Avis de conformité à la réglementation d'Industrie Canada

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Notice to Customers

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European Community contact:

IBM Technical Regulations
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Glossary

A

auto-synchronization. Synchronization on RAID level-1, level-1E, level-5, level-5EE. level-6, level-10, level-50, and level-60 drives that is automatically initiated when logical drives are created. This type of synchronization works in the background.

B

battery-backup cache. Buffer storage that protects data during write-back operations; in the event of a power failure, it preserves the data in the controller cache.

block. A data unit created when data is striped across physical drives.

C

compaction. The process by which a RAID level-5EE logical drive utilizes the distributed spare drive in the event of a physical drive failure. After the data is reconstructed, the original logical drive undergoes compaction, and the distributed spare drive becomes part of the new logical drive. The logical drive remains RAID level-5EE.

controller. A device that coordinates and controls the operation of one or more input/output devices, such as workstations, and synchronizes the operation of such devices with the operation of the system as a whole.

copy back. A method of restoring a logical drive's original configuration after replacing a failed drive in a logical drive.

critical. The state of a RAID level-1, level-1E, level-5, level-5EE, level-6, level-10, level-50, or level-60 logical drive that contains a defunct drive.

D

data mirroring. A technique that creates a single logical drive from two physical drives. All data written to the logical drive is written to both physical drives, creating a pair of physical drives containing exactly the same data.

data scrubbing. A feature that provides automatic, continuous synchronization during system use. This features works in the background, and ensures that the redundant data and/or parity is correct.

data striping. A technique that divides a logical drive into data blocks, called stripes, which are then distributed over the physical drives. The layout is such that a sequential read of data on the logical drive results in parallel reads to each of the physical drives, resulting in improved performance.

defunct. A physical-drive state in which the ServeRAID controller cannot communicate properly with the drive.

degraded. In RAID level-6, when a single physical drive fails in the logical drive, the logical drive enters the degraded state, but continues to be fault tolerant.

distributed spare drive. In RAID level-5EE, the logical drive designated as a spare drive. Because this spare drive is spread over several physical drives, it is described as distributed.

E

expansion. The process by which a compacted logical drive returns to its original striping scheme, after a failed drive is replaced in a RAID level-5EE logical drive. Contrast with compaction.

F

fault tolerance. The ability of a computer system to operate correctly even though one or more of its component parts are malfunctioning.

firmware. Proprietary code that is usually delivered as microcode as part of an operating system. Firmware is more efficient than software loaded from an alterable medium and more adaptable to change than pure hardware circuitry. An example of firmware is the Basic Input/Output System (BIOS) in read-only memory (ROM) on a PC system board.

H

hot-spare drive. A physical drive that is defined for automatic use when a similar drive fails.

hot-swappable. Pertaining to a component that can be removed or replaced while the system is running.

hot-swap rebuild. An operation that is started by the ServeRAID controller when it detects that a physical drive that is part of a logical drive and in the defunct state has been removed and replaced on a SCSI cable or backplane.

I

initialize logical drive. In the ServeRAID utilities, to erase the first 1024 sectors on a drive, preventing access to any data previously stored on the drive.

L

logical drive. A grouping of physical drives that the operating system recognizes as a single drive.

logical-drive migration. To add or remove physical drives from an existing logical drive, to change RAID levels, change logical-drive size, or effect an increase in free space.

M

migrating. The state of a logical drive undergoing a logical-drive migration.

mirror role. The role assigned to the two physical drives that an integrated SAS controller uses to create a RAID level-1 logical drive. When the logical drive is created, data is copied from the primary physical drive to the secondary physical drive. Any data on the secondary drive is destroyed.

N

Notification Manager. A tool used to notify remote systems of events, problems, and configuration changes occurring on a local system.

O

offline. A logical-drive state in which the logical drive is inaccessible.

okay. A logical-drive state in which the logical drive is functional.

online. A physical-drive state in which the physical drive is functioning properly and is part of a logical drive.

P

parity. A characteristic of the data stored on a RAID level-5, level-5EE, level-50, or level-60 logical drive that can be used, in conjunction with the data on the remaining drives, to recreate data on a failed physical drive.

parity block. In a RAID level-5, level-5EE, level-6, level-50, or level-60 logical drive, a data unit that contains a representation of the data from other blocks in the same stripe.

physical drive. A hard disk drive.

POST. Power-on self-test. During POST, the ServeRAID controller compares the stored configuration information to the configuration that is actually present. If a discrepancy exists, one or more status messages appear after the POST completes but before the operating system loads.

R

RAID. A technology of grouping several physical drives in a computer into a logical drive. Each logical drive appears to the operating system as a single drive. This grouping technique greatly enhances logical-drive capacity and performance beyond the physical limitations of a single physical drive.

RAID level-0. A RAID level that uses data striping to distribute data evenly across physical drives. While it enables full utilization of physical drive capacity and performance acceleration, RAID level-0 provides neither fault tolerance nor redundancy.

RAID level-1. A RAID level that uses data mirroring to distribute data across two physical drives. It provides data redundancy and performance acceleration, although the usable physical drive space is reduced by 50 percent.

RAID level-1E. A RAID level that uses both data striping and data mirroring to distribute data across three or more physical drives. Data is striped across each disk in the logical drive; the first set of stripes are the data stripes, and the second sets of stripes are mirror copies of the first stripe, shifted one drive. It provides data redundancy and performance acceleration, although the usable physical drive space is reduced by 50 percent.

RAID level-5. A RAID level that uses data striping and block interweaving to distribute data across three or more physical drives. It provides full data protection and performance acceleration, although only 67-94% of physical drive storage capacity can be used.

RAID level-5EE. A RAID level that uses data striping and block interweaving to more efficiently distribute data across four or more physical drives. Like RAID level-5E, it uses some space on each physical drive as a distributed hot-spare. However, RAID level-5EE offers a more efficient distributed spare drive and faster rebuild times. The spare drive is actually part of the RAID level-5EE logical drive. A RAID level-5EE spare drive is interleaved with the parity blocks. This enables data to be reconstructed more quickly if a physical drive in the logical drive fails. RAID level-5EE provides full data protection and performance acceleration, although only 50-88% of physical drive storage capacity can be used.

RAID level-6. A RAID level that is basically like RAID level-5 except that it uses two sets of parity information instead of one. When you assign RAID level-6 to a logical drive, the capacity of the logical drive is reduced by the capacity of two drives. As a result, RAID level-6 can handle two simultaneous drive failures, where other single RAID levels can handle at most only one.

RAID level-x0. RAID level-10, level-50, and level-60. These RAID levels use spanned logical drives to enable the use of up to 60 physical drives. RAID level-10, level-50, and level-60 provide full data protection, performance acceleration, and greater reliability, although only 50-94% of physical drive storage capacity can be used.

read-ahead cache mode. A ServeRAID controller setting that determines whether the ServeRAID controller transfers data from disk to its local cache in increments equal to the stripe-unit size or the system I/O requests. The options are **enabled** and **disabled**.

read-ahead cache mode—Disabled. An option of the read-ahead cache mode. When the read-ahead cache mode is disabled, the ServeRAID controller transfers data from the logical drive to its local cache in increments equal to the system I/O request size. This optimizes performance when the workload is random or the system I/O requests are smaller than the stripe-unit size.

read-ahead cache mode—Enabled. An option of the read-ahead cache mode. When the read-ahead cache mode is enabled, the ServeRAID controller transfers data from the logical drive to its local cache in increments equal to the stripe-unit size. This optimizes performance when workloads are steady and sequential.

ready. A physical-drive state in which the drive is available for definition.

rebuild. An operation to reconstruct data after the problem that caused a physical drive to become defunct has been resolved.

rebuilding. The state of a physical drive undergoing a rebuild operation.

rebuild rate. The speed (high, medium, or low) at which a rebuild operation will occur.

redundant array of independent disks (RAID). See RAID.

S

SAS. See Serial Attached SCSI.

SCSI ID. A unique ID assigned to each SCSI device connected to a SCSI controller. This ID enables the controller to identify the device and ensure that different devices on the same SCSI channel do not transfer data simultaneously.

SCSI transfer speed. The speed at which data can be transferred between a physical drive and the ServeRAID controller.

Serial Attached SCSI. A successor to parallel SCSI that addresses storage I/O requirements. It leverages the cost economies of the SATA physical interface and connector while preserving the robust software and hard disk drive reliability of SCSI.

ServeRAID Manager. A program used to configure ServeRAID controllers, view the ServeRAID configuration, create logical drives, delete logical drives, dynamically increase the logical-drive size, change RAID levels, and more.

ServeRAID ROM Update wizard. A program that updates the BIOS and firmware codes on ServeRAID controllers.

small computer system interface. A standard hardware interface that enables a variety of peripheral devices to communicate with one another.

stripe-unit size. The granularity at which data is stored on one drive of the logical drive before subsequent data is stored on the next drive of the logical drive. The performance of a ServeRAID controller is maximized if the stripe-unit size is close to the size of the system input/output requests.

stripes. The collection of stripe units, from the first to last drive of the logical drive.

sub-logical drive. In a RAID level-x0 configuration, a logical drive contained within each logical drive of the spanned logical drive. A sub-logical drive can be RAID level-1, level-5, or level-6.

synchronization. The process of recalculating and rewriting either redundant data (RAID level-1 and level-10, logical drives) or parity data (RAID level-5, level-5EE, level-6, level-50, and level-60 logical drives).

T

throughput. The speed at which data can be moved from one place to another, usually expressed in MB per second.

W

write-cache mode. A ServeRAID controller setting that determines whether the controller writes data to the physical drive before or after sending a confirmation to the operating system. The settings are **write back** and **write through**.

write-cache mode—write back. A setting of the write-cache mode. When the write-cache mode is set to write back and the operating system sends data to the controller, the controller sends a confirmation back to the operating system before actually writing the data to a storage device. This increases performance, but, if a battery-backup cache is not used, increases the risk of data loss in the event of a power failure.

write-cache mode—write through. A setting of the write-cache mode. When the write-cache mode is set to write through and the operating system sends data to the controller, the controller writes the data to a storage device before sending a confirmation to the operating system. This mode decreases performance, but does not risk data loss.

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