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Marvell RAID Utility

User Guide

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CONTENTS

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1 GETTING STARTED

This chapter describes how to get started with the Marvell Redundant Array of Independent Disks (RAID) Utility, including how to access and install this utility.

The topics included in this chapter are:

- Product Overview
- Setting Up the Software

1.1 Product Overview

The Marvell RAID Utility (MRU) software is a web-based graphical user interface (GUI) tool for the Marvell RAID adapter. The MRU GUI enables you to create and manage logical drives from the physical disk drives installed in your computer. RAID technology allows you to create logical drives based on one or more physical disk drives in combination for fault tolerance and improved performance.

For more information about RAID technology and how to determine a RAID level for your logical drive, see Chapter 4, Selecting a RAID Level.

Note: The terms adapter and controller are used interchangeably for the purpose of this document.

1.1.1 System Requirements

Before you begin, ensure that your computer meets the following requirements:

- Operating systems: Microsoft Windows® XP Media Center Edition 2005, Windows XP Professional, Windows 2003, and Windows 2000.
- Hardware: The Marvell RAID Adapter supports one PATA and a maximum of four SATA disk drives. Ensure the SATA and PATA drives are appropriately connected. For instructions on how to connect the SATA and the PATA drives, see Installing the Disk Drives on page 1-4.
- RAID adapter/controller driver
- Web service

1.1.2 Software Components

During a full installation, all of the following components, except the CLI, are automatically installed on your computer. A custom installation requires you to select individual components. The MRU software CD includes the following items:

- **Driver**. The driver is automatically installed on your system during MRU installation.
- **Web service**. The Apache server is automatically installed on your system during MRU installation.
- **Marvell Command Line Interface (CLI)**. The CLI, for only Linux users, is available with custom installation of the software.

    Note: The Linux operating system will be supported in a future release of the MRU.

- **Marvell RAID Utility software**.

Note: The Marvell BIOS Configuration, a built-in component of the Marvell RAID controller, can create, initialize, and delete the logical drives. For instructions about using the Marvell BIOS Configuration, see Chapter 3, Configuring RAID Using the Basic Input/Output System (BIOS).

1.1.3   Supported RAID Levels

The Marvell RAID controller supports the following RAID levels:

- **RAID 0** (striping). In this RAID system, identical drives can read and write data in parallel to increase performance.
- **RAID 1** (mirroring). In this RAID system, mirroring increases read performance through load balancing and elevator sorting while creating a complete real-time backup of your files.
- **RAID 10** (mirroring/striping). In this nested RAID system, combining mirroring with striping offers both high read/write performance and fault-tolerance.

For more information about RAID levels, see Comparing RAID Levels on page 4-39.

1.2   Setting Up the Software

This section describes how to install the disk drives and the MRU.

The topics included in this section are:

- Installing the Disk Drives
- Verifying Driver Installation
- Installing the Software

1.2.1   Installing the Disk Drives

Before installing the MRU, ensure that you have the required number of SATA and PATA disk drives connected to the appropriate ports on your computer's motherboard. We recommend installing SATA and PATA drives of similar capacity, which enhance performance.

To install the SATA and PATA disks

1. Connect one end of each data cable to the individual disk drives and connect the other end of each data cable to the connectors either on the motherboard or on the adapter.
2. Connect power to each of the disk drives.

    Note: To create the logical drives, use only drives connected to a single adapter.

The following table lists the minimum number of drives required for each RAID level.

RAID Level	Number of Drives Required
RAID 0	Any number
RAID 1	2 only
RAID 10	4 only

1.2.2   Verifying Driver Installation

To run the MRU, install the driver specific to your operating system. The driver file is automatically installed on your computer during MRU installation.

To verify the driver installation

1. On the **Desktop**, right-click **My Computer**, and then select **Manage**.

    The Computer Management window appears.

2. In the left pane, double-click **System Tools**, and then double-click **Device Manager**.

    The left pane displays a list of devices for your computer. If the driver properly installed during the MRU installation, the right pane displays the Marvell RAID adapter under SCSI and RAID Controllers.

1.2.3   Installing the Software

This sections describes the MRU Setup Wizard windows. The recommended screen resolution for the MRU GUI is 1024 × 768 pixels.

To install the MRU software

1. Insert the MRU CD into your computer's CD drive.

    The MRU Setup Wizard starts.

    Figure 1-1 MRU Setup Wizard: Main Window

2. Click **NEXT**.

    The Choose Components window appears, as shown in Figure 1-2, with the Full install option pre-selected.

Figure 1-2 MRU Setup Wizard: Choose Components
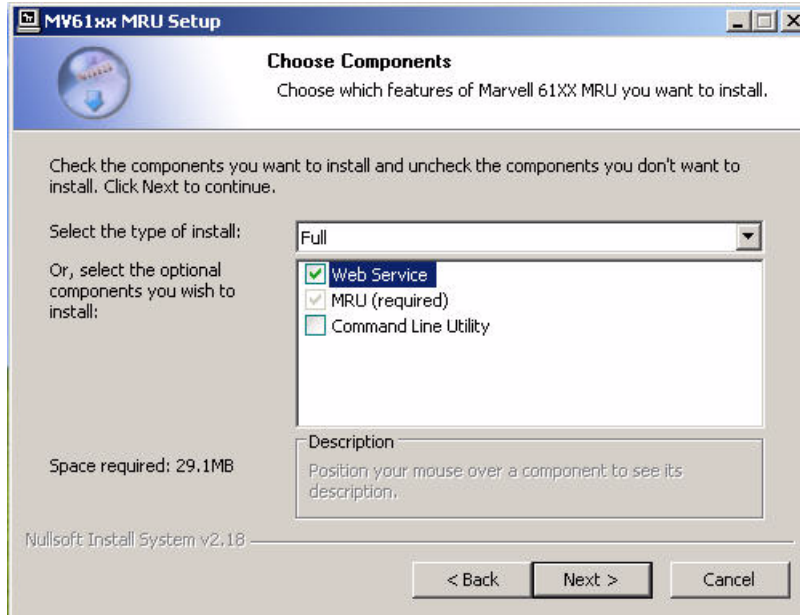
3. Select the options you want for custom installation.

    Web Service is preselected for both Full and Custom installation. If you deselect this option, the Apache server is not installed if the Web Service is unavailable on your computer. Web Service is required to run the MRU software.

4. Click **NEXT**.

    The Choose Install Location window appears, as shown in Figure 1-3, with the default location displayed in the **Destination Folder** field.

Figure 1-3 MRU Setup Wizard: Choose Install Location
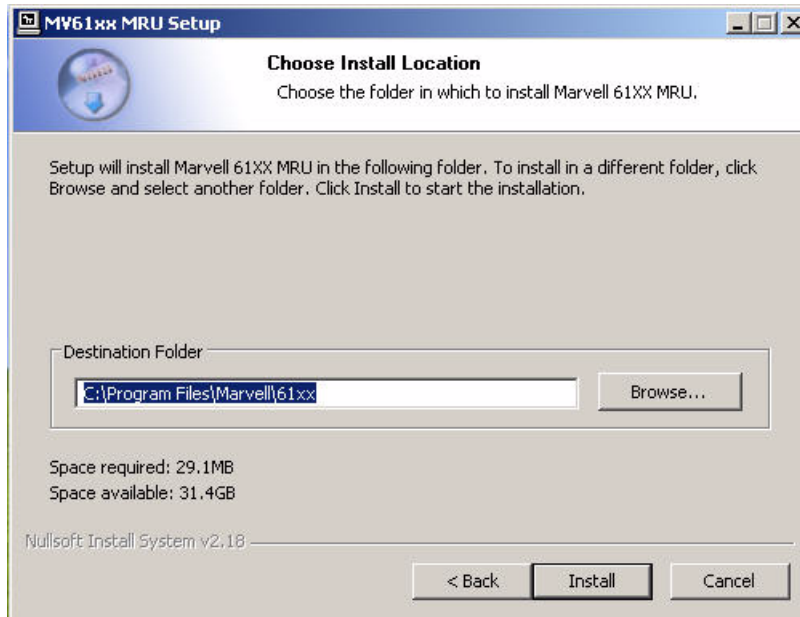
5. Click **Browse**, and then select the installation location.

6. Click **Install**.

The installation window appears for a few seconds, indicating that installation is in progress.

Afterwards, the installation wizard appears, indicating that the software installation is now complete, as shown in Figure 1-4.

Figure 1-4 MRU Installation Wizard: Last Window

7. Click **Finish**.

    A shortcut to the MRU software appears on the **Desktop**.

2   USING THE SOFTWARE

The Marvell RAID Utility (MRU) creates and manages logical drives on your computer by using RAID technology. RAID allows multiple physical drives to be combined together to create a logical drive. Logical drives can continuously protect critical data and improve performance depending on which RAID level you choose. For more information, see Comparing RAID Levels on page 4-39.

Although most functions pertaining to creating and managing logical drives can be performed using the Marvell BIOS Configuration or the Marvell CLI, the MRU GUI offers additional capabilities. The GUI is an easy-to-use customization tool for managing logical drives.

This chapter describes the options available in the MRU for creating and managing logical drives. The topics included in this chapter are:

- GUI Overview
- Viewing and Creating a Logical Drive
- Modifying a Logical Drive
- Deleting a Logical Drive
- Rebuilding a Logical Drive
- Initializing a Logical Drive
- Checking the Integrity of a Logical Drive

2.1   GUI Overview

The MRU GUI has a top and bottom pane, as shown in Figure 2-1. The top pane, with four tabs, is the interactive interface. The four tabs in this pane are Logical Drives, Physical Drives, Adapters, and System. Clicking on each tab brings up a window that lets you perform specific tasks and view configuration details specific to that tab.

Figure 2-1 MRU Main Window

The bottom pane displays the status and severity of events in the RAID system. The following table describes the three kinds of events.

Symbol	Name	Description
	Info	This is for information only.
	Warning	This is to notify that the user may need to take an action.
	Major	This is to notify that an action is urgently required.

The following sections describe the items in the top pane and the options available under each tab.

2.1.1 Logical Drives

The Logical Drives window, shown in Figure 2-2, lets you perform the following tasks:

- View the existing logical drives and their configurations.
- Create a new RAID.
- View the properties for individual logical drives, as shown in Figure 2-3.

Figure 2-2 MRU Logical Drives
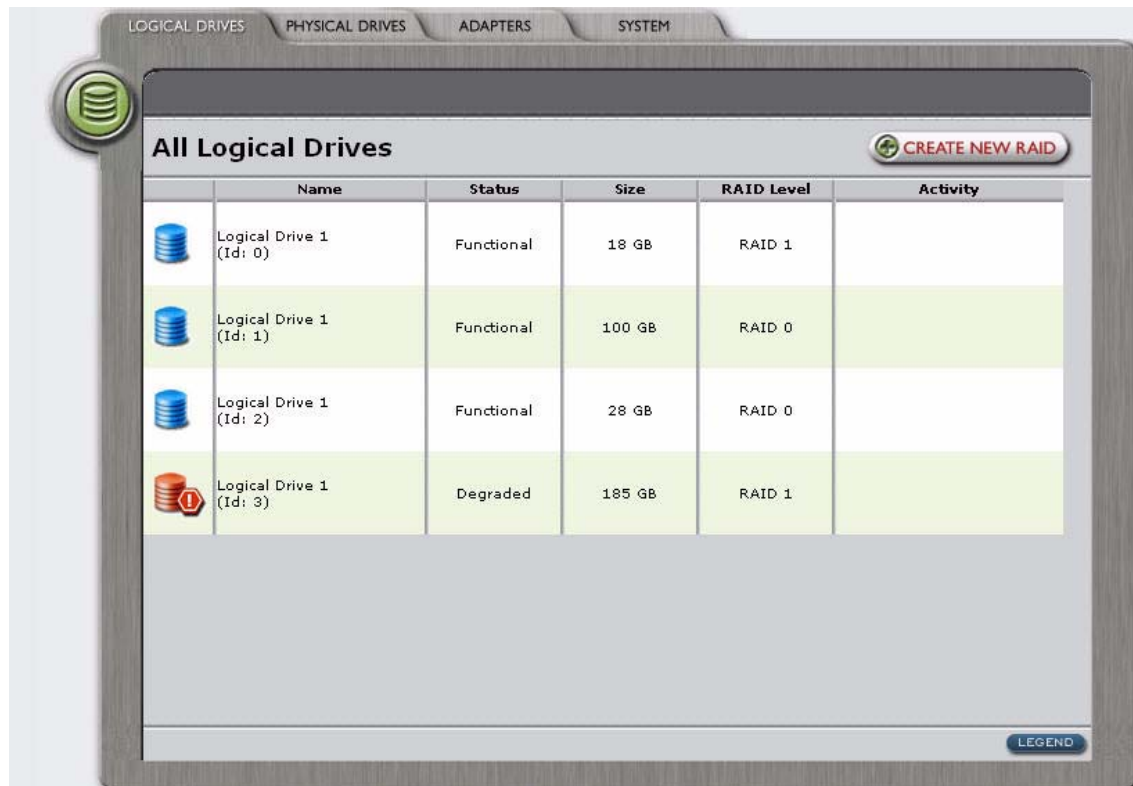
Figure 2-3 MRU Logical Drive Details
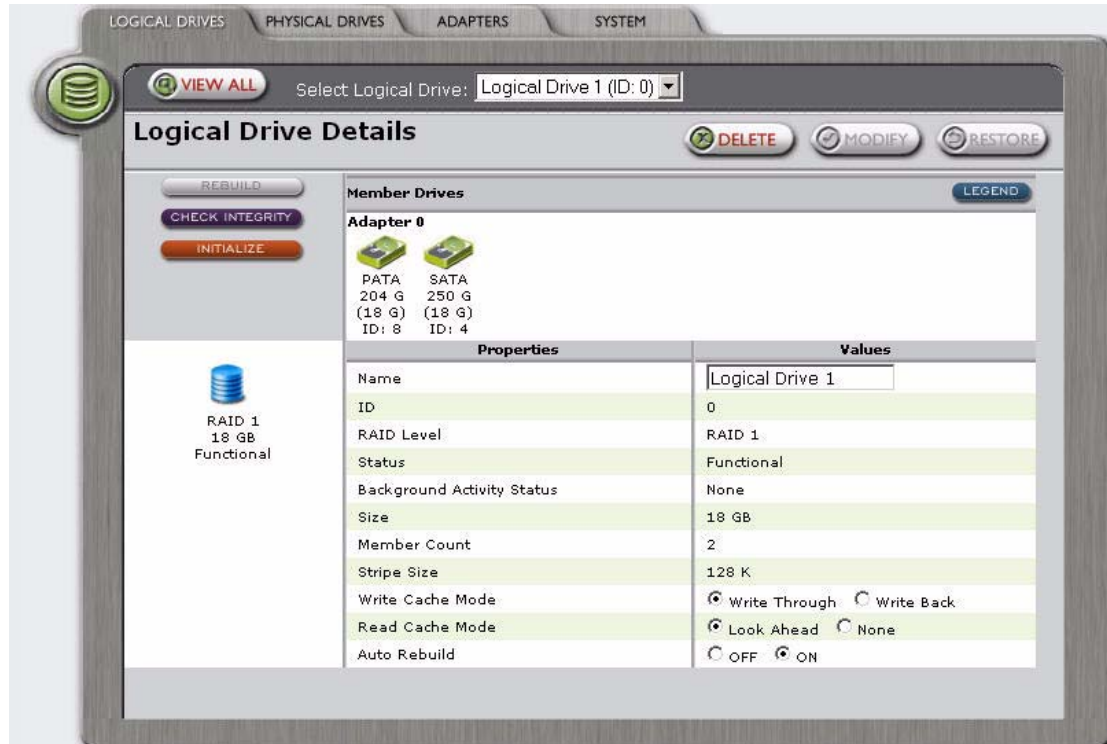
The Logical Drive Details window performs the following tasks: Delete, Modify, Restore, Rebuild, Check integrity, and Initialize.

2.1.2   Physical Drives

The Physical Drives window displays the SATA and PATA drives on your computer and indicates the status for each physical drive, as shown in Figure 2-4,

Symbol	Name
	Configured
	Unconfigured
	Spare drive

Note: Click **LEGEND** at the bottom corner for a quick overview of the drive icons.

Figure 2-4 MRU All Physical Drives
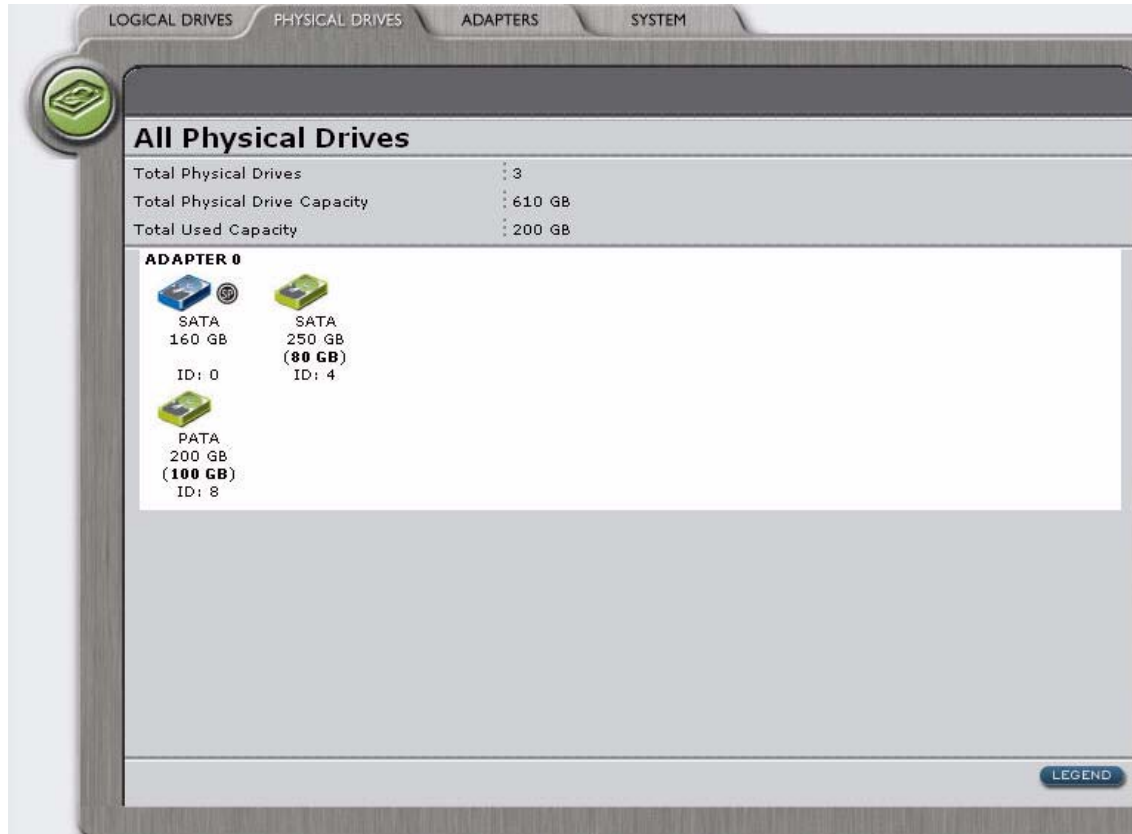
Click on an individual drive to view the Physical Drive Details window, as shown in Figure 2-5.

The Physical Drive Details window displays the properties for the specific physical drive and the available resources for creating a logical drive.

Figure 2-5 MRU Physical Drive Details

You can perform the following tasks from this window:

■ View the properties for each physical drive connected to the RAID controller.

■ Set a physical drive as a spare drive for use while rebuilding a logical drive.

2.1.3 Adapters

The Adapters window, as shown in Figure 2-6, provides information about each adapter, including the Driver Version, Vendor Device ID, Sub Vendor Device ID, Port Count, Background Activity Rate, and Auto-Rebuild.

Note: Your computer can have a maximum of two adapters.

Figure 2-6 MRU Adapters
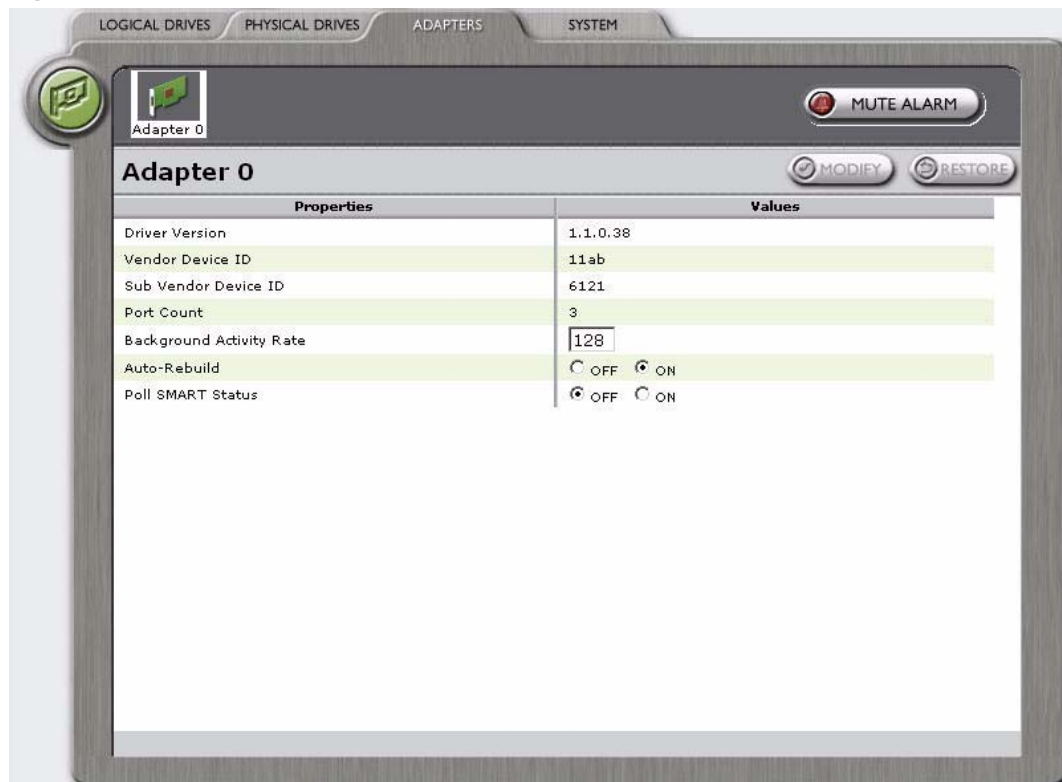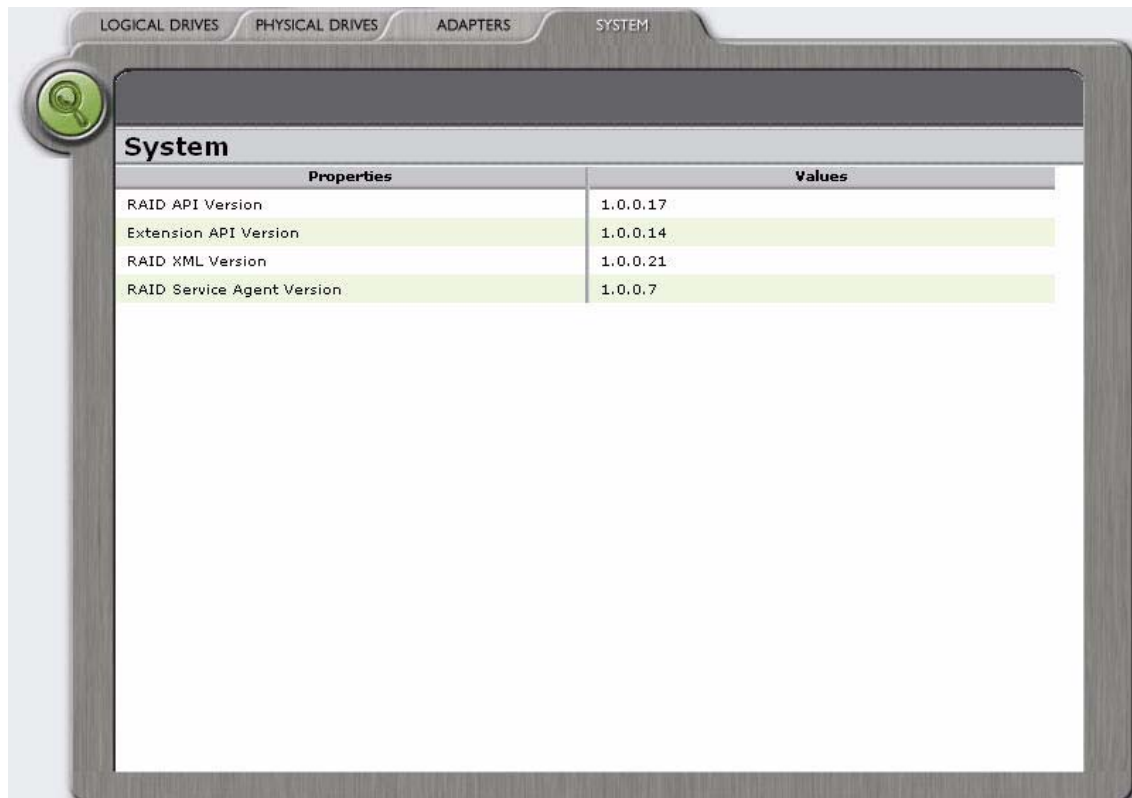
You can perform the following tasks from this window:

- Turn the alarm on or off.
- Set **Auto-Rebuild** on or off.
- Cancel the changes and restore the configuration.

2.1.4 System

The System window, as shown in Figure 2-7, provides information about the system-level components of the MRU software.

Figure 2-7 MRU System

2.2 Viewing and Creating a Logical Drive

You can view details about an existing logical drive and create a new logical drive from the Logical Drives window of the MRU.

To view the logical drive details

1. Start the MRU.
2. Click the **Logical Drives** tab, as shown in Figure 2-2, and then click the icon for the individual logical.

   The Logical Drive Details window appears, as shown in Figure 2-8.

Figure 2-8 MRU Logical Drive Details
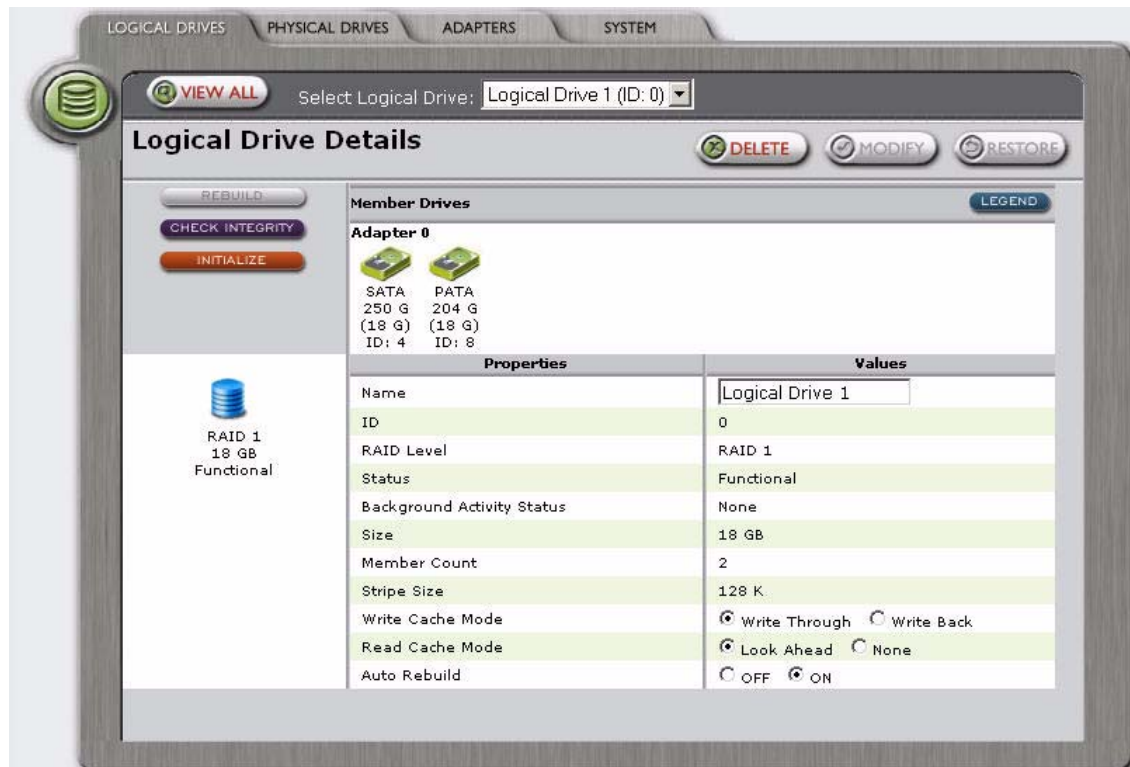
You can determine the status of each logical drive by its icon, which are listed in the following table.

Symbol	Name	Description
	Functional logical drive	This logical drive operates at its optimal strength.
	Offline logical drive	This logical drive is not functional, either due to a disk failure or a disk being unplugged.

Symbol	Name	Description
	Degraded logical drive	This logical drive is no longer reliable. Therefore, you must either rebuild the drive or delete it. If you have a degraded logical drive, the alarm goes on. To turn off the alarm, click on the Adapters tab.

Note: Click **LEGEND** at the bottom corner for a quick overview of the logical drive types.

To create a logical drive

1. Start the MRU.
2. Click the **Logical Drives** tab.
3. At the upper right side of the screen, click **Create New RAID**.

   The Create Logical Drive window appears, as shown in Figure 2-9. This window displays the physical drives available for creating new logical drives.

   Figure 2-9 MRU Create Logical Drive
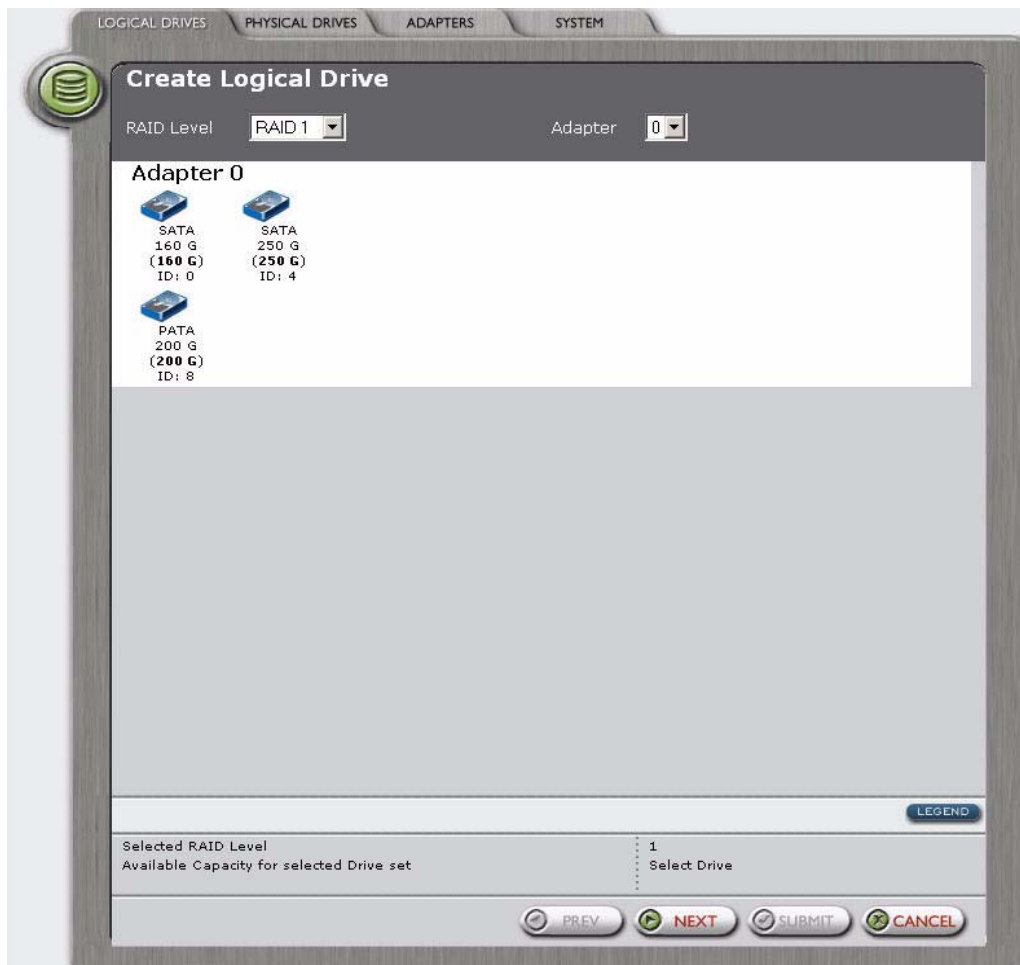
4. In the **RAID Level** box, select a level.

    Table 2-1 lists the minimum number of drives required for each RAID level.

    Table 2-1   Raid Level

RAID Level	Number of Drives Required
RAID 0	Any number
RAID 1	2 only
RAID 10	4 only

5. In the **Adapter** box, select the appropriate adapter.

6. Click on the specific SATA and PATA drives to create the RAID of your choice.

7. Click **NEXT**.

    Note: If the combination of selected drives is not supported by the particular RAID level, an error message appears reminding you to select the appropriate number of drives.

    The second Create Logical Drive window appears, as shown in Figure 2-10, and for setting the properties.

Figure 2-10 MRU Create Logical Drive (second window)
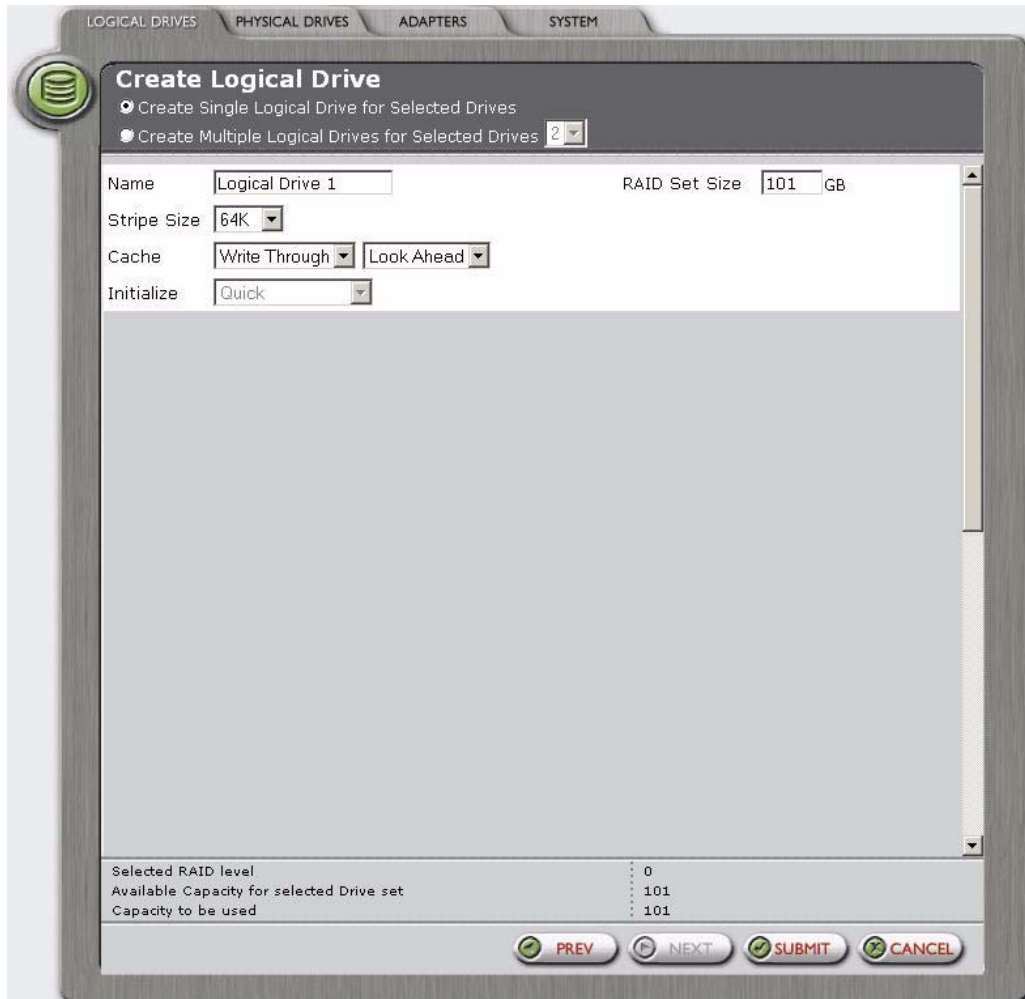
8. Enter the desired value in each field, and then click **SUBMIT** at the bottom of the screen.

   Note: You have three options for initializing a logical drive: Quick, Full, and None. You can initialize the logical drive while creating it or afterwards.

   A window appears with a message about formatting the new logical drive.

9. Click **OK**.

   The All Logical Drives window appears, displaying the new logical drive.

2.3   Modifying a Logical Drive

You can change the configuration of an existing logical drive to enhance its performance.

To modify a logical drive

1. Start the MRU.
2. Click the **Logical Drives** tab, and then click the icon for the logical drive.

    The Logical Drive Details window appears, as shown in Figure 2-11.

    Figure 2-11 MRU Logical Drive Details
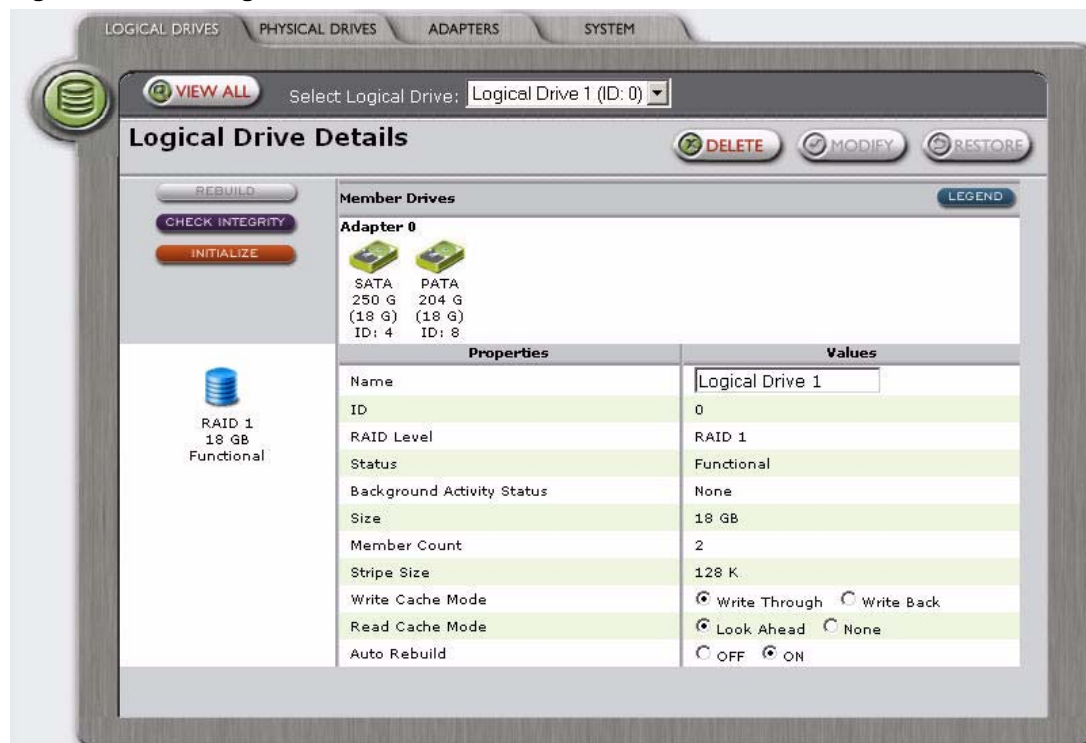
3. Change the properties as needed, and then click **MODIFY** at the top of the screen.

Note: To return the editable properties to their original values, click **RESTORE**.

2.4   Deleting a Logical Drive

If you want to change the size of a logical drive, you must delete that logical drive and create a new one with the desired configuration.

To delete a logical drive

1. Start the MRU.

2. Click the **Logical Drives** tab, and then click the icon for the logical drive.

   The Logical Drive Details window appears.

3. Click **Delete**.

   A message appears confirming the deletion of the logical drive.

4. Click **OK**.

After deleting the logical drive, the additional free space is shown in the space available on the physical drives. Any physical drive that is not used as part of a logical drive is available through the Windows Storage Manager.

2.5 Rebuilding a Logical Drive

The MRU can rebuild the logical drive by reconstructing data from a failed drive onto one of its spare physical drives. Rebuilding is available for logical drives created using RAID level 1 and 10, which have the capability of mirroring data.

RAID 0 excludes rebuild capabilities. Therefore, the entire stripe is lost if one of the physical drive fails.

When a logical drive fails and is degraded, you are notified in two ways:

- Triggering of the alarm. You can turned it off in the **Adapters** window.
- Displaying the logical drive red icon with a warning symbol next to it.

You have the option to rebuild the logical drive either automatically or manually. To use the auto-rebuild process, there must be a spare drive available. Go to the Physical Drive Details window to set a physical drive as a spare. Any physical drive that is fully or partially configured cannot be set as a spare drive.

2.5.1 Auto-Rebuild

If the Auto-Rebuild option is on when creating the logical drive, the rebuilding process begins automatically if there is a degraded drive.

2.5.2 Manual Rebuild

Follow these steps to manually rebuild a logical drive:

1. Start the MRU.
2. Click the **Physical Drives** tab, and then select a physical drive as the target spare drive.
3. Click the **Logical Drives** tab, and then select the logical drive to rebuild.
4. Click **REBUILD**.

   The Event Log pane displays the rebuilding status.

2.6   Initializing a Logical Drive

There are two methods for initializing a logical drive:

- **Quick initialization**. Use this method if the logical drive consists one or more disk drives. This method erases only the Master Boot Record (MBR) in all of the selected disk drives.
- **Full Background initialization**. In this method, data synchronization occurs in the background while the operating system continues to have access to the logical drive. Full initialization is available for RAID 1 and RAID 10 logical drives.

    Note: This option is not available in the Marvell RAID BIOS Configuration.

To initialize a logical drive

1. Start the MRU.
2. Click the **Logical Drives** tab, and then click the icon for the logical drive.
3. In the Logical Drive Details window, click **INITIALIZE**.

    The Initialize window appears, as shown in Figure 2-12.

    Figure 2-12 MRU Initialize Window

4. In the **Initialize Options** box, select an initialization method.
5. Click **SUBMIT**.

    The Logical Drive Details window reappears and the Event Log pane displays the status of initialization.

2.7   Checking the Integrity of a Logical Drive

This feature enables the software to check and fix the data parity in the logical drives using RAID levels 1 and 10. Checking the integrity of data on your logical drive is performed as a housekeeping function.

Note: Perform this task when the logical drive you want to check is not performing RAID activities.

To check integrity of a logical drive

1. Start the MRU.
2. Click the **Logical Drives** tab, and then click the icon for the logical drive.

    The Check Integrity window appears.
3. Click **CHECK INTEGRITY**.
4. Select one of the following options:
    - **Check**. This option checks and reports data inconsistencies.
    - **Check and Fix**. This option checks, reports, and resolves data inconsistencies.

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3 CONFIGURING RAID USING THE BASIC INPUT/OUTPUT SYSTEM (BIOS)

The Marvell RAID BIOS Configuration, which is built into the Marvell RAID controller, creates logical drives.

Note: For extended capabilities in creating and managing logical drives, run the MRU. For information about using the MRU, see Chapter 2, Using the Software.

The topics included in this chapter are:

- Accessing the BIOS
- Using the BIOS

3.1   Accessing the BIOS

The main BIOS configuration screen displays three main functions, a set of keyboard commands, and configuration information about the physical disk drives and the logical drives, if any.

The functions are:

- **Adapter**. Displays the physical drives installed on your computer.
- **Create**. Lets the user create logical drives.
- **Delete**. Lets the user delete an existing logical drive.

The keyboard commands are:

- Arrow keys. Use the arrow keys to navigate the screens.
- **ENTER/SPACE**. Use these keys to select an item and execute a command.
- **ESC**. Use the escape key to go back one screen or exit the program.

The configuration information for the physical and logical drives are:

- **ID**. This displays the identification number assigned to each logical drive by the BIOS.
- **Level**. This displays the RAID level configuration of the logical drive.
- **Size**. This displays the data capacity of the logical drive in Megabytes (MB).
- **Members**. This displays the disks that are included in a logical drive.
- **Status**. This displays one of the following logical drive conditions:
  - **Online**: The logical drive is functioning at the optimal level.
  - **Degraded**: The logical drive is functional but does not perform fault tolerance. For RAID levels 1 and 10, the logical drive contains a drive that has stopped functioning. If set to auto-rebuild, the logical drive rebuilds itself on the spare drive, if available on your computer. Identify and replace the failed disk drive.
  - **Offline**: The logical drive is not functional and cannot be rebuilt. Therefore, replace the failed drive and create a new logical drive to copy over your data.

To access the MRU through the BIOS

1. Reboot your computer.
2. Before Windows starts, press CTRL+M to enter the BIOS, as shown in Figure 3-1.

Figure 3-1 BIOS Main Screen

```
┌─[Adapter] ──── [Create]──── [Delete] ─────────────────────────────────┐
│  Adapter 1                                                            │
│  Arrays Information:                                                  │
│      No array is defined?                                            │
│                                                                      │
│  Disks Information:                                                   │
│  ID  Port    Disk Name                        Size      Speed        │
│  1   1       SATA: HDT722516DLA380            164.6GB   SATA 1       │
│  5   2       SATA: HDT722516DLA380            164.6GB   SATA 1       │
│  9   3       SATA: HDT722516DLA380            164.6GB   SATA 1       │
│  13  4       SATA: HDT722516DLA380            164.6GB   SATA 1       │
│  17  5       PATA: ST3400832A                 400GB     UDMA-5       │
│  18  5       PATA: Maxtor 6L200P0             203.9GB   UDMA-6       │
│                                                                      │
│                                                                      │
│                                                                      │
│                                                                      │
│                                                                      │
│                                                                      │
│  ↓↑←→:Navigate, ENTER/SPACE:Select, ESC:Back/Exit                   │
└──────────────────────────────────────────────────────────────────────┘
```

3.2 Using the BIOS

This section describes the menus and related screens for configuring the MRU through the BIOS.

3.2.1 Adapter

Figure 3-1 shows the main BIOS menu screen, which displays the physical drives and related information installed on your computer.

From the Adapter screen, you can navigate to the Create and Delete screens.
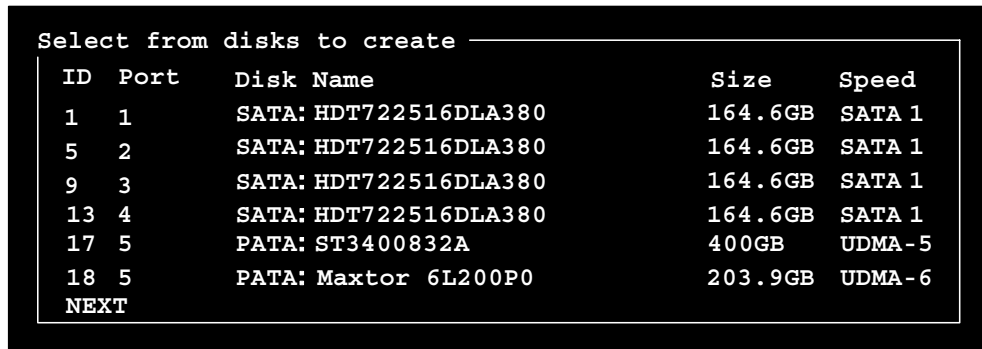
3.2.2 Create

Follow these steps to create a logical drive:

1. Start the BIOS.

2. At the top of the screen, select the **Create** tab, and then press **ENTER**.

The Create screen appears. This screen lets you select the disk drives for the logical drive.

Figure 3-2 Select Disks to Create, Screen 1

```
Select from disks to create
 ID   Port   Disk Name                      Size      Speed
 1    1      SATA: HDT722516DLA380          164.6GB   SATA 1
 5    2      SATA: HDT722516DLA380          164.6GB   SATA 1
 9    3      SATA: HDT722516DLA380          164.6GB   SATA 1
 13   4      SATA: HDT722516DLA380          164.6GB   SATA 1
 17   5      PATA: ST3400832A               400GB     UDMA-5
 18   5      PATA: Maxtor 6L200P0           203.9GB   UDMA-6
 NEXT
```

3. Select a drive, and then press **ENTER**.

   An asterisk appears next to the selected drive.

   Figure 3-3 Select Disks to Create, Screen 2

   ```
   Select from disks to create
     ID  Port    Disk Name                        Size      Speed
    *1   1        SATA:HDT722516DLA380            164.6GB   SATA 1
     5   2        SATA:HDT722516DLA380            164.6GB   SATA 1
     9   3        SATA:HDT722516DLA380            164.6GB   SATA 1
     13  4        SATA:HDT722516DLA380            164.6GB   SATA 1
     17  5        PATA:ST3400832A                 400GB     UDMA-5
     18  5        PATA: Maxtor 6L200P0            203.9GB   UDMA-6
     NEXT
   ```

4. Select **NEXT**, and then press **ENTER**.

   The Create Array screen appears, as shown in Figure 3-4.

   Figure 3-4 Create Array Screen

   ```
   Create Array

     Raid level    :  RAID0
     Array Name    :
     Disks ID      :  1 5 9 13 17 18
     Max Size(MB)  :  987776
     Capacity(MB)  :  987776
     Strip Size    :  64KB
     Init Mode     :  No
     Cache Mode    :  Write Through

     NEXT
   ```

5. View the options available by clicking in each field.

---

6. Enter values for the following logical drive properties:
   - RAID Level (RAID 0, RAID 1, RAID 10)
   - Array Name
   - Capacity
   - Stripe Size (16K, 32K, 64K, 128K)
   - Init Mode (Initialization: None or Quick)
   - Cache Mode (Write Through or Write Back)
7. Select **NEXT**, and then press **ENTER**.

   The BIOS main screen appears and displays the new logical drive.

   Figure 3-5 Logical Drive Display

```
 ┌[Adapter] ───── [Create]───── [Delete] ──────────────────────┐
 │ Adapter 1                                                     │
 │ Arrays Information:                                           │
 │ ID  Array Name   Size      Level    Status  Stripe Members   │
 │ 1   New array    293.8GB   RAID10   Online  64KB   1.5.9.13.17.18 │
 │                                                               │
 │ Disks Information:                                            │
 │ ID  Port   Disk Name                        Size     Speed    │
 │ 1   1      SATA:HDT722516DLA380             164.6GB  SATA 1   │
 │ 5   2      SATA:HDT722516DLA380             164.6GB  SATA 1   │
 │ 9   3      SATA:HDT722516DLA380             164.6GB  SATA 1   │
 │ 13  4      SATA:HDT722516DLA380             164.6GB  SATA 1   │
 │ 17  5      PATA:ST3400832A                  400GB    UDMA-5   │
 │ 18  5      PATA: Maxtor 6L200P0             203.9GB  UDMA-6   │
 │                                                               │
 │                                                               │
 └───────────────────────────────────────────────────────────────┘
  ↓↑←→:Navigate, ENTER/SPACE:Select, ESC:Back/Exit
```

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3.2.3 Delete

Follow these steps to delete a logical drive:

1. Start the BIOS.

See

2. At the top of the screen, select the **Delete** tab, and then press **Enter**.

The Delete Array screen appears.

Figure 3-6 BIOS Delete, Screen 1

```
 Delete array ─────────────────────────────────────────────

  ID   Array Name   Size      Level     Status  Stripe Members
  1    new array    293.8GB   RAID10    Online  64KB    1.5.9.13.17.18
  NEXT

```

3. Select the logical drive to delete.

An asterisk appears next to the selected logical drive.

Figure 3-7 BIOS Delete, Screen 2

```
 Delete array ─────────────────────────────────────────────

  ID   Array Name   Size      Level     Status  Stripe Members
 *1    new array    293.8GB   RAID10    Online  64KB    1.5.9.13.17.18
  NEXT

```

4. Select **NEXT,** and the press **ENTER**.

A message appears at the bottom of the BIOS screen about deleting the Master Boot Record (MBR).

5. Press Y to delete the MBR.

The BIOS main screen appears and the deleted logical drive is no longer displayed.

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4 SELECTING A RAID LEVEL

Redundant array of independent disks (RAID) is a storage technology consisting of one or more disks working in parallel. RAID technology allows an array of physical disks to be combined together to form a logical drive, which appears as a single storage device to the user.

You can configure a RAID logical drive in several different ways, with each configuration offering its own benefits. The Marvell RAID controller supports RAID 0, RAID 1, and RAID 10.

This chapter provides information about the properties of each RAID level and how to choose a suitable RAID level.

The topics included in this chapter are:

- RAID 0 (Striping)
- RAID 1 (Mirroring)
- RAID 10 (Mirroring and Striping)
- Comparing RAID Levels

4.1 RAID 0 (Striping)

RAID 0 is known as striping because data stripes of equal size on the logical drive are divided among an even number of physical disks, as shown in Figure 4-1. Consequently, the speed at which data is read and written is increased because data stored on multiple drives can be read and written simultaneously. However, it is important to remember that data is divided between multiple disk drives, so data is not recoverable if one of the physical disks fails.

Figure 4-1 RAID 0: Striping
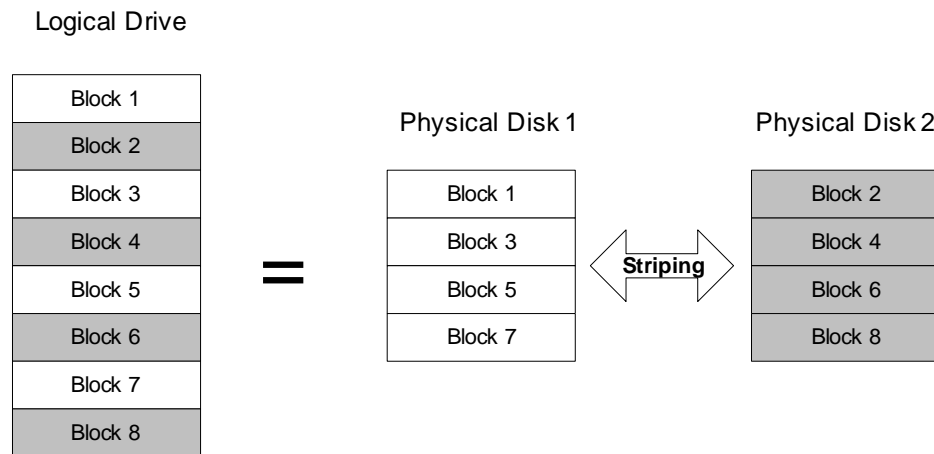
Logical Drive

RAID 0 is ideally suited in situations where all of the physical disk drives have the same capacity. However, you can create a logical drive if the selected disk drives have different capacities, but it will have a maximum capacity equal to the size of the smallest disk multiplied by the total number of disks in the array. For example, a logical drive consisting of two disks, an 80 Gb physical disk and a 100 Gb physical disk, can only create a logical drive up to a maximum of 160 Gb (2 x 80 Gb).

4.2   RAID 1 (Mirroring)

RAID1 is known as mirroring because the data on the logical drive is written to a pair of physical disks, which ensures that identical data appears on both of the physical disks. See Figure 4-2 for more detail.

Figure 4-2 RAID 1: Mirroring

Logical Drive
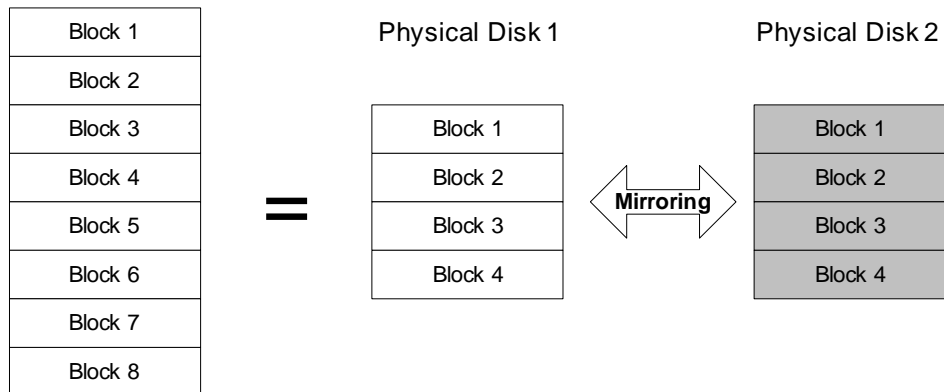
RAID 1 can increase Read performance. Data is identical on both of the physical disks, so a read command can be sent to the disk that is not busy, rather than wait for the primary drive to finish an in-process read. However, RAID 1 does incur a slight drop in Write performance because both drives must be written to when sending data to the logical drive.

RAID 1 also incorporates fault-tolerance, which allows access to the data even if one physical disk fails. In addition, if you replace the failed disk with a new physical disk, the rebuild begins recreating the mirror set of drives, which can be accomplished while the system continues to function normally.

Note: Mirroring is a technique used for redundancy, so it is important to remember that, for example, two 80 Gb physical disks (a total of 160 Gb) would only store 80 Gb of original data because the remaining 80 Gb is required to mirror the original data.
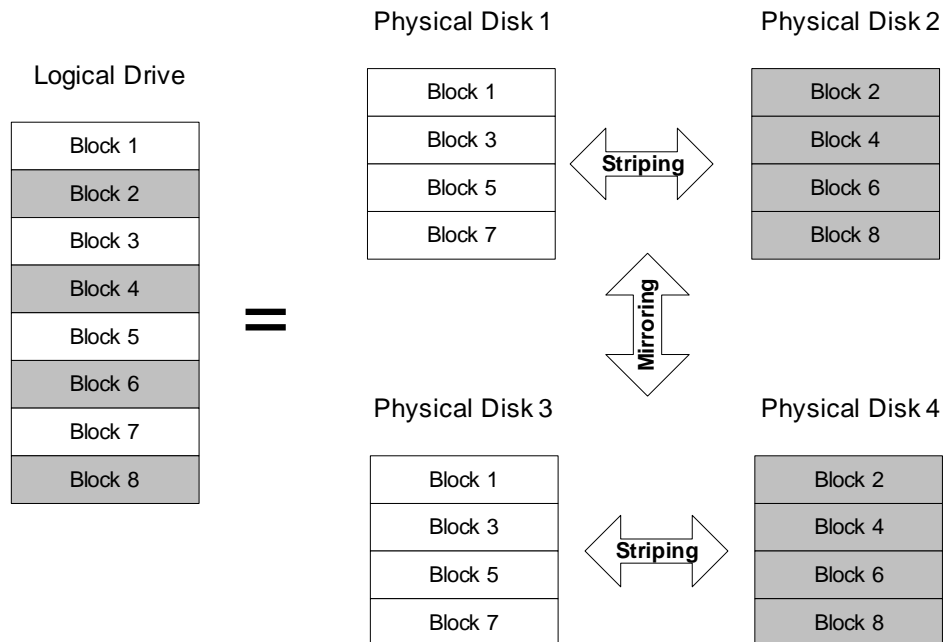
4.3 RAID 10 (Mirroring and Striping)

RAID 10 is a combination of the mirroring (RAID 1) and striping (RAID 0) techniques. At least four physical disks (two pairs) are needed to configure a RAID 10 logical drive. Both pairs of physical disks make separate RAID 0 stripes, and then the first RAID 0 drive is mirrored to the second RAID 0 drive. See Figure 4-3 for more detail.

RAID 10 provides the read and write performance of RAID 0, while providing the redundancy protection of RAID 1.

Also, in the event of a disk failure, the logical drive can rebuild itself while the system continues to function normally.

Figure 4-3 RAID 10: Mirroring and Striping

Logical Drive	Physical Disk 1	Physical Disk 2
Block 1	Block 1	Block 2
Block 2	Block 3	Block 4
Block 3	Block 5	Block 6
Block 4	Block 7	Block 8
Block 5	**Striping**	**Mirroring**
Block 6	Physical Disk 3	Physical Disk 4
Block 7	Block 1	Block 2
Block 8	Block 3	Block 4
	Block 5	Block 6
	Block 7	Block 8
	Striping	

Note: Like RAID 1, RAID 10 uses the mirroring technique for redundancy, so it is important to remember that, for example, two 80 Gb physical disks (a total of 160 Gb) would only store 80 Gb of original data because the remaining 80 Gb is required to mirror the original data.

4.4 Comparing RAID Levels

Each RAID level has features that may or may not be suitable in certain situations, so it is important to carefully consider which RAID level is best suited for a particular purpose.

4.4.1 RAID 0 (striping)

RAID 0 is simple to implement and provides increased reading and writing speed by spreading the transfer of data across multiple channels and drives. However, RAID 0 does not provide fault-tolerance, so all of the data is lost if one or more physical disks fail.

4.4.2 RAID 1 (mirroring)

RAID 1 is simple to implement and features automatic fault-tolerance. RAID 1 also provides increased read performance because data can be requested in parallel. However, write performance is decreased because two writes are required for each write command. Also, RAID 1 uses just 50 percent of the total disk capacity.

4.4.3 RAID 10 (mirroring and striping)

RAID 10 features automatic fault-tolerance and provides increased reading and writing speed by spreading the transfer of data across multiple channels and drives. However, RAID 10 uses just 50 percent of the total disk space and scalability is limited at a high inherent cost.

4.4.4 Overview of RAID Levels

Table 4-1 gives an overview of the features for each RAID level.

Table 4-1 RAID Features

Features	RAID 0	RAID 1	RAID 10
Simple implementation	√	√	
Improved read speed	√	√	√
Improved write speed	√		√
Fault-tolerance		√	√
Efficient use of disk capacity	√		
Scalable	√	√	
Automatic rebuild		√	√
Minimum number of drives	2	2	4

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