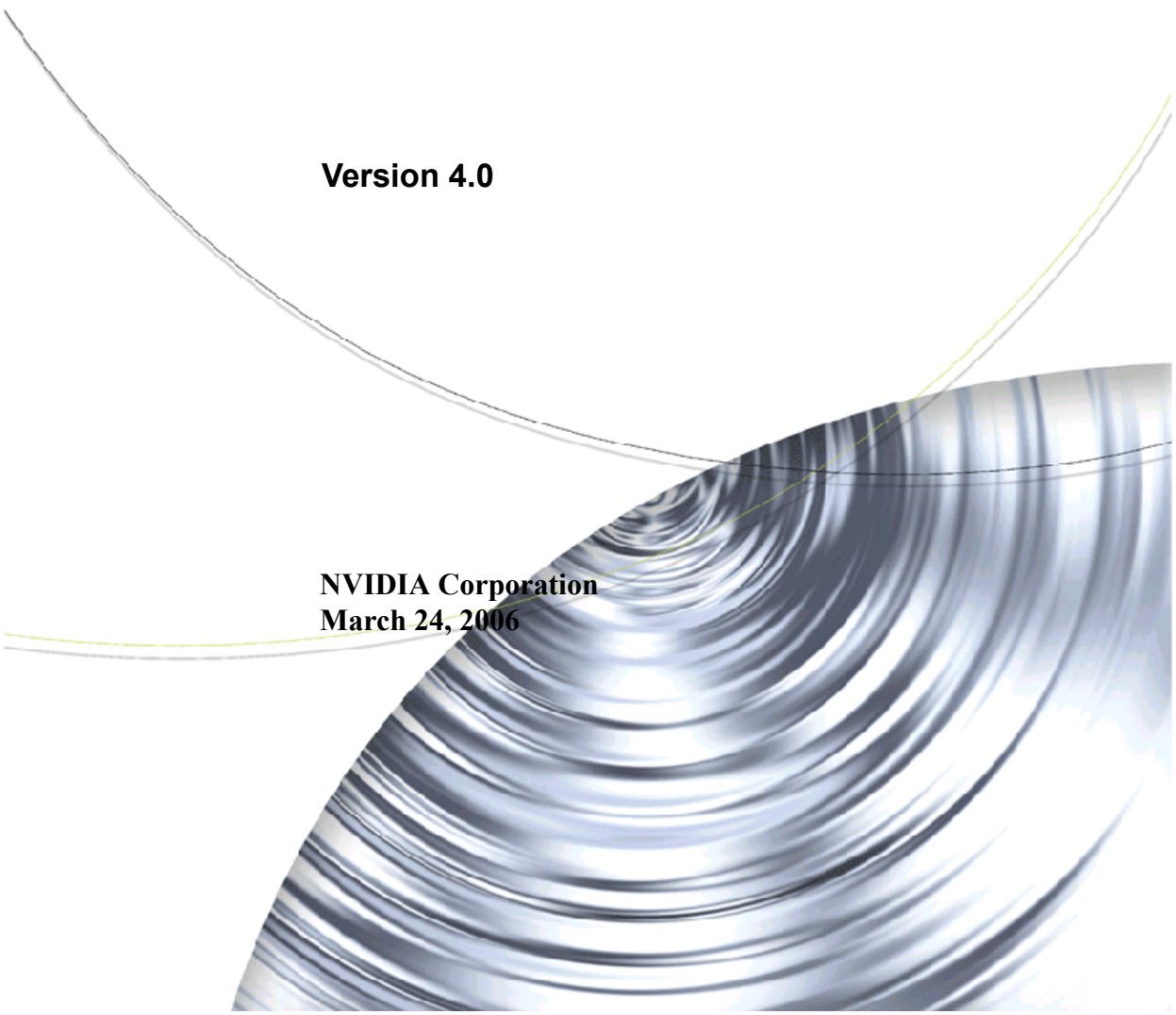
ForceWare Software

MediaShield User's Guide

Version 4.0



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CHAPTER

1

ABOUT NVIDIA® MEDIASHIELD™

NVIDIA brings Redundant Array of Independent Disks (RAID) technology—which is used by the world's leading businesses—to the common PC desktop. This technology uses multiple drives to either increase total disk space or to offer data protection.

RAID techniques were first published in 1988 by a multivendor consortium—the RAID Advisory Board. RAID techniques were divided into different categories or levels. Originally, RAID levels focused on improving resiliency or data availability. As additional RAID levels were defined, one was introduced for improving performance. For all levels, RAID techniques optimize storage solutions by using multiple disks grouped together and treating them as a single storage resource.

This chapter describes NVIDIA MediaShield in the following sections:

- "System Requirements" on page 2.
- "RAID Arrays" on page 4 describes the RAID levels supported by NVIDIA MediaShield.
- "NVIDIA MediaShield Features" on page 10 describes additional features offered by NVIDIA MediaShield.

System Requirements

Hardware Support

NVIDIA MediaShield supports the following NVIDIA® nForce™ versions:

- NVIDIA nForce 590 SLI
- NVIDIA nForce 570 SLI
- NVIDIA nForce 570
- NVIDIA nForce 550
- NVIDIA nForce 430
- NVIDIA nForce 410
- NVIDIA nForce4
- NVIDIA nForce4 Ultra
- NVIDIA nForce4 Ultra Intel Edition
- NVIDIA nForce4 SLI
- NVIDIA nForce4 SLI Intel Edition
- NVIDIA nForce4 SLI X16
- NVIDIA nForce4 SLI XE Intel Edition
- NVIDIA nForce4 Professonal IO-4
- NVIDIA nForce4 Professonal Pro
- NVIDIA nForce4 Professonal Pro SLI
- NVIDIA nForce3 Pro250
- NVIDIA nForce3 250Gb
- NVIDIA nForce3 Ultra
- NVIDIA nForce3 250
- NVIDIA nForce3 150
- NVIDIA nForce2 MCP2S

Operating System Support

NVIDIA MediaShield supports the following operating systems:

- Windows® XP Home Edition
- Windows XP Professional Edition
- Windows 2000 Professional
- Windows Server 2003

RAID Arrays

This section describes the following types of RAID arrays that MediaShield supports:

- RAID 0

  RAID 0 defines a disk striping scheme that improves the disk read and write times for many applications.

- RAID 1

  RAID 1 defines techniques for mirroring data.

- RAID 0+1

  RAID 0+1 combines the techniques used in RAID 0 and RAID 1 arrays.

- RAID 5 [1]

  RAID 5 provides fault tolerance and better utilization of disk capacity.

- JBOD

  JBOD provides a method for combining drives of different sizes into one large disk.

Note: Not all nForce platforms provide support for all the RAID levels listed.

1. RAID 5 is supported on select boards only. Please check with your motherboard manufacturer to determine whether RAID 5 is supported for the type and model of your motherboard.

RAID 0

How RAID 0 Works

In a RAID 0 array, the controller "stripes" data across multiple drives in the RAID subsystem. RAID 0 breaks up a large file into smaller blocks and then performs disk reads and writes across multiple drives in parallel. The size of each block is determined by the stripe size parameter, which you set during the creation of the RAID 0 set. Performance of applications running with a RAID 0 can vary greatly depending on the stripe size configured when creating the array. The default stripe size is 64K, but 32K or 16K may be more efficient if the application issues many smaller I/O operations. Some amount of trial and error may be appropriate to find the optimum stripe size.

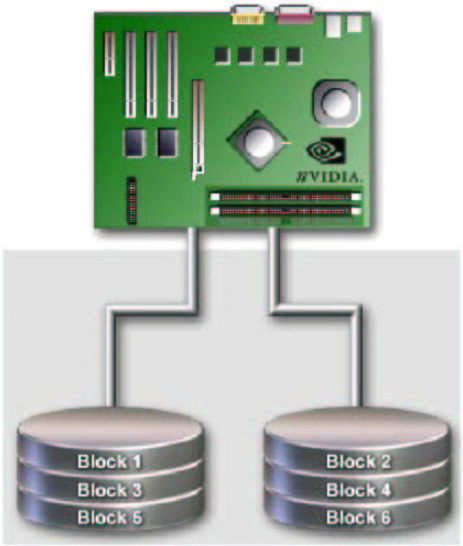


Figure 1.1 RAID 0 Array Diagram

RAID 0 is ideal for applications that require high bandwidth but do not require fault tolerance. RAID 0 has the best performance and capacity of any RAID level, but the lowest availability (no fault tolerance). If one drive fails, the entire array fails because part of the data is missing with no way to recover it other than restoring from a backup.

Summary of Features and Benefits

- **Benefits:** Provides increased data throughput, especially for large files.
- **Drawbacks:** No fault tolerance—all data is lost if any drive in the array fails.
- **Uses:** Intended for non-critical data requiring high data throughput, or any environment that does not require fault tolerance.
- **Drives:** Minimum: 1. Maximum: Up to 8, depending on the platform.
- **Fault Tolerance:** No.

RAID 1

How RAID 1 Works

In a RAID 1 array, every read and write is carried out in parallel across two disk drives. The mirrored—or backup—copy of the data can reside on the same disk or on a second redundant drive in the array. RAID 1 provides a hot-standby copy of data if the active volume or drive is corrupted or becomes unavailable due to a hardware failure. RAID 1 techniques can be applied for high-availability solutions, or as a form of automatic backup that eliminates tedious manual backups to more expensive and less reliable media.

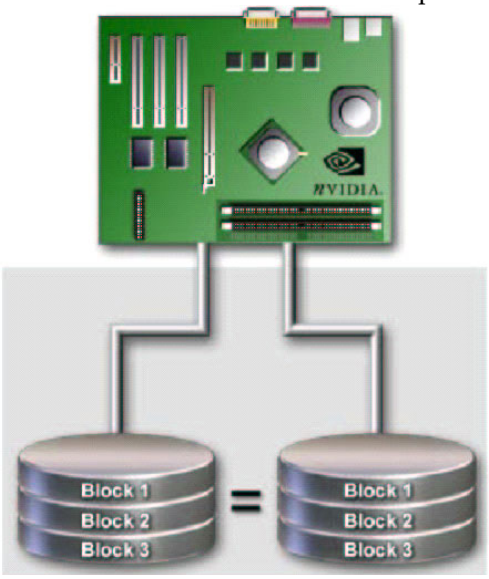


Figure 1.2 RAID 1 Array Diagram

RAID 1 provides complete data redundancy, but at the cost of doubling the required data storage capacity, resulting in 50% capacity utilization. Performance is roughly the same as for a single drive, although in some instances the dual write may be somewhat slower.

Summary of Features and Benefits

- **Benefits:** Provides 100% data redundancy. Should one drive fail, the controller switches to the other drive.
- **Drawbacks:** Requires two drives for the storage space of one drive. Performance is impaired during drive rebuilds.
- **Uses:** RAID 1 is ideal for small databases or any other application that requires fault tolerance and minimal capacity.
- **Drives:** Minimum, 2. Maximum, 2.
- **Fault Tolerance:** Yes

RAID 0+1

How RAID 0+1 Works

RAID 0 drives can be mirrored using RAID 1 techniques, resulting in a RAID 0+1 solution for improved performance plus resiliency.

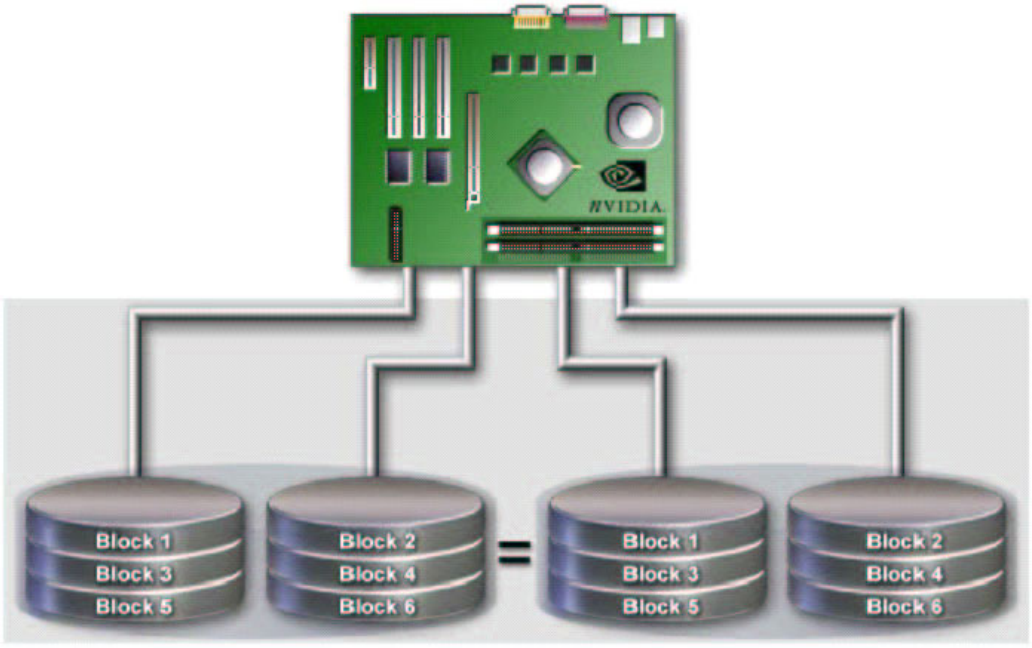


Figure 1.3 RAID 0+1 Array Diagram

The controller combines the performance of data striping (RAID 0) and the fault tolerance of disk mirroring (RAID 1). Data is striped across multiple drives and duplicated on another set of drives.

Summary of Features and Benefits

- **Benefits:** Optimizes for both fault tolerance and performance, allowing for automatic redundancy. May be simultaneously used with other RAID levels in an array, and allows for spare disks.
- **Drawbacks:** Requires twice the available disk space for data redundancy, the same as RAID level 1.
- **Drives:** Minimum: 4. Maximum: 6 or 8, depending on the platform.
- **Fault Tolerance:** Yes

RAID 5

How RAID 5 Works

RAID 5 stripes both data and parity information across three or more drives. It writes data and parity blocks across all the drives in the array. Fault tolerance is maintained by ensuring that the parity information for any given block of data is placed on a different drive from those used to store the data itself.

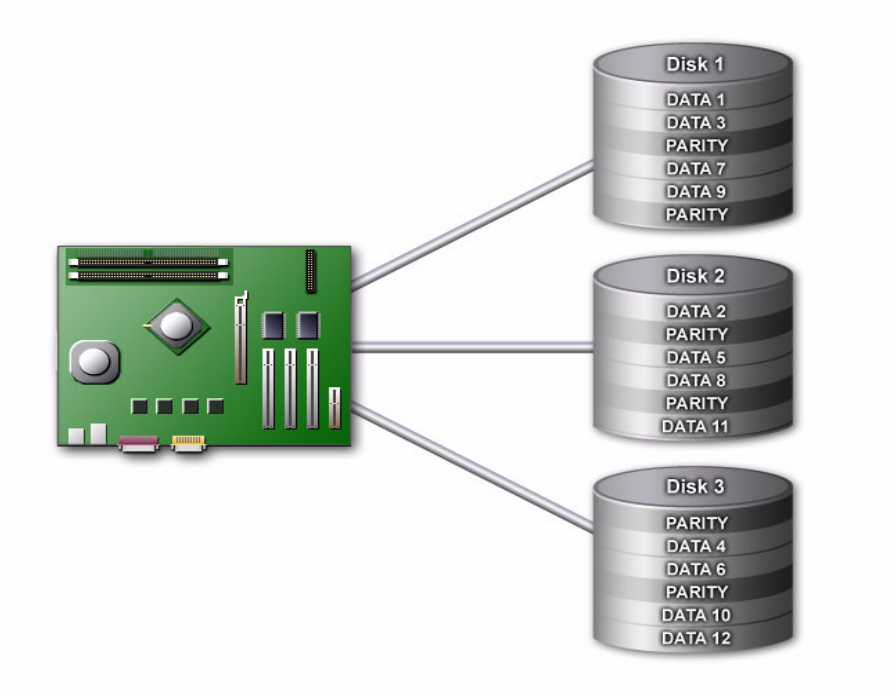


Figure 1.4 RAID 5 Array Diagram

Summary of Features and Benefits

- **Benefits:** An ideal combination of good performance, good fault tolerance, and high capacity and storage efficiency.
- **Drawbacks:** Individual block data transfer rate same as a single disk. Write performance can be CPU intensive.
- **Uses:** RAID 5 is recommended for transaction processing and general purpose service.
- **Drives:** Minimum, 3
- **Fault Tolerance:** Yes

JBOD

How JBOD Works

JBOD stands for “Just a Bunch of Disks”. Each drive is accessed as if it were on a standard SCSI host bus adapter. This is useful when a single drive configuration is needed, but it offers no speed improvement or fault tolerance.

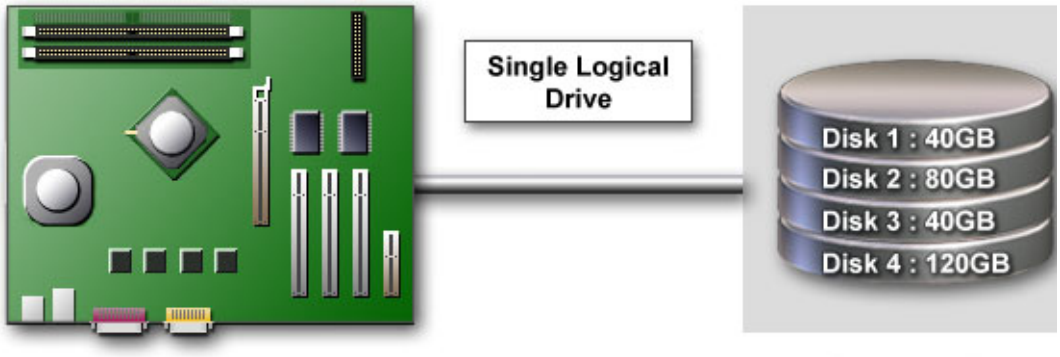


Figure 1.5 JBOD Array Diagram

Summary of Features and Benefits

- **Benefits:** JBOD provides the ability to combine odd size drives using all of the capacity of the drives.
- **Drawbacks:** No additional fault tolerance or performance relative to individual disks.
- **Uses:** JBOD works best if you have odd sized drives and you want to combine them to make one big drive.
- **Fault Tolerance:** No

Summary of RAID Configurations

Table 1.1 RAID Configuration Summary

Array	Uses	Advantages	Drawbacks	# Hard Disks	Fault Tolerance
RAID 0	Non-critical data requiring high performance.	High data throughput.	No fault tolerance.	multiple	None
RAID 1	Small databases or any other small capacity environment requiring fault tolerance.	100% data redundancy. Allows spare disks	Requires two drives for the storage space of one drive.	2	Yes
RAID 0+1	Critical data requiring high performance.	Optimized for both 100% data redundancy and performance. Allows spare disks.	Requires two drives for the storage space of one drive—the same as RAID level 1.	4+	Yes
RAID 5	Critical data and reasonable level of performance.	Fault tolerance and better utilization of disk space.	Decreased write performance due to parity calculations. Requires at least three drives.	3+	Yes
JBOD	Combining odd size drives into one big drive.	Combines and uses the capacity of odd size drives.	Decreases performance because of the difficulty in using drives concurrently or to optimize drives for different uses.	multiple	No

NVIDIA MediaShield Features

Additional RAID Features

NVIDIA MediaShield offers the following additional features:

- **Free Disk and Dedicated Spare Disk**

  A Free Disk or Dedicated Disk can be automatically used in case one drive of a fault-tolerant array fails. NVIDIA MediaShield defines a fault-tolerant array as either RAID 1, RAID 0+1, or RAID 5. A free disk can be used by any available fault-tolerant array, while a dedicated disk can be used only by the array to which it is assigned.

- **Bootable RAID**

  This allows you to install the operating system onto the RAID volume.

- **Migrating**

  Migrating is the ability to convert from one RAID mode to another RAID mode. This allows the user to upgrade their current disk or array for better performance, higher security, and increased capacity. More importantly, this is accomplished without

having to go through multiple steps. The migrating feature gives the user an upgradeable option to manage storage easily.

- **Hot Plug Array**

  A nice flexibility feature is the ability to move MediaShield RAID arrays from one nForce system to another. Since most nForce systems support SATA hot plug capability, you can add/remove a RAID array even while the system is running. This is done using the Hot Plug Array wizard.

Features and Benefits Summary

Features	Benefits
Spare Drive and Dedicated Drive Support	• Allows the user to dedicate a "spare" disk as a hot standby in the event of a array failure. • Offers additional protection in case of a failure in a mirrored array.
Bootable RAID	• Supports the use of a RAID drive for loading the operating system at power up for optimal performance
Migrating	• Allows the user to upgrade for more performance, security, and capacity. • Allows the user to change the current state of a disk/ array to another array with a one step process called "migrating", without losing any data during the configuration change.
Disk Failure Identification	• Notifies the user when a disk fails and indicates which one to replace
Hot Plug Array	• Allows the user to safely add a drive to the array when needed.

CHAPTER 2

SETTING UP YOUR RAID CONFIGURATION

This chapter provides instructions for:

- Setting Up a Non-Bootable RAID Array
- Setting Up a Bootable RAID Array

Setting Up a Non-Bootable RAID Array

RAID arrays can be created/deleted using both MediaShield RAID BIOS and the MediaShield RAID Manager from Windows. This section only covers basic BIOS setup required for non-bootable array.

- See the section "Setting Up a Bootable RAID Array" for instructions on configuring the RAID array in BIOS.
- See "Creating RAID Arrays" on page 43 for instructions on how to create a RAID array for your unused SATA storage devices.
- See "Using the NVIDIA MediaShield RAID Management Utility" on page 33 for details on configuring non-bootable RAID from Windows.

Setting Up the BIOS

1 Start your computer, then press **Delete** to enter the BIOS setup.

The BIOS CMOS Setup Utility window appears.

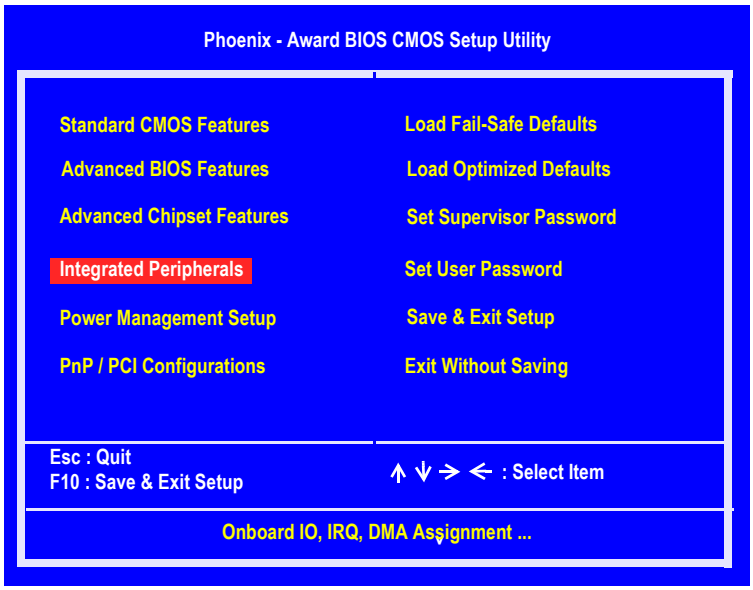


Figure 2.1 BIOS CMOS Setup Utility Main Window

2 Use the arrow keys to select **Integrated Peripherals** (see Figure 2.1), then press **Enter**.

The Integrated Peripherals window appears.

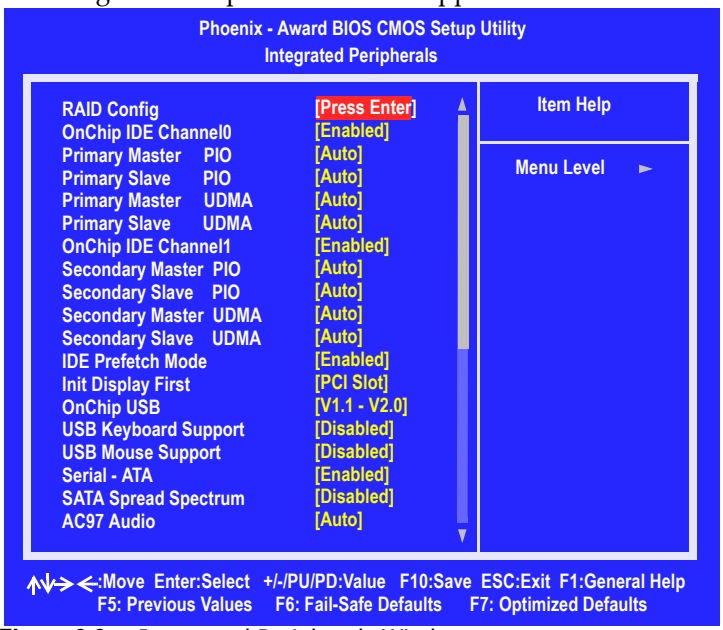


Figure 2.2 Integrated Peripherals Window

3 Use the arrow keys to select the RAID Config (see Figure 2.2), then press Enter.

The RAID Config window appears.

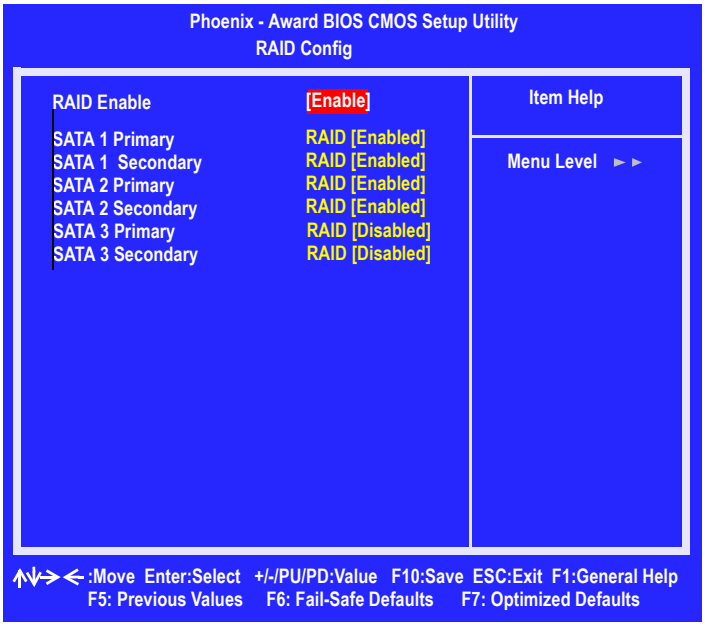


Figure 2.3 RAID Config Window

4 From the RAID Config window, globally enable RAID, then enable the SATA ports with disks that you want to use for RAID.

If RAID is enabled globally but not enabled on the individual SATA port, disks on that port can only be used for non-RAID applications.

In the example in Figure 2.3, four SATA ports are enabled, so the non-bootable RAID array can include up to four SATA disks. If there is a disk connected to "SATA 3 Primary" or “SATA 3 Secondary", it can not be used for RAID.

5 Press **F10** to save the configuration and exit.

The PC reboots.

Installing the NVIDIA MediaShield Software Under Windows

This section describes how to run the setup application and install the RAID software[1].

1 Start the nForce Setup program to open the NVIDIA Windows nForce Drivers page.

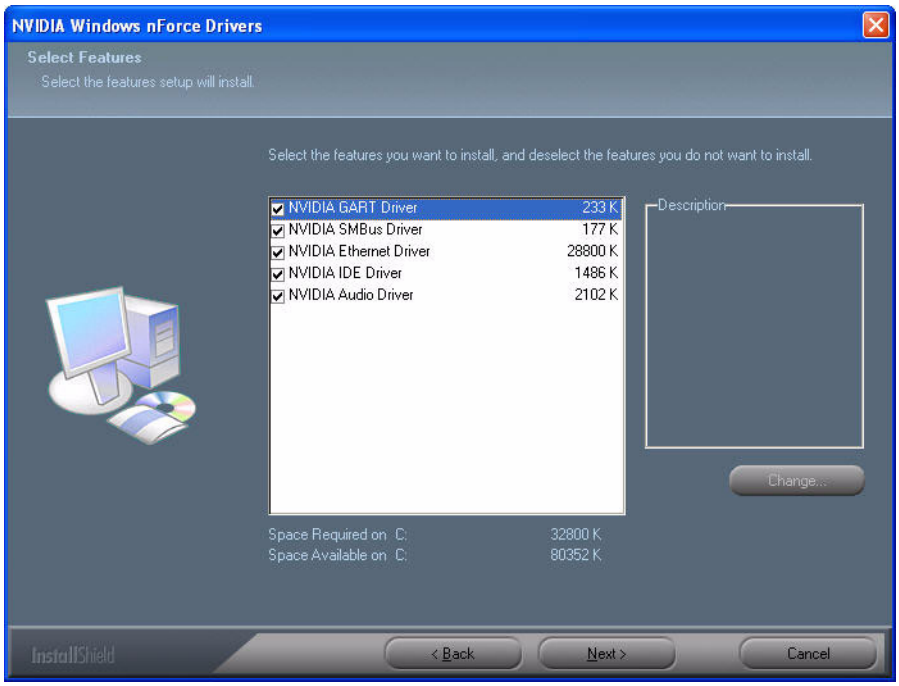


Figure 2.4 nForce Driver Installation Window

2 Select the modules that you want to install.

Make sure that the "NVIDIA IDE Driver" is selected.

You must install the NVIDIA IDE driver in order to enable NVIDIA MediaShield. If you do not install the NVIDIA IDE driver, NVIDIA MediaShield will not be enabled.

3 Click **Next** and then follow the instructions.

4 After the installation is completed, be sure to reboot the PC.

5 After the reboot, initialize the newly created array as described in the next section.

1. See the application note "Installing the NVIDIA IDE Driver in Windows 2000" on page 150 for information on how to install the NVIDIA IDE Driver under Windows 2000.

Using RAID Arrays Under Windows

After rebooting the PC, initialize the newly created array under Windows as follows:

1 Launch Computer Management by clicking Start → Settings → Control Panel then open the Administrative Tools folder and double click on Computer Management.

2 Click Disk Management (under the Storage section).

The Initialize and Convert Disk Wizards appears.

Figure 2.5 Initialize and Convert Disk Wizard

3 Click **Next**.

The Select Disks to Initialize window appears.

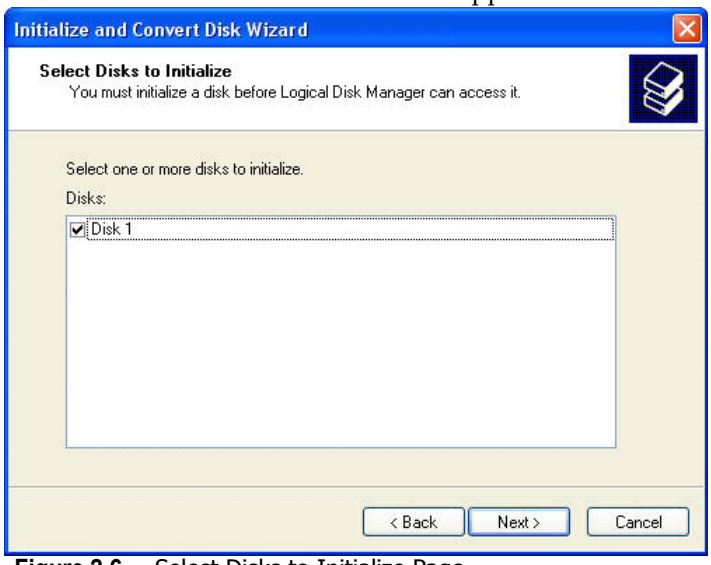


Figure 2.6 Select Disks to Initialize Page

The disks listed depend on how many arrays you have configured

4 Click **Next**.

The Select Disks to Convert window appears.

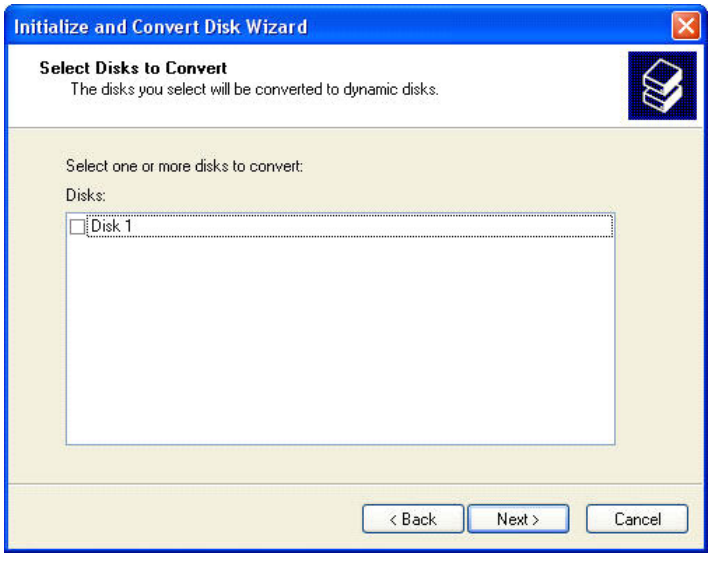


Figure 2.7 Select Disks to Convert Page

5 Check the disk in the list if you want to make the array a dynamic disk, then click **Next**. The Completing the Initialize and Convert Disk Wizard window appears.

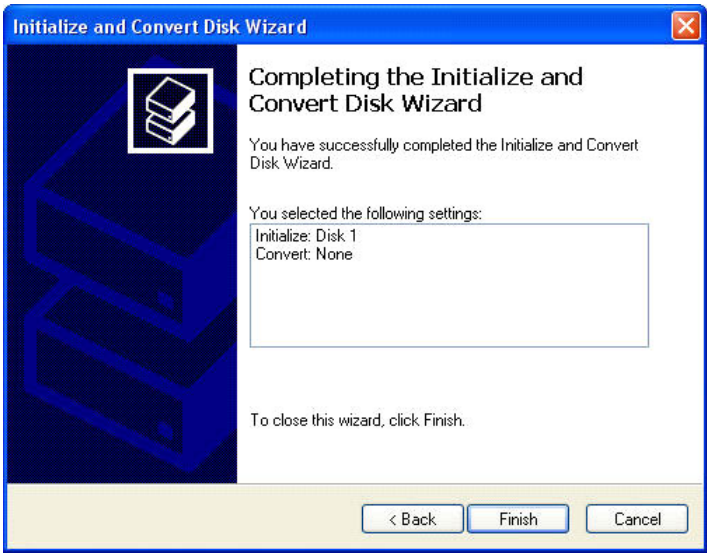


Figure 2.8 Completing the Initialize and Convert Disk Wizard Page

6 Click **Finish**.

The Computer Management window appears.

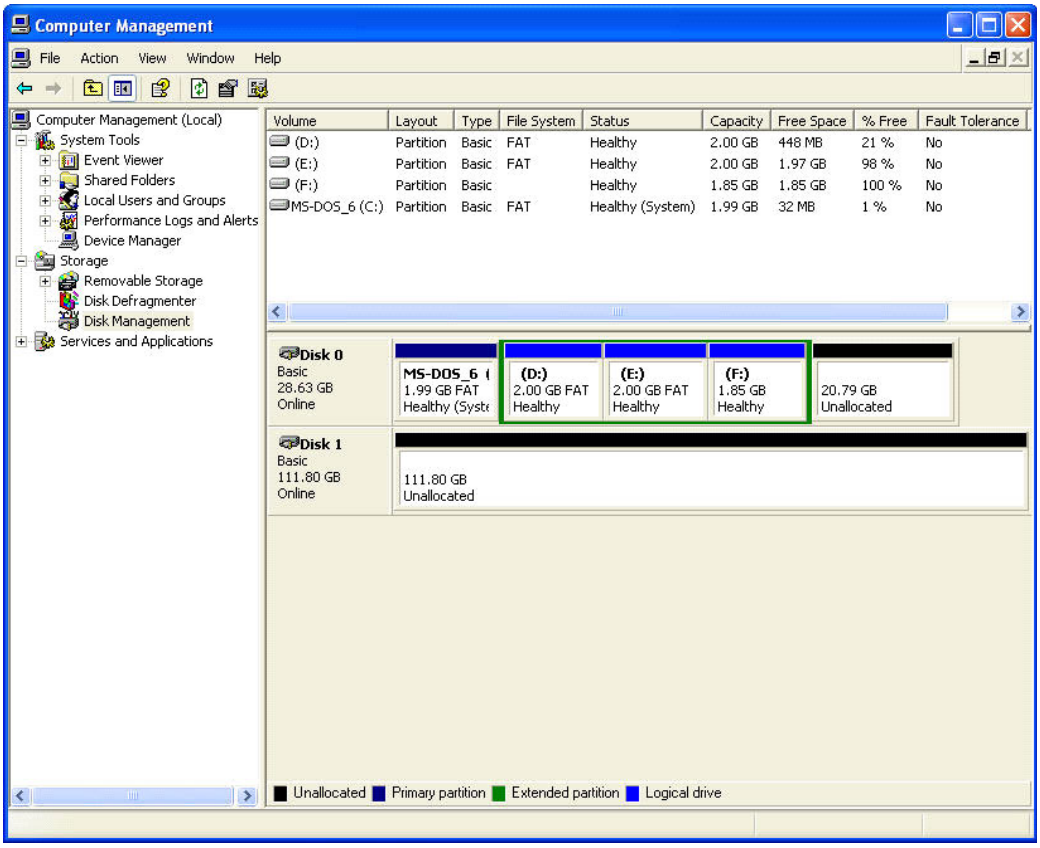


Figure 2.9 Computer Management Window

The actual disks listed will depend on your system. In Figure 2.9, there is a 111 GB unallocated partition (which is the total combined storage of two 60 GB HD). You must format the unallocated disk space in order to use it.

7 Format the unallocated disk space.

- Right click “Unallocated space”, select “New Partition…” and follow the Wizard instructions.
- After the drive has been formatted, it is ready for use. See “Using the NVIDIA MediaShield RAID Management Utility” on page 33 for instructions on how to create and configure RAID arrays.

Setting Up a Bootable RAID Array

This section explains how to configure a bootable RAID array.

Setting Up the BIOS

1 Start your computer, then press **Delete** to enter the BIOS setup.

The BIOS CMOS Setup Utility screen appears.

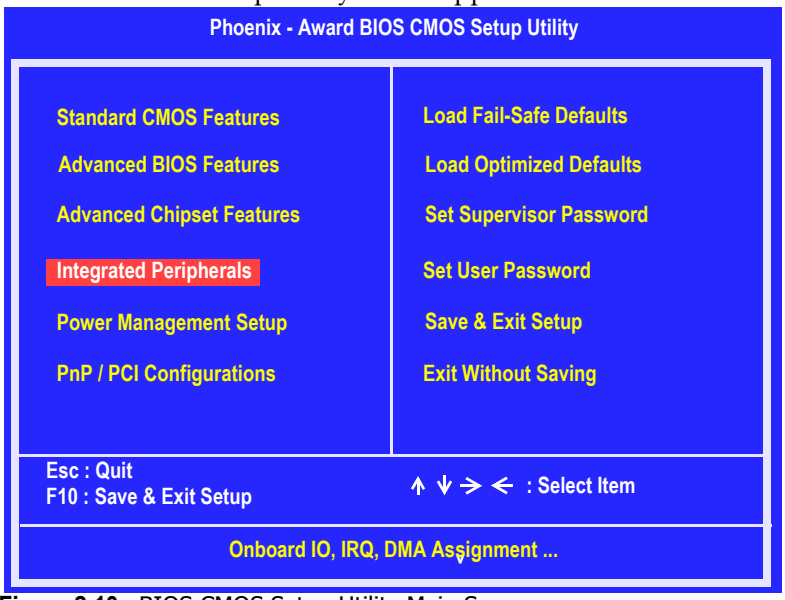


Figure 2.10 BIOS CMOS Setup Utility Main Screen

2 Use the arrow keys to select **Integrated Peripherals** (see Figure 2.10), then press **Enter**.

The Integrated Peripherals screen (or a screen similar to it) appears.

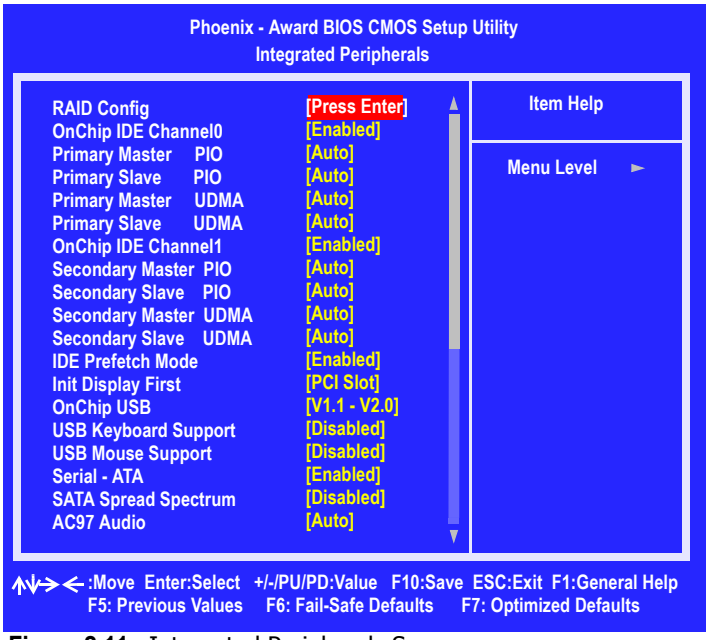


Figure 2.11 Integrated Peripherals Screen

3 Use the arrow keys to select the RAID Config (see Figure 2.11).

4 Press **Enter**.

The RAID Config screen appears.

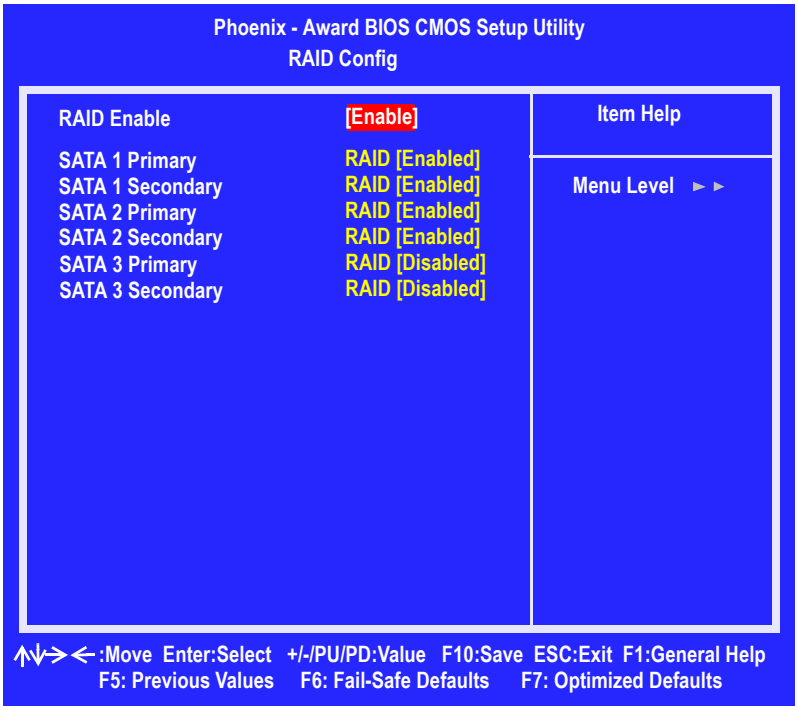


Figure 2.12 RAID Config Screen

5 From the RAID Config window, globally enable RAID, then enable the SATA ports with disks that you want to use for RAID.

If RAID is enabled globally but not enabled on the individual SATA port, disks on that port can only be used for non-RAID applications.

In the example in Figure 2.12, four SATA ports are enabled, so the non-bootable RAID array can include up to four SATA disks. If there is a disk Connected to "SATA 3 Primary" or "SATA 3 Secondary", it cannot be used for RAID.

6 Press **F10** to save the configuration and exit.

The PC reboots.

7 Enter the RAID BIOS Setup by pressing **F10** when prompted, and proceed to set up the RAID BIOS as described in the next section.

Configuring the NVIDIA RAID BIOS

The NVIDIA RAID BIOS setup lets you choose the RAID type and which hard drives you want to make part of the array.

Entering the RAID BIOS Setup:

1 Wait until you see the RAID software prompting you to press **F10**.

The RAID prompt appears as part of the system POST and boot process prior to loading of the OS. You have a few seconds to press **F10** before the screen disappears.

2 Press **F10.**

The NVIDIA MediaShield Utility—**Define a New Array** screen appears (Figure 2.13).

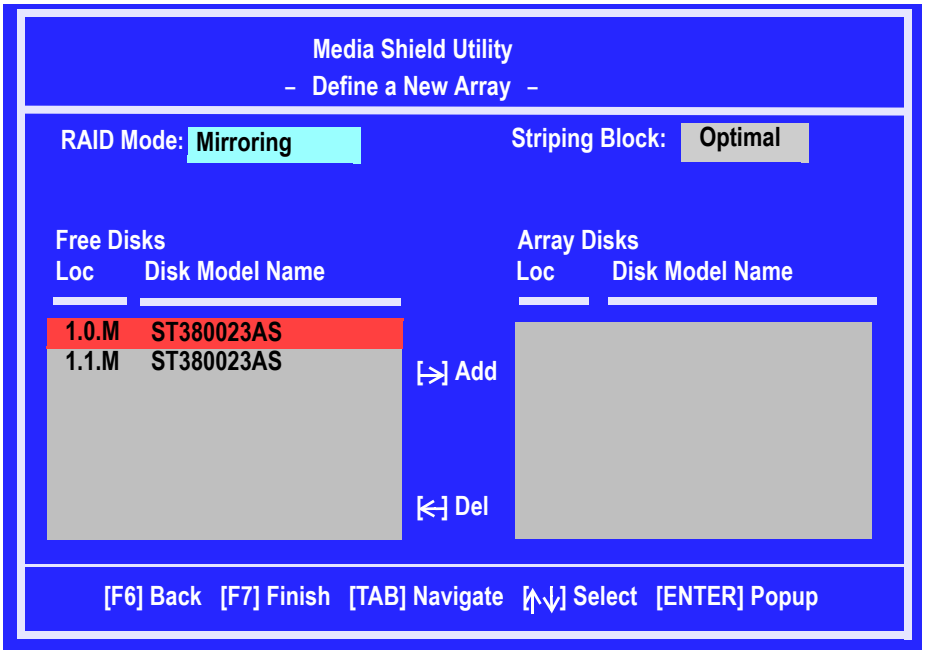


Figure 2.13 NVIDIA MediaShield Utility

By default, RAID Mode is set to Mirroring and Striping Block is set to Optimal.

Understanding the Define a New Array Window

Use the Define a New Array window to

- Select the RAID Mode
- Set up the Striping Block
- Specify which disks to use for the RAID Array

  The SATA ports are called channels and they are associated with adapters. The first digit in the Location field defines the adapter that the port is associated with. The 2nd digit defines the channel. (The "M" field,which used to specify Master or Slave, is obsolete.)

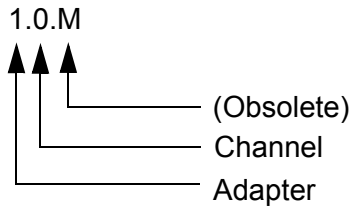


Figure 2.14 Loc Column Information

In Figure 2.14, 1.0. means the hard drive is attached to Adapter 1, Channel 0.

The location, disk model and capacity fields should allow you to identify disks. It may be useful to try attaching a SATA hard drive to the ports provided with your platform and determine which location IDs are associated with SATA ports on your motherboard.

Using the Define a New Array Screen

If necessary, press the tab key to move from field to field until the appropriate field is highlighted.

- **Selecting the RAID Mode**

  By default, this is set to Mirroring. To change to a different RAID mode, press the down arrow key until the mode that you want appears in the RAID Mode box—either Mirroring, Striping, Spanning, Stripe Mirroring or RAID 5.

  Note: Not all RAID levels are supported on all platforms.

- **Selecting the Striping Block Size**

  Striping block size is given in kilobytes, and affects how data is arranged on the disk. It is recommended to leave this value at the default Optimal, which is 64KB, but the values can be between 4 KB and 128 KB (4, 8, 16, 32, 64, and 128 KB)

Assigning the Disks

The disks that you enabled from the RAID Config BIOS setup page appear in the Free Disks block. These are the drives that are available for use as RAID array disks.

To designate a free disk to be used as a RAID array disk,

1. Tab to the Free Disks section.

   The first disk in the list is selected

2. Move it from the Free Disks block to the Array Disks block by pressing the right-arrow key (→).

   The first disk in the list is moved, and the next disk in the list is selected and ready to be moved.

3. Continue pressing the right-arrow key (→) until all the disks that you want to use as RAID array disks appear in the Array Disks block.

Figure 2.15 illustrates the Define a New Array screen after two disks have been assigned as RAID1 array disks.

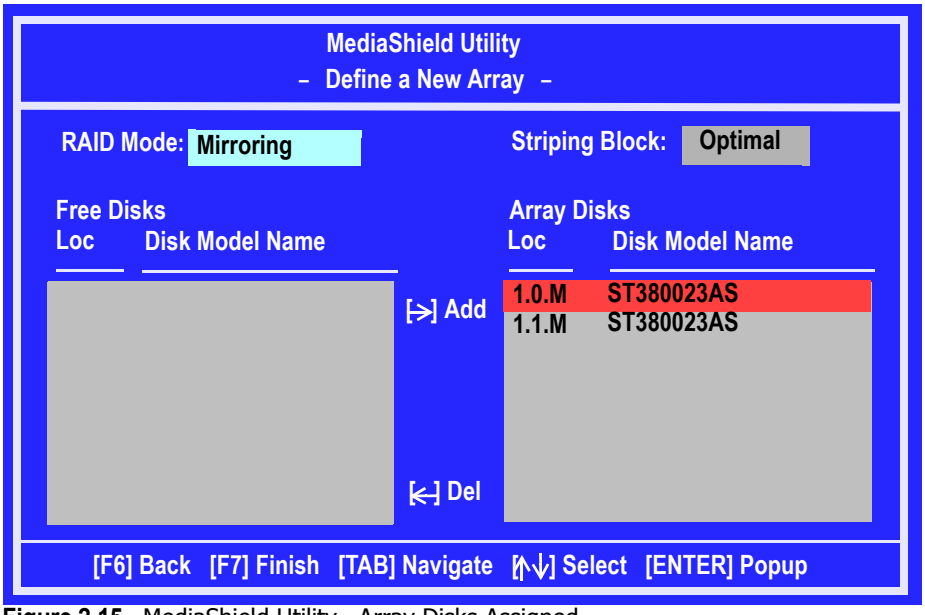


Figure 2.15 MediaShield Utility—Array Disks Assigned

Completing the RAID BIOS Setup

1 After assigning your RAID array disks, press **F7.**

The Clear disk array prompt appears.

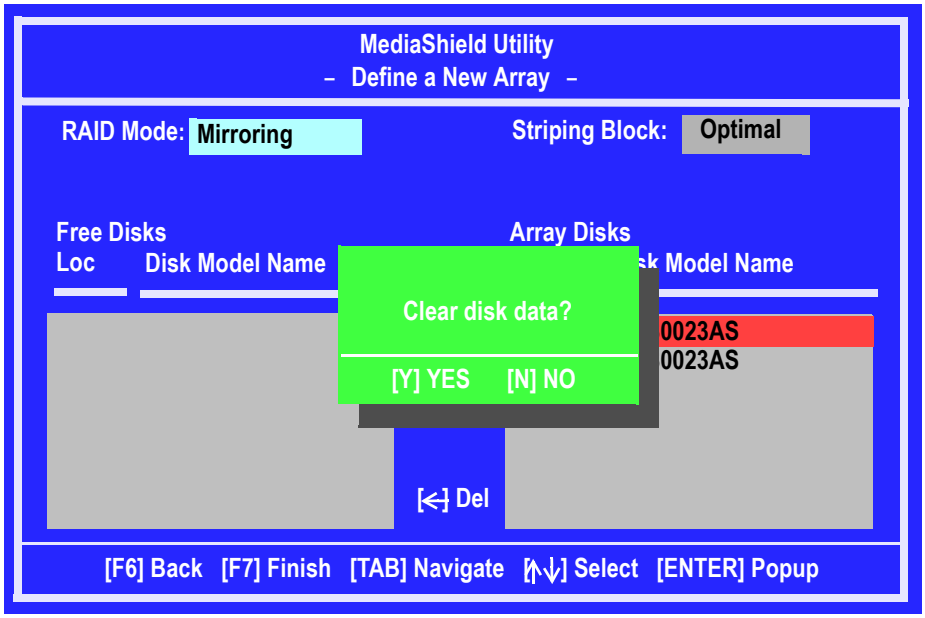


Figure 2.16 Clear Disk Data Prompt

2 Press **Y** to clear the disk data.

The **Array List** screen appears, where you can review the RAID arrays that you have set up.

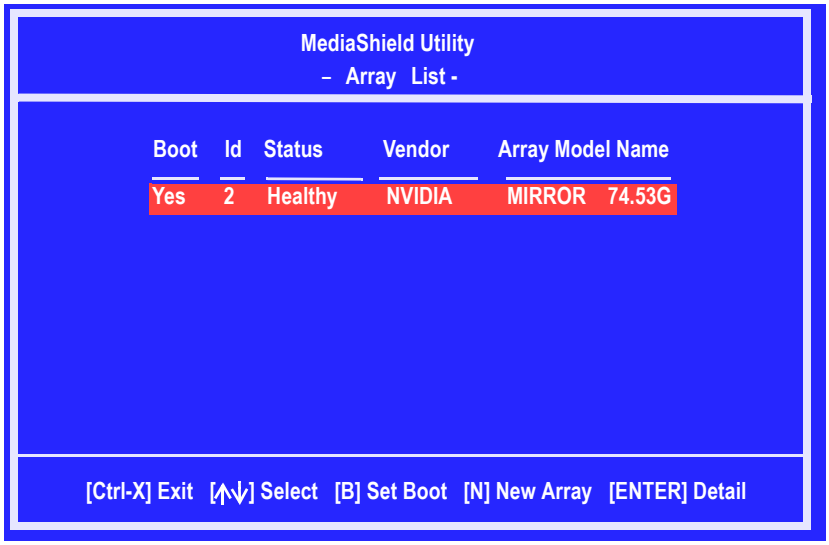


Figure 2.17 Array List Window

3 Use the arrow keys to select the array that you want to set up, then press **B** to specify the array as bootable.

4 Press **Enter** to view and verify details.

The **Array Detail** screen appears.

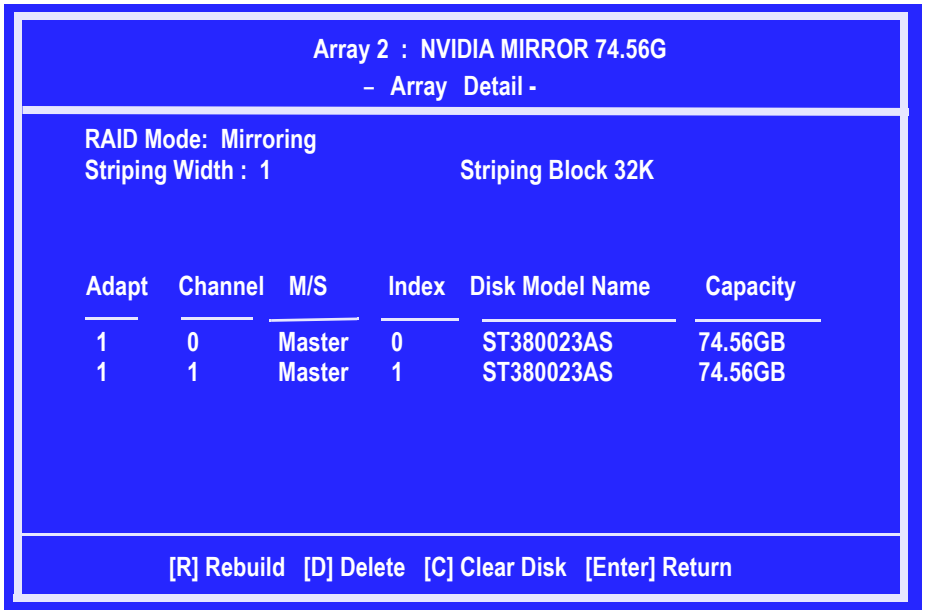


Figure 2.18 Array Detail Screen

The Array Detail screen shows various information about the array that you selected, such as Striping Block used, RAID Mode, Striping Width, Disk Model Name, and disk capacity.

5 If you want to mark this disk as empty and wipe out all its contents, press **C**.

6 At the prompt, press **Y** to wipe out all the data, otherwise press **N**.

7 Press **Enter** again to go back to the previous screen and then press **F10** to exit the RAID setup.

Installing the RAID Drivers

Your system may come with a Windows install CD that already includes NVIDIA RAID drivers. If so, then this section is not relevant.

If that is not the case (or you are trying to install a new version of Windows), then you will need an NVIDIA RAID driver F6 install floppy. Check to see if one came with your system. If not, you can create one by downloading the appropriate driver package and following the steps in this section.

1. Create an F6 install floppy by using the "-x" option, then copy all files in "…\IDE\WinXP\sataraid" to a floppy disk. (For Windows 2000, substitute "Win2K" in the path.)

2. After you complete the RAID BIOS setup, boot from the Windows CD.

   The Windows Setup program starts.

3. Press **F6** and wait a few moments for the Windows Setup screen to appear.

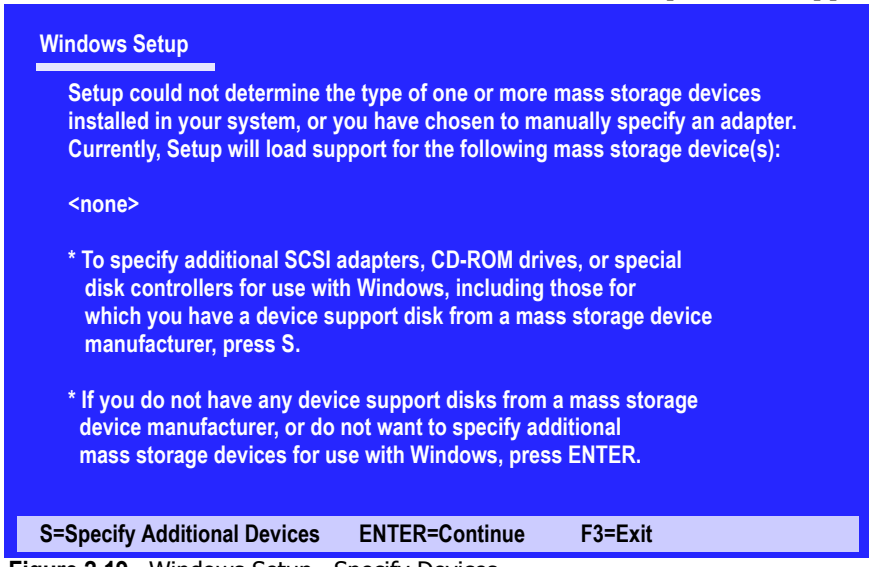


Figure 2.19 Windows Setup—Specify Devices

4. Specify the NVIDIA drivers.

   a Insert the floppy that has the RAID driver, press **S**, then press Enter.

The following Windows Setup screen appears:

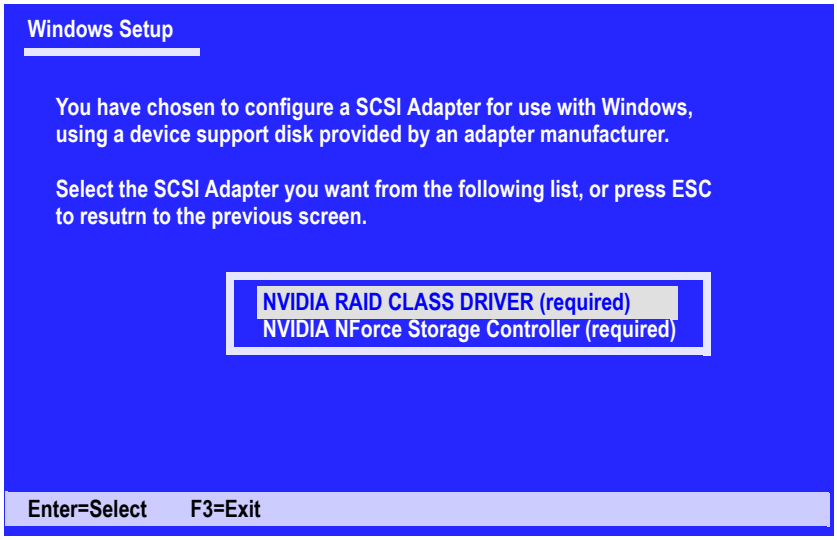


Figure 2.20 Windows Setup—Select SCSI Adapter

b Select "NVIDIA RAID CLASS DRIVER (required)" and then press **Enter**.

c Press **S** again at the Specify Devices screen, then press **Enter.**

d Select "NVIDIA NForce Storage Controller (required)" and then press **Enter.**

The following Windows Setup screen appears listing both drivers:.

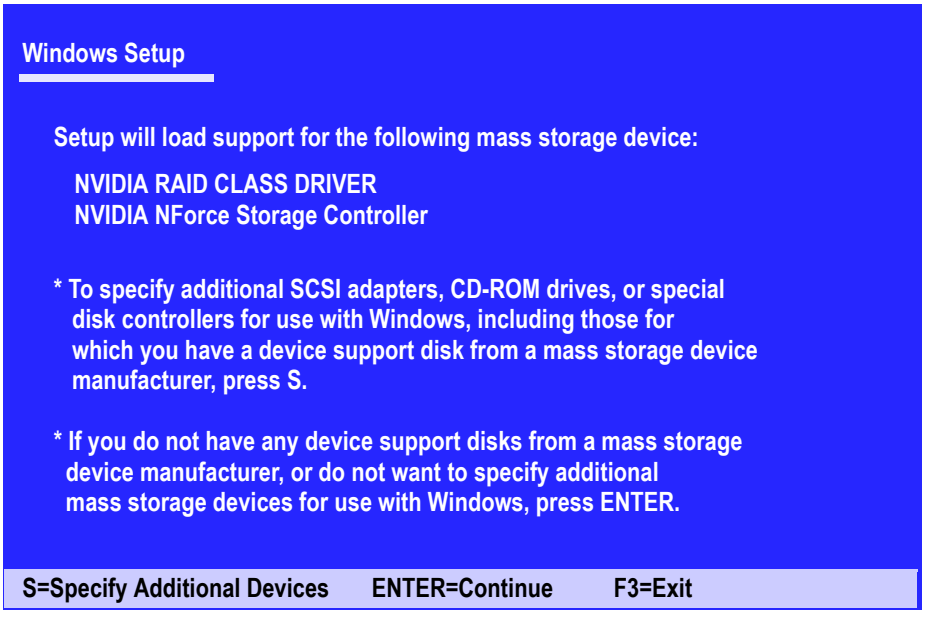


Figure 2.21 Windows Setup—NVIDIA drivers listed

5 Press **Enter** to continue with Windows XP Installation.

Be sure to leave the floppy disk inserted in the floppy drive until the blue screen portion of Windows XP installation is completed, then take out the floppy.

6 Follow the instructions on how to install Windows XP.

After Windows XP is completely installed, it is recommended that you install the ForceWare software in order to access the MediaShield RAID Management tool.

Note: Each time you add a new hard drive to a RAID array, the RAID driver will have to be installed under Windows once for that hard drive. After that, the driver will not have to be installed.

CHAPTER 3

USING THE NVIDIA MEDIASHIELD RAID MANAGEMENT UTILITY

About the MediaShield RAID Management Utility

The MediaShield RAID software ships with an application called MediaShield. This chapter describes the MediaShield tasks in the following sections:

- Viewing RAID Array Configurations

  View an array configuration (mirrored, striped, mirrored-striped, JBOD, RAID 5 or any supported combination)

- Setting Up a Spare RAID Disk
  - View free and/or dedicated free disks
  - Designate a free disk to a particular array
- Creating RAID Arrays
- Deleting a RAID Array
- Migrating From One RAID Array to Another
- Hot Plug Array

Viewing RAID Array Configurations

To view your RAID configuration from Windows, launch the MediaShield RAID Management utility by double-clicking MediaShield.

The RAID configuration information appears in the right-side pane, as shown in Figure 3.1.

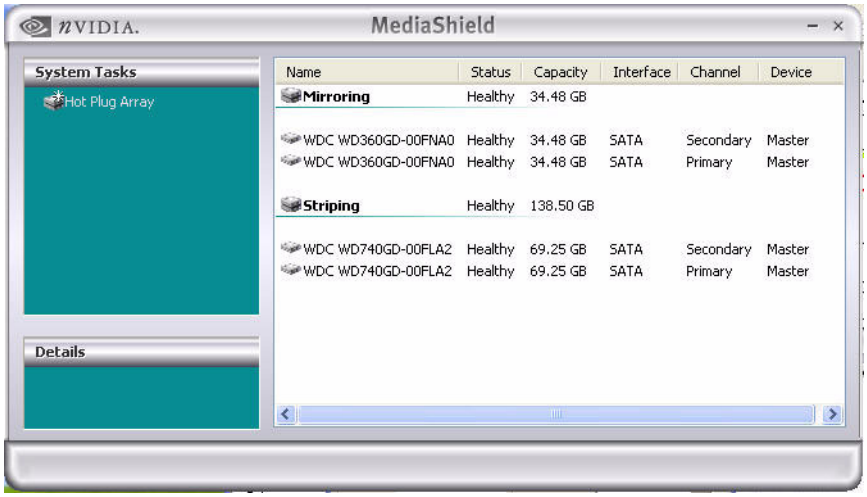


Figure 3.1 MediaShield RAID Management Utility Window

The following are examples of the information displayed for the various RAID levels. While the details of your own configuration will likely vary from what is shown, the examples serve to illustrate the basic differences between the RAID levels.

Mirrored RAID Array

Figure 3.2 shows an example of a two hard drive mirrored array using identical 34.4 GB[1] SATA hard drives (WD360GB), where one drive is configured as Primary and the other drive is configured as Secondary.The total hard disk space used is 34.4 GB.

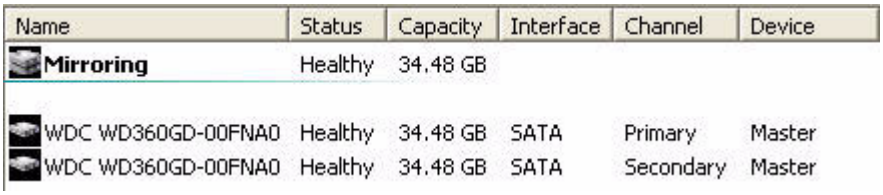


Figure 3.2 MediaShield Mirrored Array Information

1. 1 GB = 1,073,741,824 bytes

Striped RAID Array

Figure 3.3 shows an example of a two hard drive striped array using identical 34.48 GB SATA hard drives (WD360GB), where one drive is configured as Primary and the other drive is configured as Secondary. The total disk space used is 68.95GB.

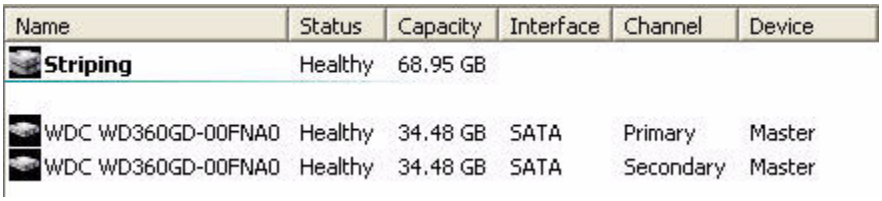


Figure 3.3 MediaShield Striped Array Information

Mirrored-Stripe RAID Array

Figure 3.4 shows an example of a four hard drive mirrored-stripe array. The total disk space used is 68.95 GB.

The total storage space is 68.95 GB because the two upper drives (the drives with the 34.48 GB size) are first striped, and then they are mirrored onto the 69.25 GB drives.

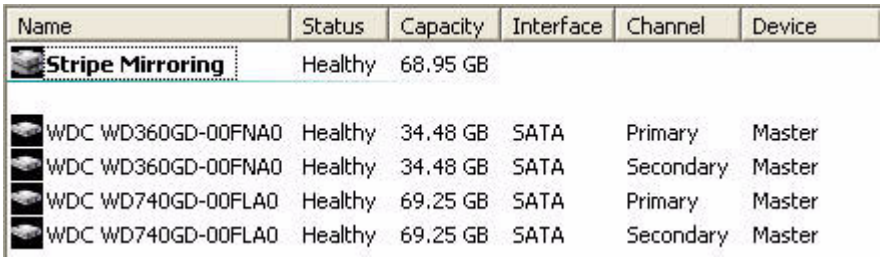


Figure 3.4 MediaShield Stripe Mirroring Array Information

Spanning (JBOD) RAID Array

Figure 3.5 shows an example of a two hard drive spanning array. The total disk space used is 68.95 GB.

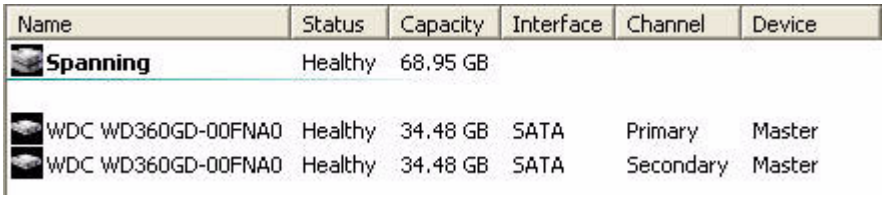


Figure 3.5 MediaShield Spanning Array Information

Mirrored RAID Array and Striped RAID Array

Figure 3.6 shows an example of a two hard drive mirrored array as well as a two hard drive striped array.

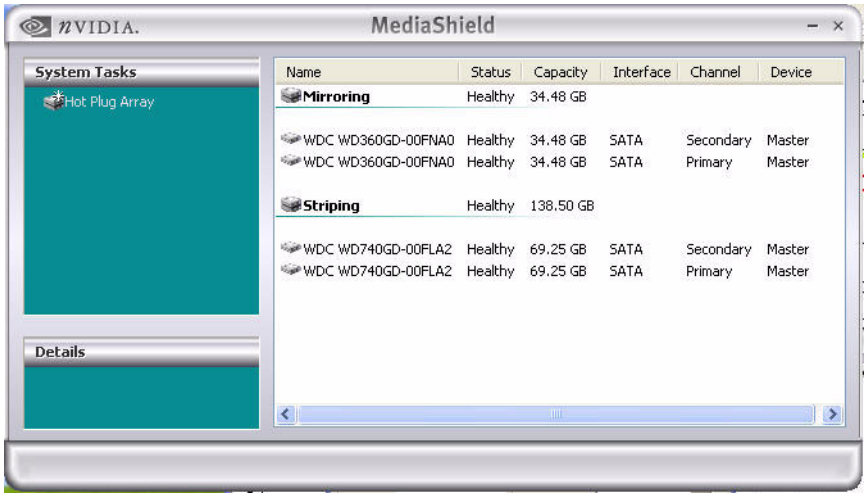


Figure 3.6 MediaShield Mirrored Array and Striped Array Information

Setting Up a Spare RAID Disk

You can designate a hard drive to be used as a spare drive for a RAID 1, RAID 0+1 or RAID 5 array[2]. The spare drive can take over for a failed disk. MediaShield RAID supports two types of spare drives:

- **Free Disk**

  A free disk is a disk that is not part of any RAID array, but can be used by any available RAID 1, RAID 0+1, or RAID 5 array that requires a particular disk when one of its disks crashes or becomes unusable. The process is automatic and doesn't require any user interaction.

  For example, if you have a system with four hard disks where one disk is used to boot the OS, two hard drives are set up in a mirrored array, and a fourth hard disk is set up as a free disk, then if one of the mirrored array drives fails, the free disk will be automatically assigned to the mirrored array to be used instead of the failed disk.

- **Dedicated Disk**

  A dedicated free disk is a disk that is assigned to a RAID 1, RAID 0+1, or RAID 5 array and that disk is used by that array only when needed, for example during a system crash where a RAID mirrored drive is broken. The dedicated disk can be used only by the array that it is assigned to and not by any other array, unlike a free disk which can be used by any available RAID 1, RAID 0+1, or RAID 5 array.

  Note: You must have at least two RAID arrays to use this feature.

2. Spare disks cannot be used for RAID0 or JBOD arrays.

Assigning a Free Disk

To mark a disk as free, or not a part of any array, do the following:

1. Enter the system BIOS setup and make sure that the drive that you want to mark as free is RAID enabled.
2. Enter the RAID BIOS and make sure that the drive is not part of any array (if one exists).
3. Boot into Windows and run the MediaShield program.

   The drive appears under the Free Disk section.

Figure 3.7 shows an example of the MediaShield display if you have a mirror array and two free disks.

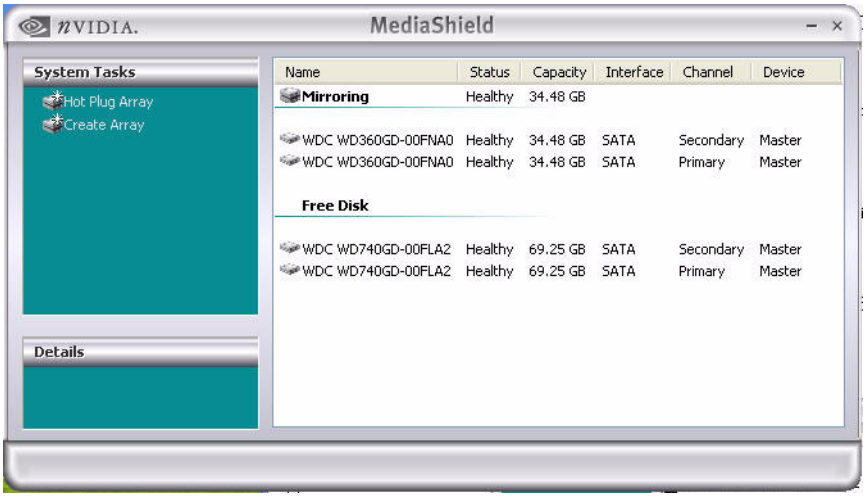


Figure 3.7 MediaShield Free Disk Information

Assigning a Dedicated Disk

To mark a disk as dedicated, or reserve it for use by a specific array, you must have at least one free disk and you must also have at least two RAID 1, RAID 0+1, or RAID 5 arrays created. In this example, there are two mirrored arrays and two free disks.

Step 1: Mark the Disk as a Free Disk

1. Enter the system BIOS setup and make sure that the drive that you want to mark as free is RAID enabled.

2. Boot into Windows and run the MediaShield program.

   If the disk is not part of any RAID array, then it will appear under the Free Disk section of the RAID GUI.

Step 2: Dedicate the Free Disk to an Array

While running MediaShield, dedicate a free disk to an array by doing the following:

1. Right click one of the two Mirrored arrays as shown below

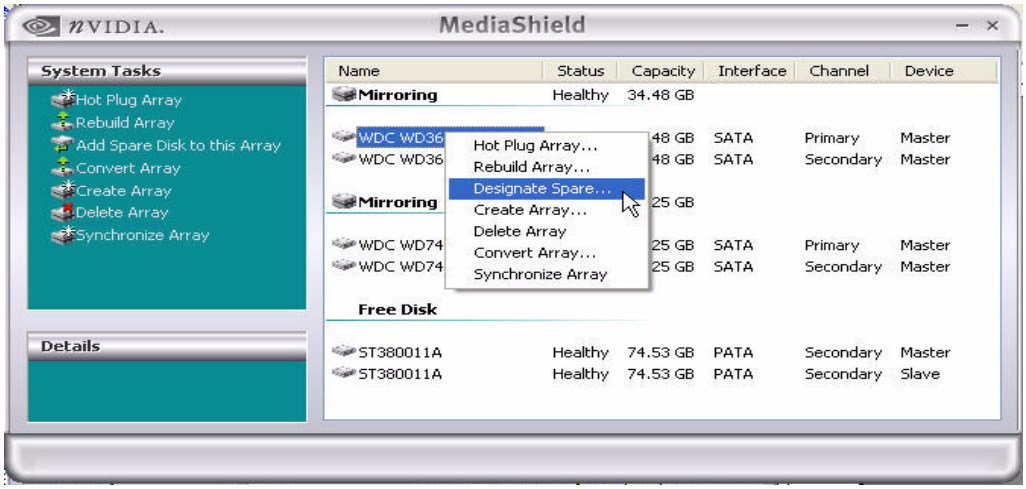


Figure 3.8 Designate Spare Pop-up Menu

2 Select **Designate Spare** from the menu to launch the Spare Disk Allocation Wizard.

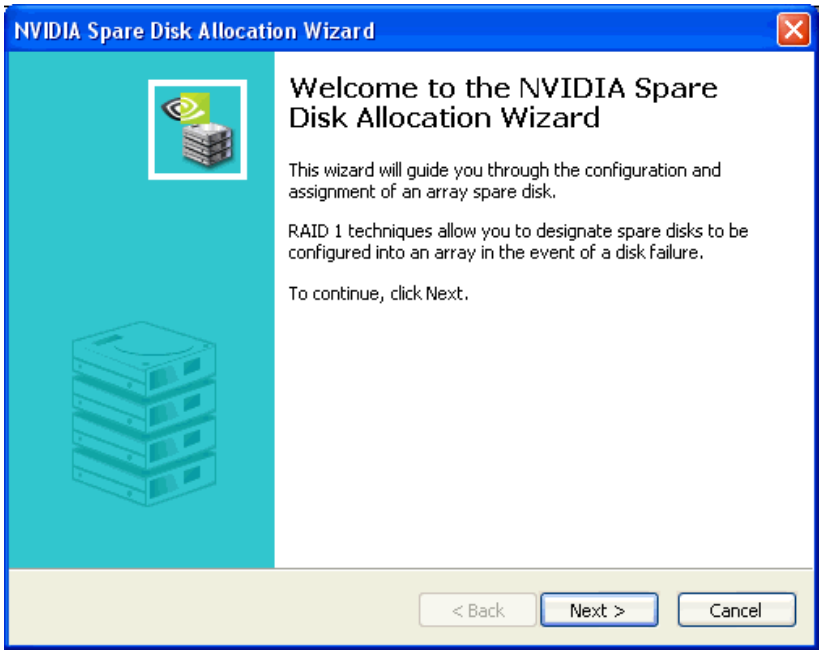


Figure 3.9 Spare Disk Allocation Wizard

3 Click **Next**.

The Free Disk Selection page appears.

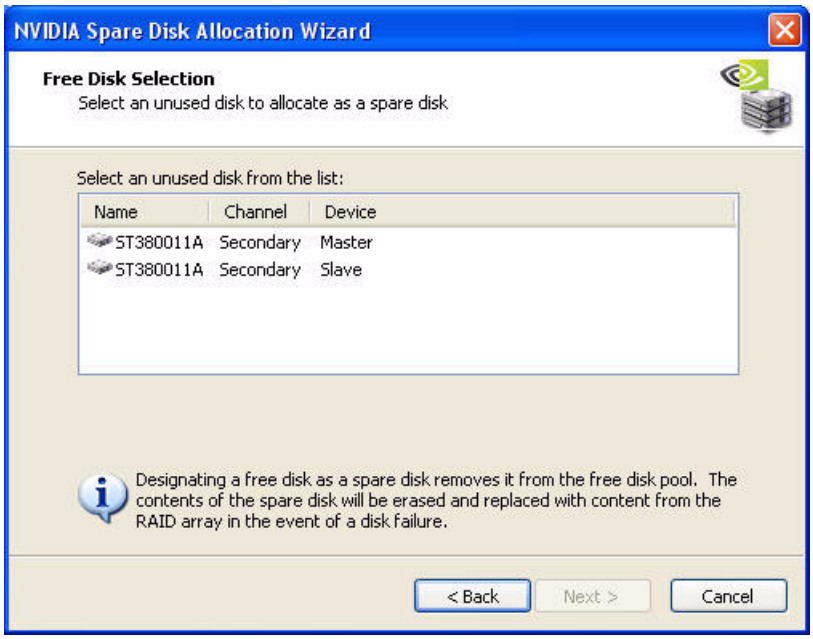


Figure 3.10 Free Disk Selection Page

4 From the Free Disk Selection page, select one of the two free disks available. This would be the disk that will be designated to the mirror array.

Note: In Figure 3.10 there are two disks available.

5 Click **Next**.

The Completing the NVIDIA Spare Disk Allocation page appears.

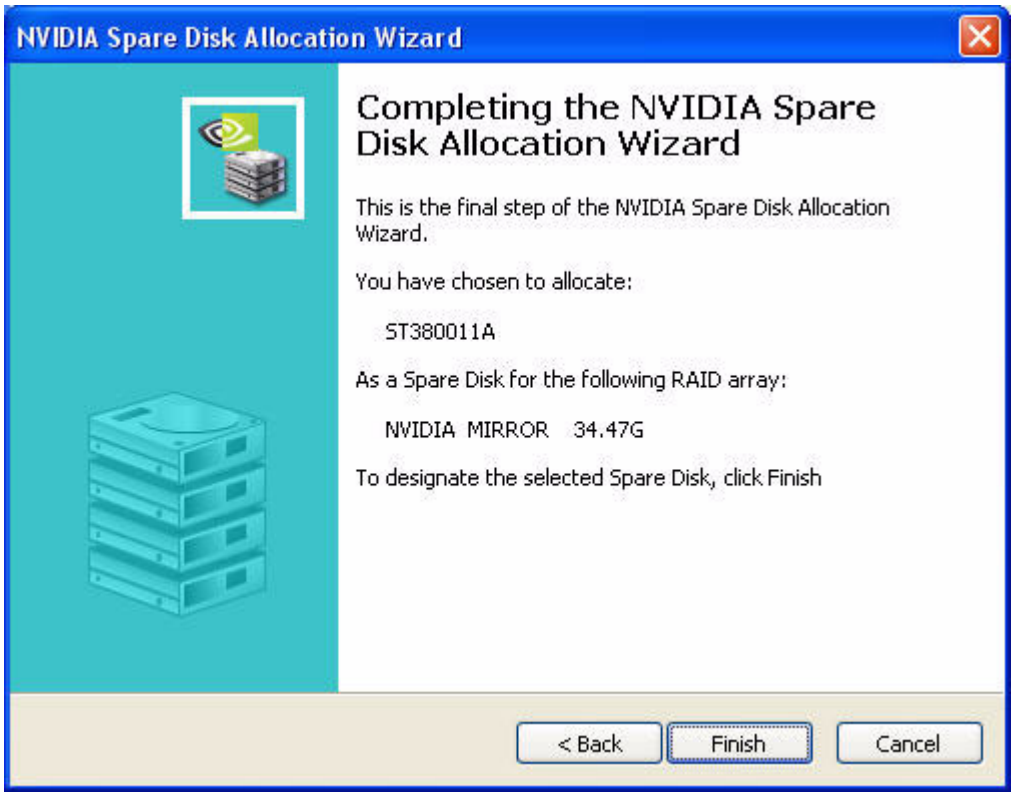


Figure 3.11 Completing Spare Disk Allocation Wizard Page

6 Click **Finish**.

As shown in Figure 3.12, the ST380011A drive is now a dedicated free disk in the mirrored array.

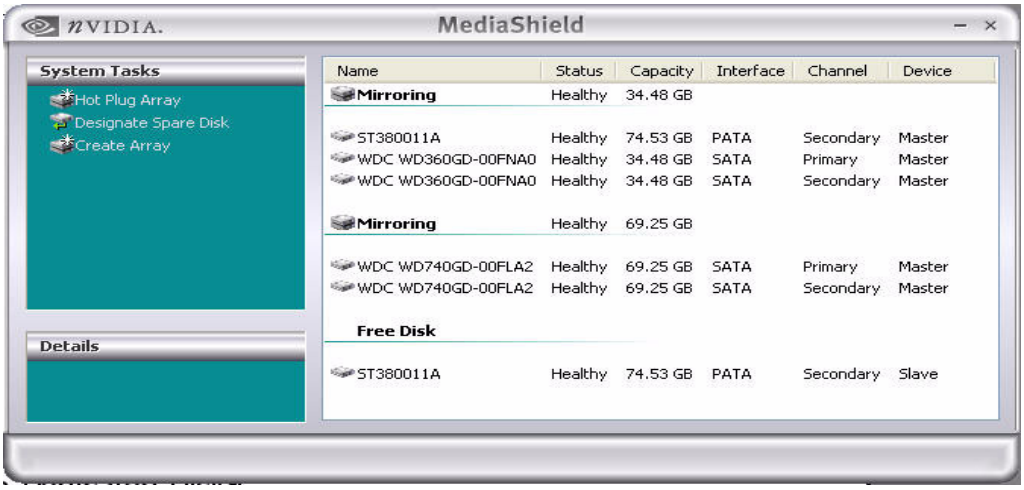


Figure 3.12 Designated Spare Disk

If a system crash occurs that causes any of the two WD360GD drives to fail, the ST380011A hard drive will take over and be used in the newly formed mirrored array.

Removing a Dedicated Disk

Once a dedicated disk has been assigned to a particular array, it can be removed at any time. To remove the disk, right click on the dedicated disk and select “Remove Disk...” to remove it. In the previous example, simply right click on the ST380011A drive and select “Remove Disk...”. as shown in the screen shot below:

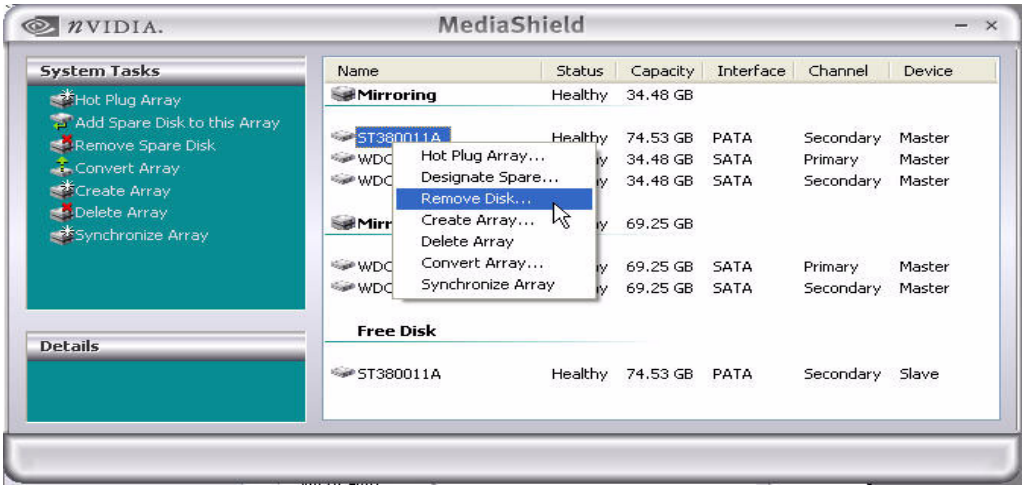


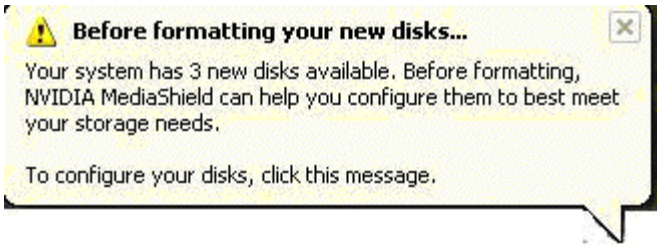
Figure 3.13 Removing a Dedicated Disk

Creating RAID Arrays

This section covers use of the MediaShield Creation Wizard. This wizard will step through configuration of your available storage.

There are three ways in which the MediaShield Create Wizard can be launched:

- Using the balloon popup that appears when the system boots:



  This balloon indicates that MediaShield has discovered free disks in your system available for configuration. If you click on the bubble, the MediaShield Create Wizard will be launched.

  Note: This balloon will only pop up if you have up to three available disks. If you have four or more disks available, you must use one of the remaining two methods to start the MediaShield Create Wizard.

- Using the following dialog that appears when launching MediaShield:

  If you select **Yes**, the MediaShield Create Wizard will be launched, and will step you through configuration of your storage.

- You can also select the Create option under System Tasks to launch the MediaShield Create Wizard.

Using the MediaShield Create Wizard

The MediaShield Create Wizard walks you through the creation of your available storage resources.

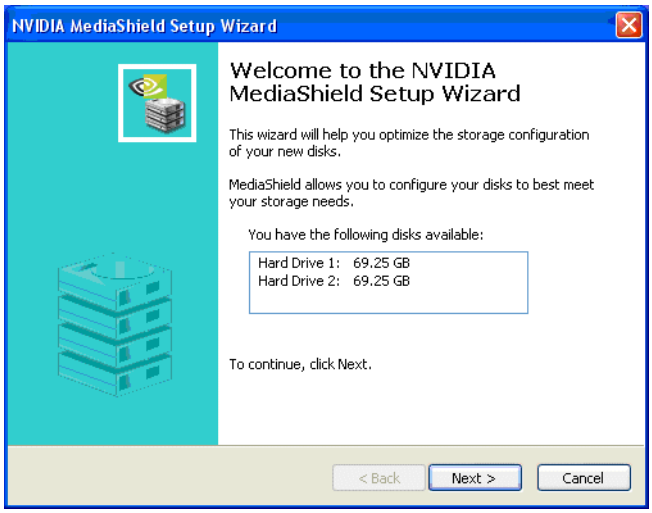


Figure 3.14 MediaShield Wizard Welcome Screen

The welcome screen lists the disks that are available for configuration.

1 Click **Next** to go to the following screen:

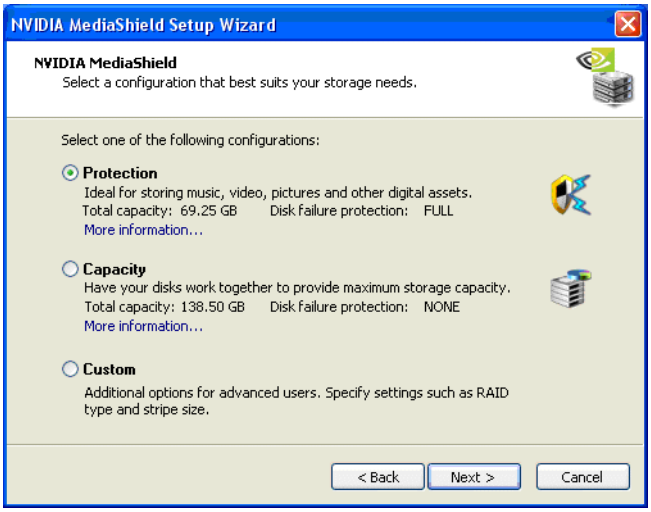


Figure 3.15 MediaShield Wizard–Select a Configuration Screen

Note: You will only see this screen if you have less than 4 free disks in the system. If there are 4 or more free disks available, you will proceed to directly to custom setup.

As shown in Figure 3.15, there are three options:

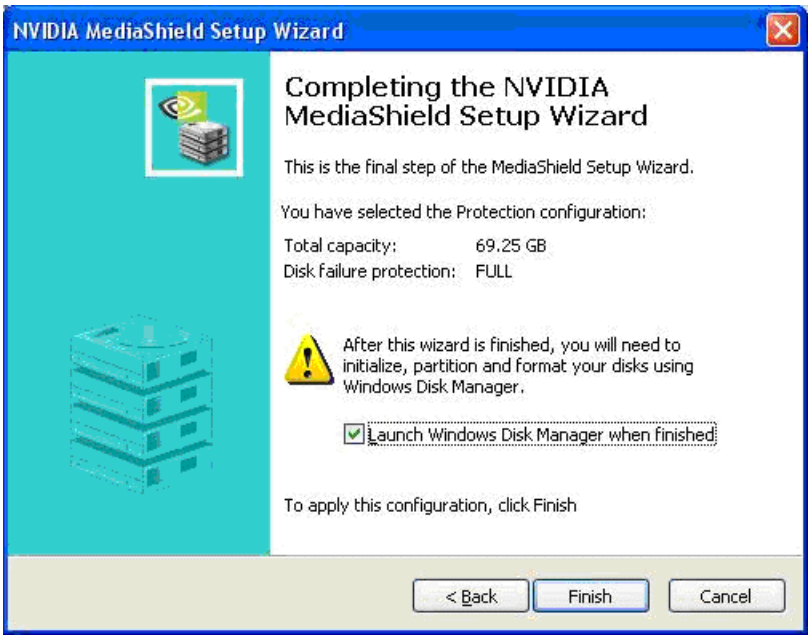
- Protection
- Capacity
- Custom

Protection

Select this option and MediaShield will automatically configure the best RAID option based on the number of drives and with the criteria that if a drive fails you will not lose your data. The total capacity of the volume that will be created is displayed. You can click on **more information** to see a detailed description of the volume that will be created.

1 Click **Next.**

The following screen appears:



The checkbox titled "Launch Windows Disk Manager when finished" will automatically bring up Windows Disk Manager to complete the configuration.

See the chapter titled "Initializing and Using the RAID Array Under Windows" for more information on using Windows Disk Manager.

2 Click **Finish**.

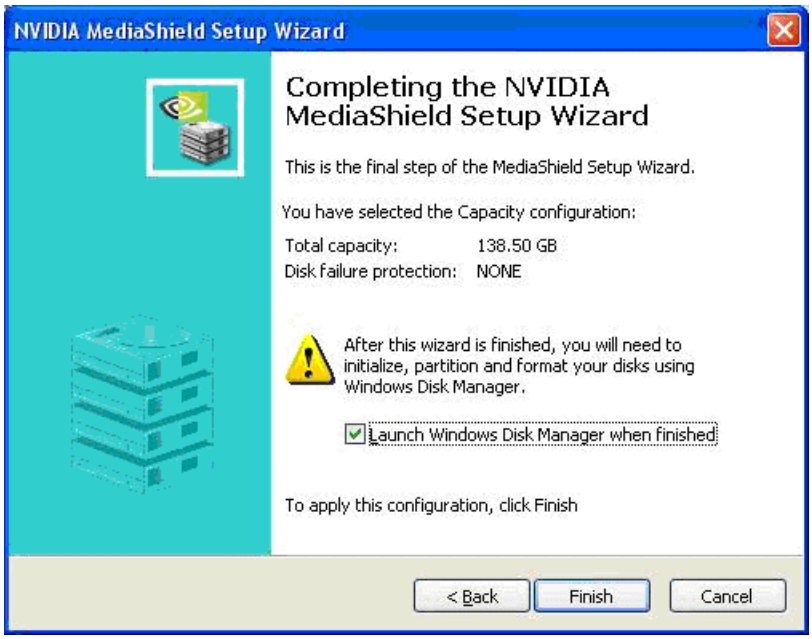
Your RAID volume will be configured and ready for use.

Capacity

Select this option and MediaShield will automatically configure the best RAID option based on the number of drives and the desire for maximum capacity. This array will NOT be fault-tolerant, so choose this option only if your data is non-critical or is being backed up. The total capacity of the volume that will be created is displayed. You can click on **more information** to see a detailed description of the volume that will be created.

1 Click **Next.**

The following screen appears:



The checkbox titled "Launch Windows Disk Manager when finished" will automatically bring up Windows Disk Manager to complete the configuration. See the chapter titled "Initializing and Using the RAID Array Under Windows" for more information on using Windows Disk Manager.

2 Click **Finish**.

Your RAID volume will be configured and ready for use.

Custom

Select this option to perform the RAID array configuration yourself.

Note: Custom is the only option if there are 4 or more free disks in system.

Click **Next** to see the RAID Array Selection screen. The next sections explain how to custom create various types of RAID arrays.

Creating a Striped Array

MediaShield can be used to create a striped array from one disk up to the maximum supported number of disks in the system.

To create a two-disk Striped Array do the following:

1 Make sure the drives that you want to use are RAID-enabled in the system BIOS.

2 Select the Custom option in the MediaShield Create Wizard.

3 :Click **Next** and the following screen shot will appear:

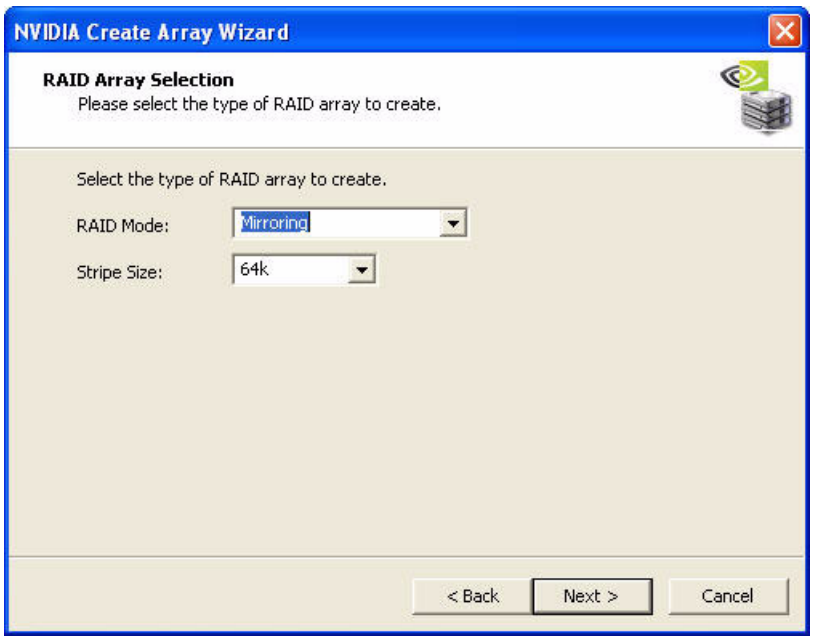


Figure 3.16 RAID Array Selection Page

4 Click the RAID Mode list arrow and select Striping, and leave the "Stripe Size" with its default value as shown in the following screen shot:

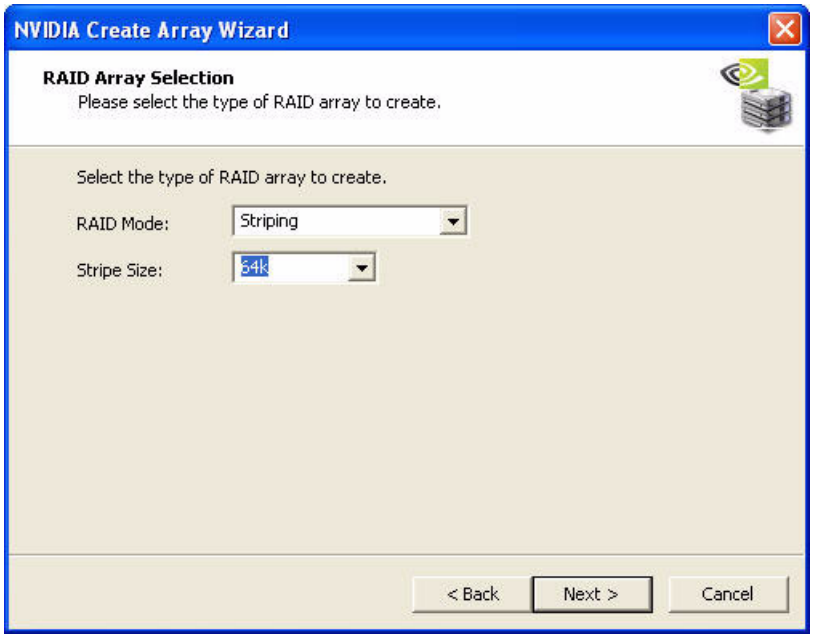


Figure 3.17 RAID Array Selection—Striping

5 Click **Next**, and the following screen shot will appear:

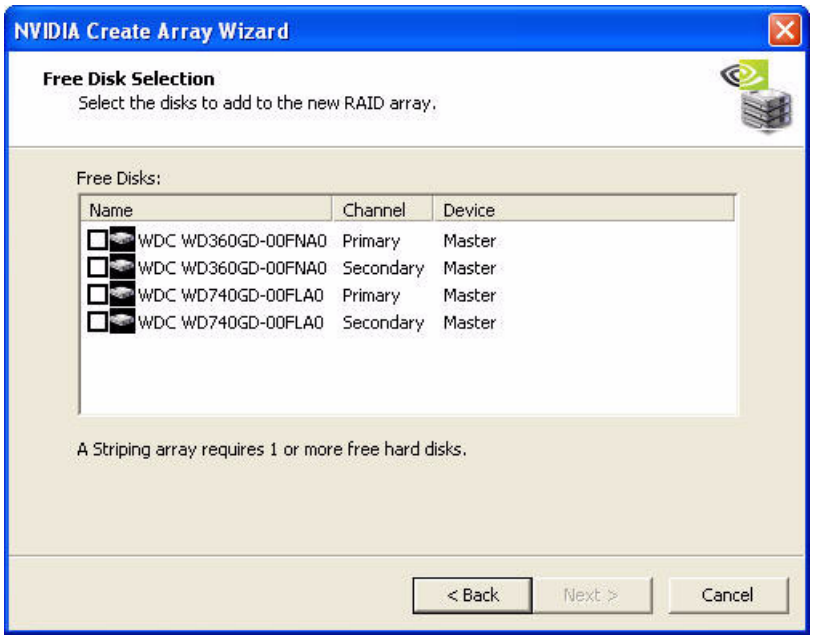


Figure 3.18 Free Disk Selection Page

6 Select the two disks that you want to include in the stripe set.

In this example the upper two disks were selected as shown in Figure 3.19.

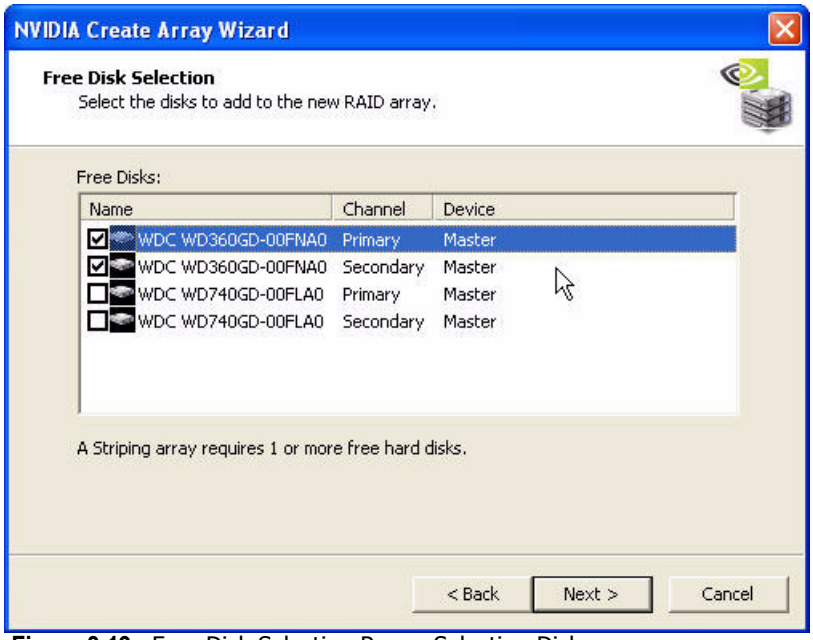


Figure 3.19 Free Disk Selection Page—Selecting Disks

To create a striped array with more disks, select additional disks from the list.

7 Click **Next** and click **Next** again, then the following screen shot will appear:

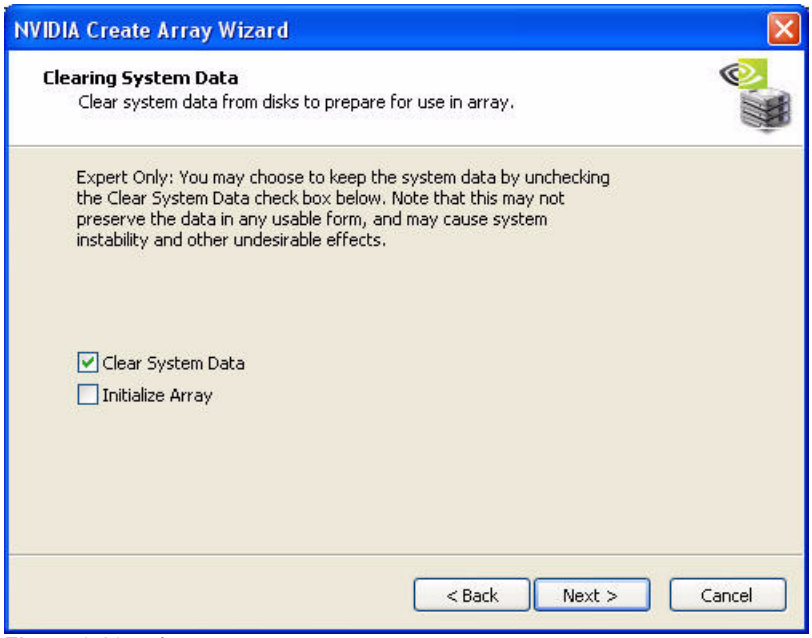


Figure 3.20 Clearing System Data

8 To clear all system data from the drives click on **Next** and the following will appear:

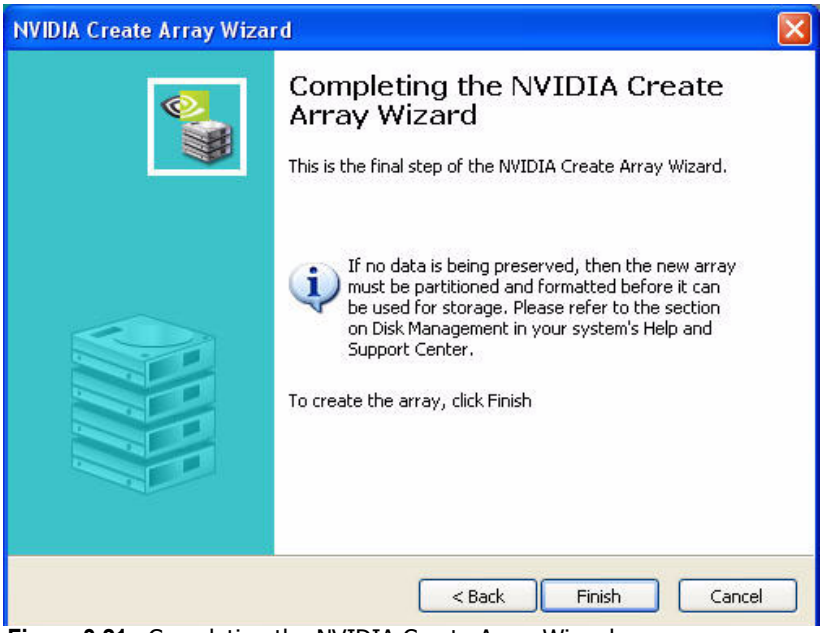


Figure 3.21 Completing the NVIDIA Create Array Wizard

9 Click **Finish** and the following screen shot will appear:

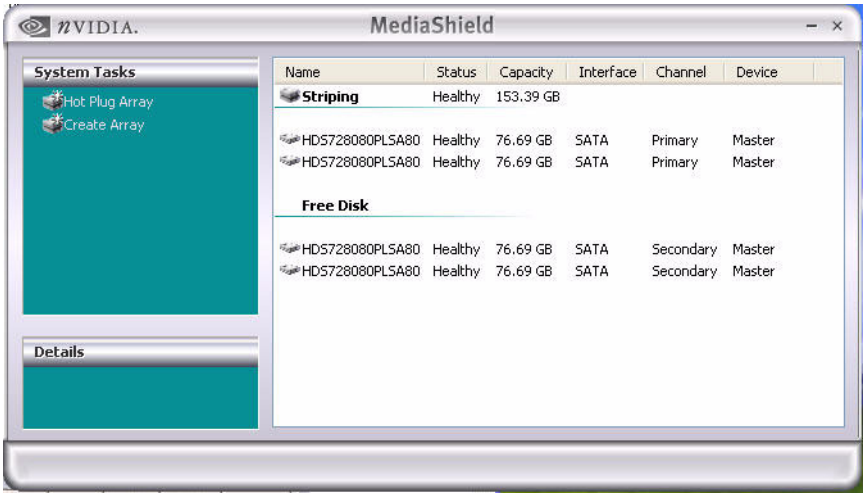


Figure 3.22 Stripe RAID Array Created

As you can see from the above screen shot a striped array with two SATA disks has been created, while the other two disks are allocated as Free Disks.

To create an array with three or more disks, be sure to add the number of disks that you want to use in the array during creation. To "extend" the size of an existing striped array, use the process described in "Migrating From One RAID Array to Another" on page 69.

Creating a Mirrored Array

The MediaShield application can be used to create a Mirrored Array. By definition, a mirrored array consists of two drives. Data is written to both drives, and if one drive fails then data can be recovered from the other drive.

To create a Mirrored Array, do the following:

1 Make sure the drives that you want to use are RAID-enabled in the system BIOS.

2 Select the Custom option in the MediaShield Create Wizard.

3 Click **Next** and the following screen will appear:

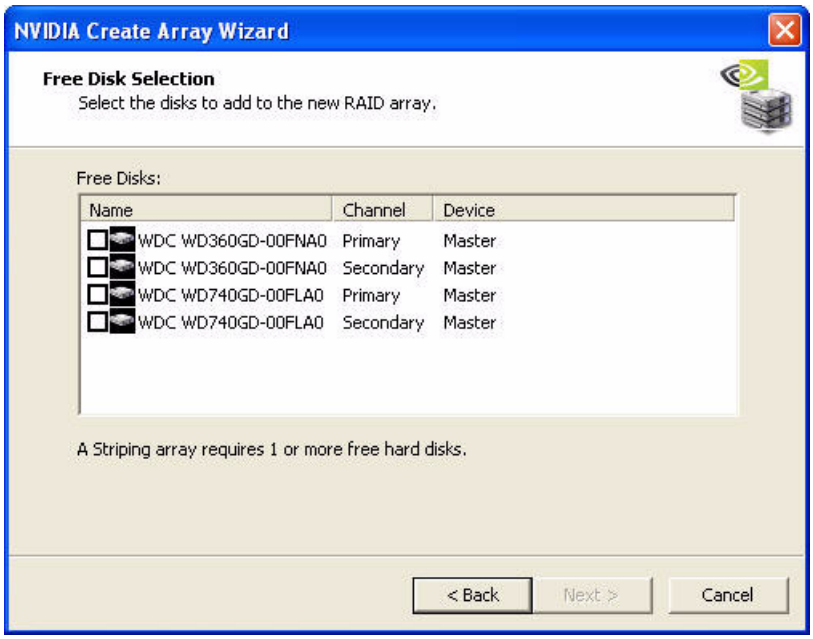


Figure 3.23 Free Disk Selection Page

4 Select the two drives that you want to use in the Mirrored array.

In this example the upper two disks were selected as shown in Figure 3.24.

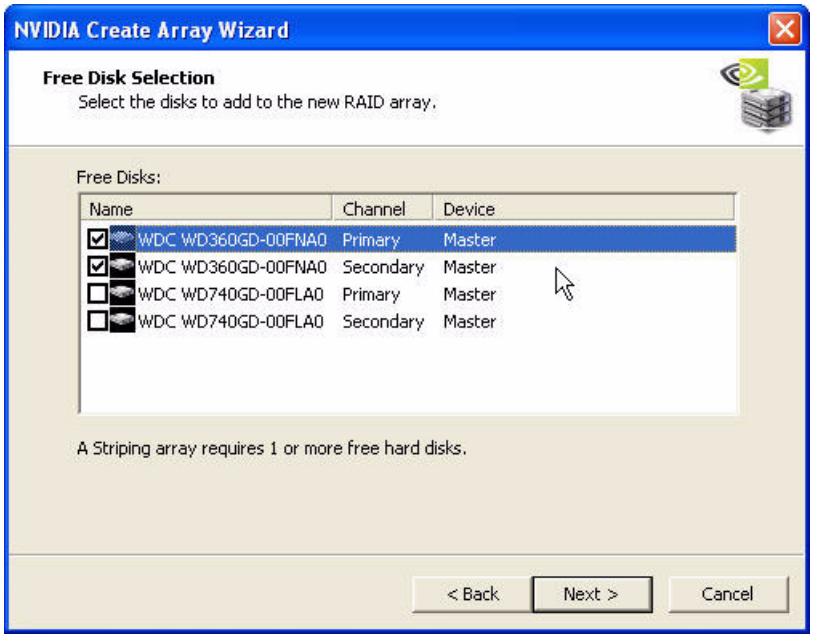


Figure 3.24 Free Disk Selection Page—Selecting Disks

5 Click **Next** and click **Next** again, then the following screen shot will appear:

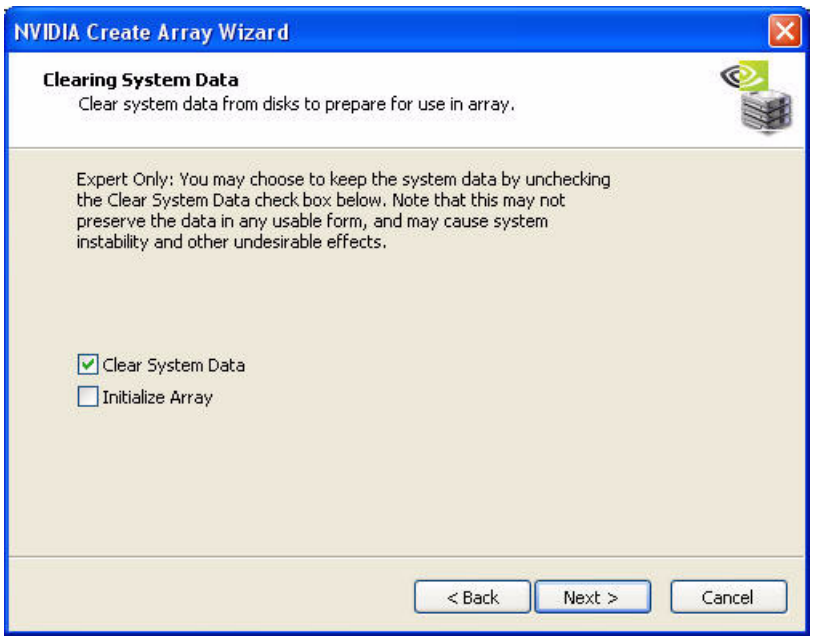


Figure 3.25 Clearing System Data

6 To clear all system data from the drives click on **Next** and the following will appear:

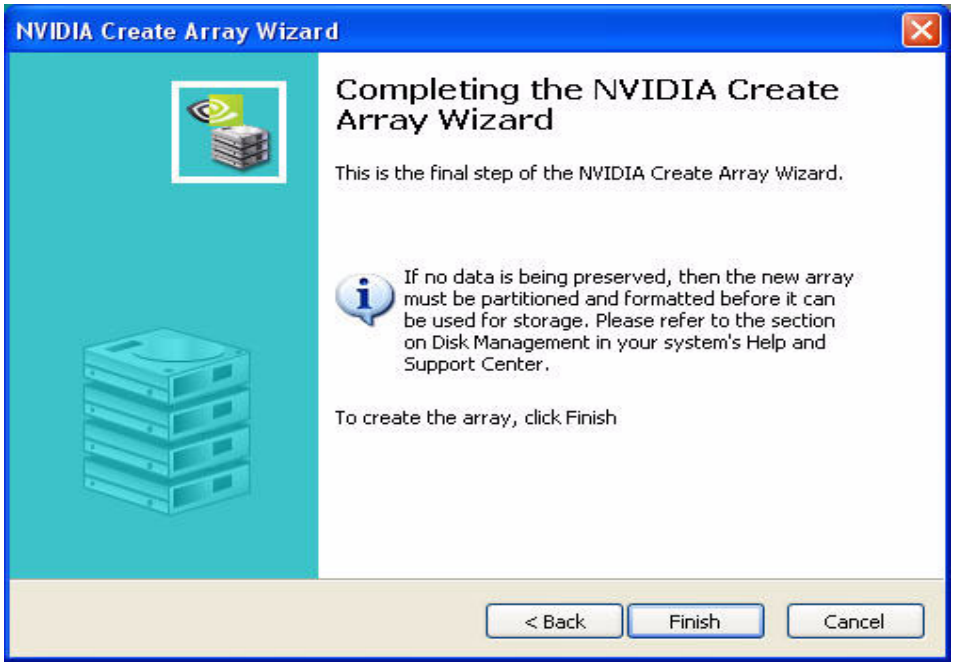


Figure 3.26 Completing the NVIDIA Create Array Wizard

7 Click **Finish.**

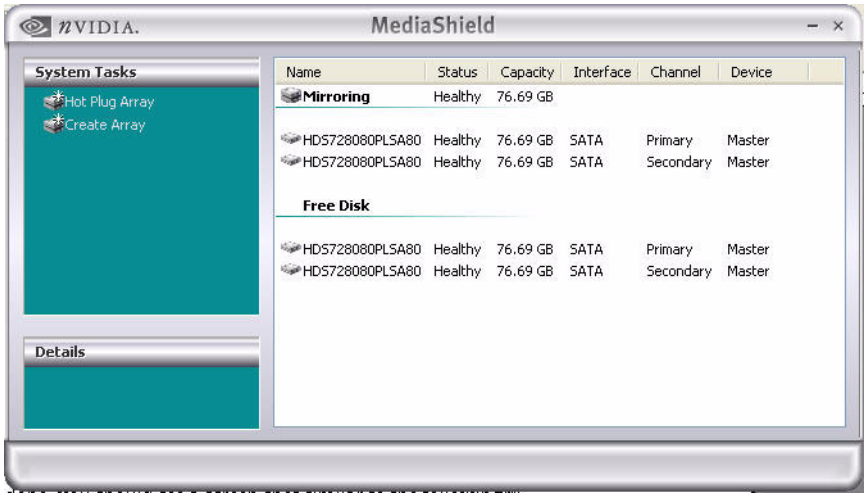


Figure 3.27 Mirrored RAID Array Created

A mirrored array has been created, while the other two disks are set to free disks.

Creating a Stripe Mirroring Array

MediaShield can be used to create a Stripe Mirroring array which requires at least four disks to start such an array.

To create a Stripe Mirror Array do the following:

1 Make sure the drives that you want to use are RAID-enabled in the system BIOS.

2 Select the Custom option in the MediaShield Create Wizard.

3 Click **Next** and the following screen will appear:

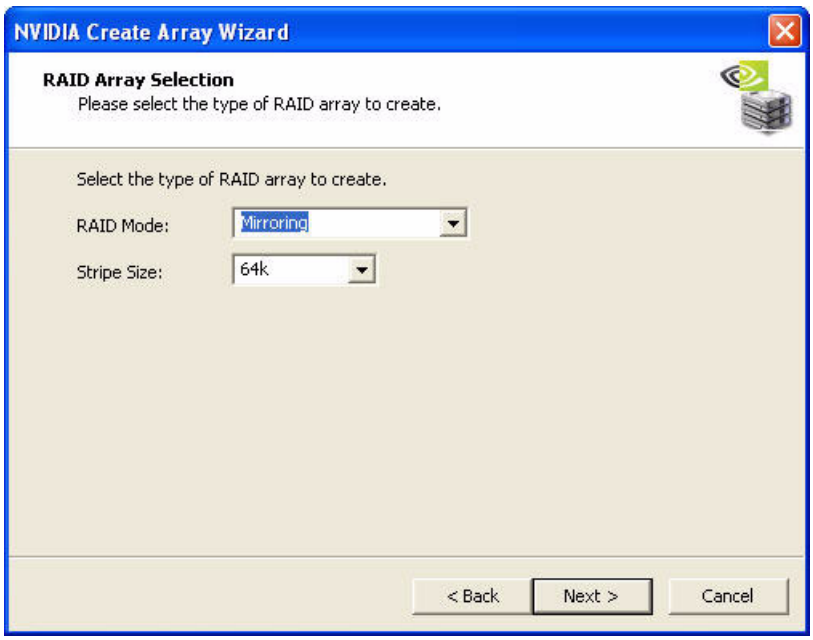


Figure 3.28 RAID Array Selection

4 Click on "RAID Mode:" and select "Stripe Mirroring" while leaving the Stripe Size set to its default value as shown in the following screen shot:

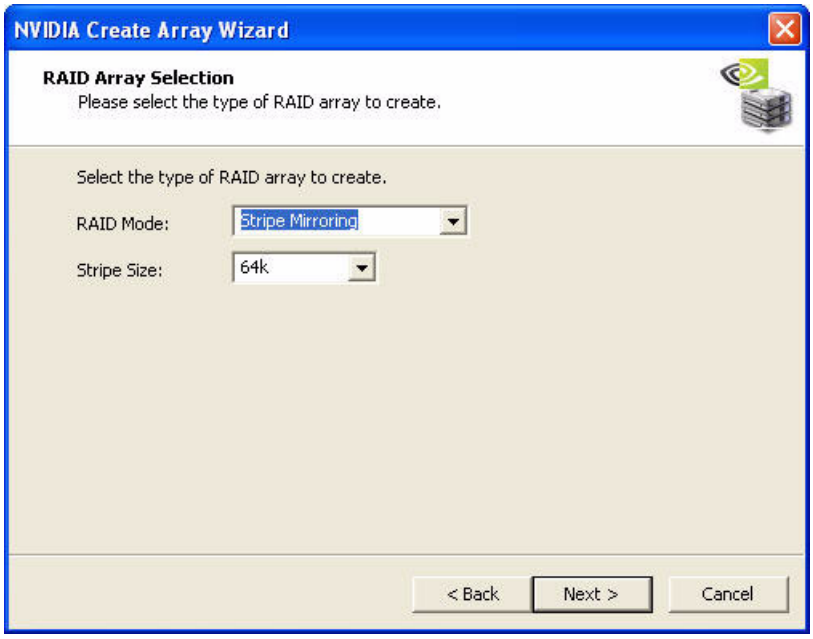


Figure 3.29 RAID Array Selection—Stripe Mirroring

5 Click **Next** and the following screen will appear:

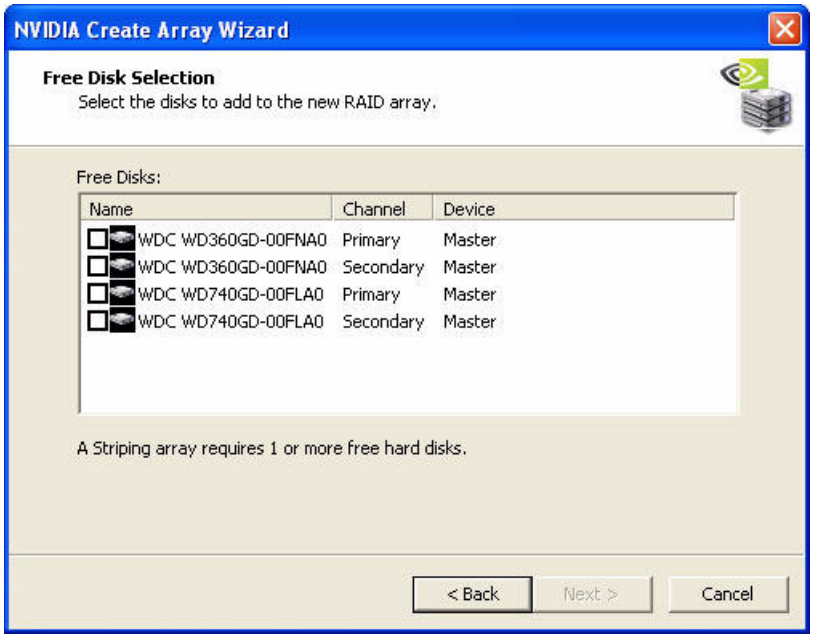


Figure 3.30 Free Disk Selection Page

6 Select the four drives that you want to use in the Stripe Mirroring array.

In this example all of the drives are selected as shown in the following screen shot:

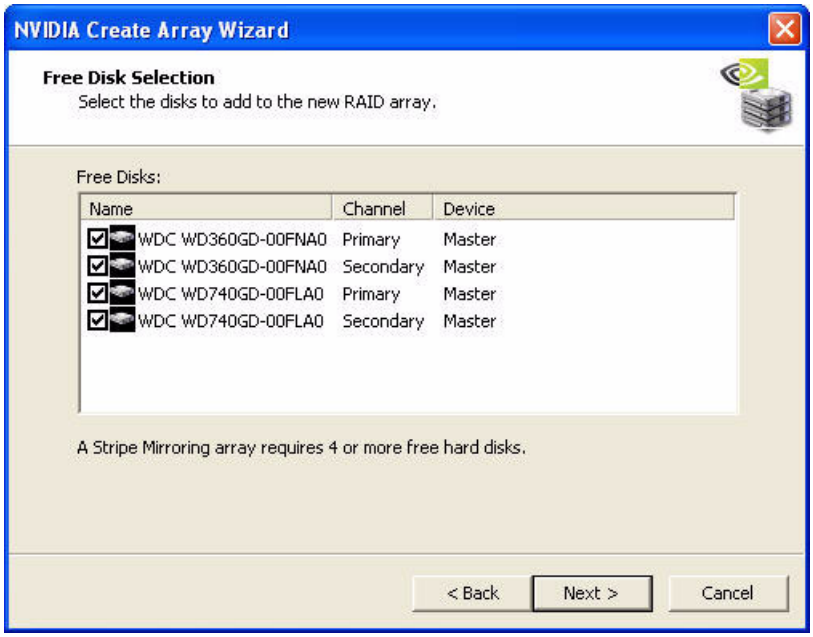


Figure 3.31 Free Disk Selection Page—Selecting Disks

7 Click **Next** and click **Next** again, then the following screen shot will appear:

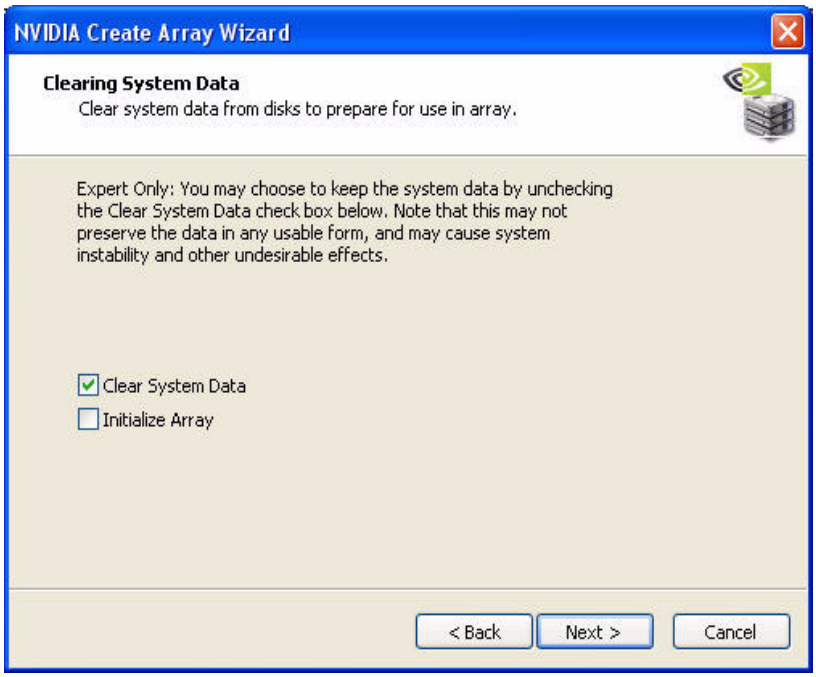


Figure 3.32 Clearing System Data

8 To clear all system data from the drives click on **Next** and the following will appear:

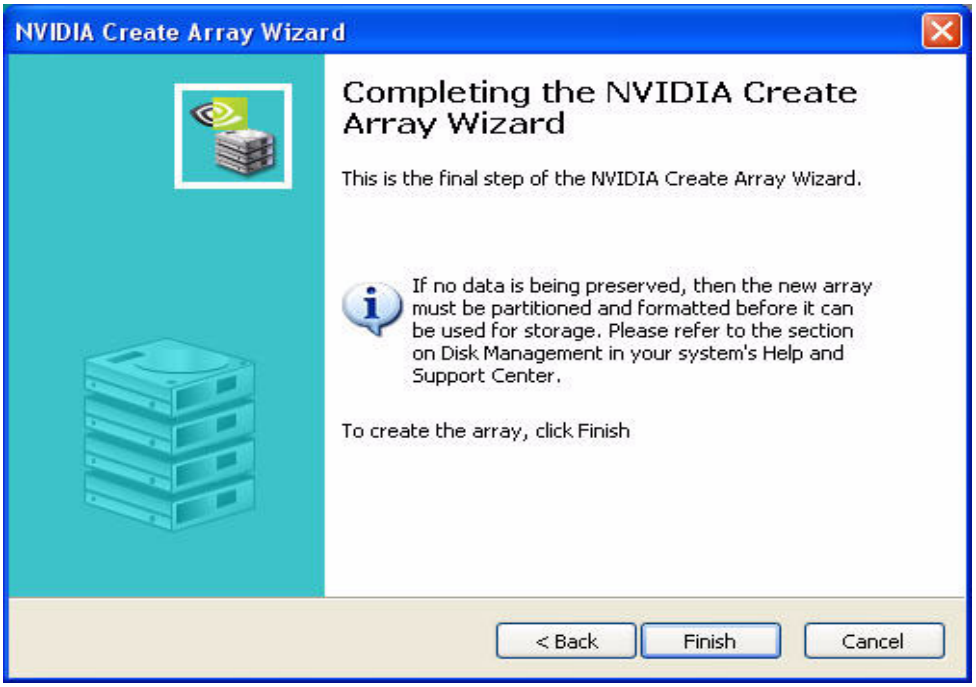


Figure 3.33 Completing the NVIDIA Create Array Wizard

9 Click **Finish** and the following screen shot will appear:

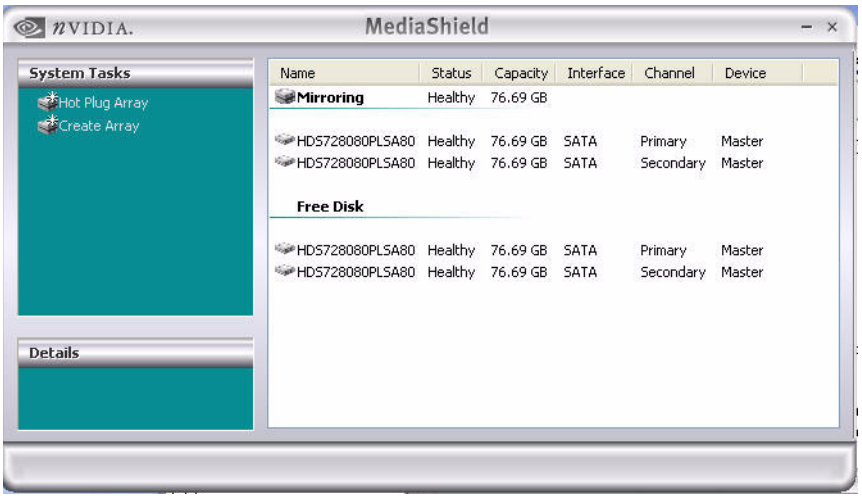


Figure 3.34 RAID Stripe Array Created

A Stripe Mirroring array has been created.

Creating a Spanning Array

MediaShield can be used to create a Spanning Array which requires at least one disk to start such an array.

To create a Spanning Array do the following:

1 Make sure the drives that you want to use are RAID-enabled in the system BIOS.

2 Select the Custom option in the MediaShield Create Wizard.

3 Click **Next** and the following screen will appear:

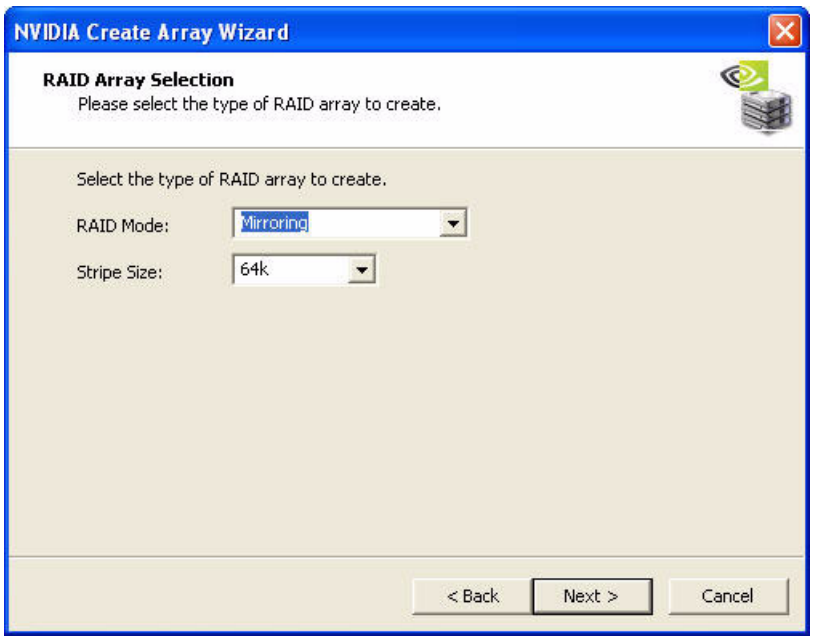


Figure 3.35 RAID Array Selection Page

4 Click the RAID Mode list arrow and select "Spanning" while leaving the Stripe Size set to its default value as shown in the following screen shot:

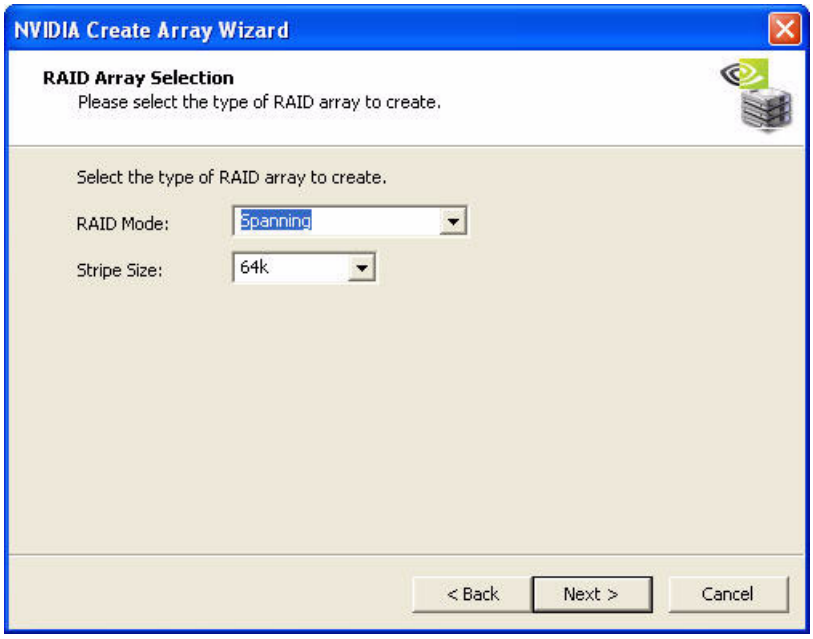


Figure 3.36 RAID Array Selection Page—Spanning

5 Click **Next** and the following screen shot will appear:

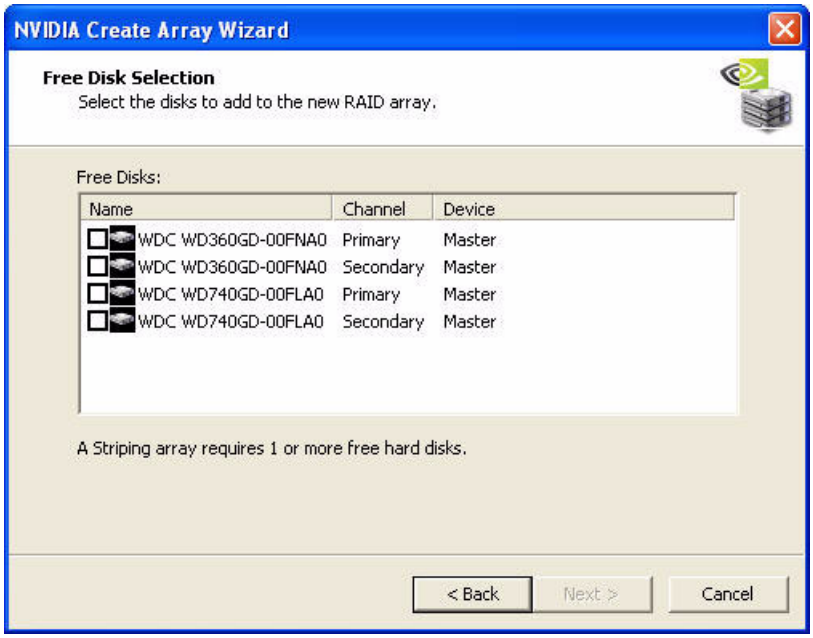


Figure 3.37 Free Disk Selection Page

6 Select the two drives that you want to use in the Spanned array.

In this example the upper two disks were selected as shown in the following screen shot:

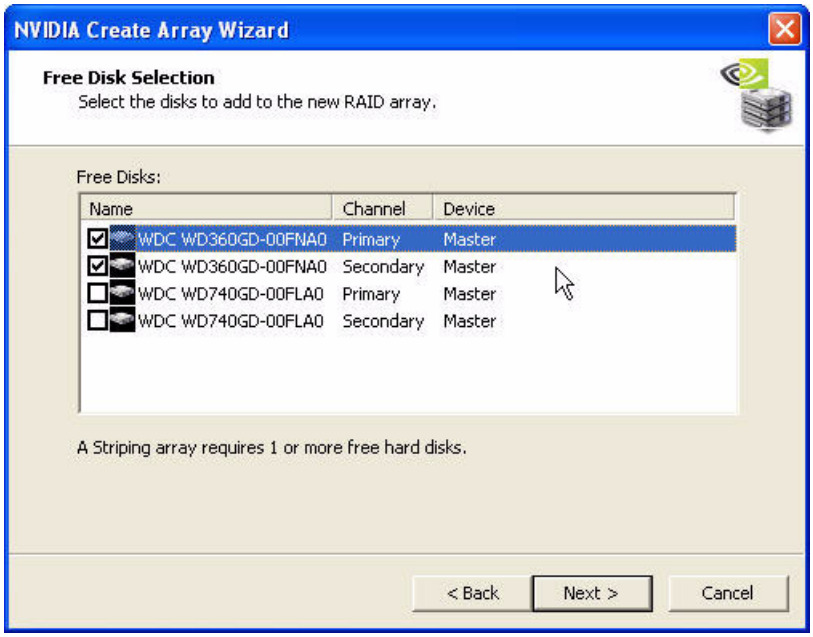


Figure 3.38 Free Disk Selection Page—Selecting Disks

7 Click **Next** and **Next** again, the following screen shot will appear:

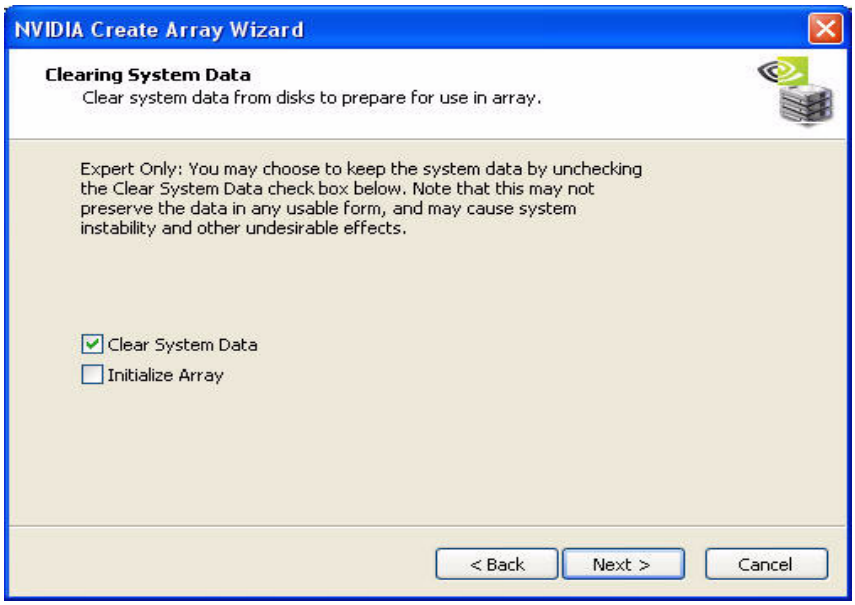


Figure 3.39 Clearing System Data

8 To clear all system data from the drives click on **Next** and the following will appear:

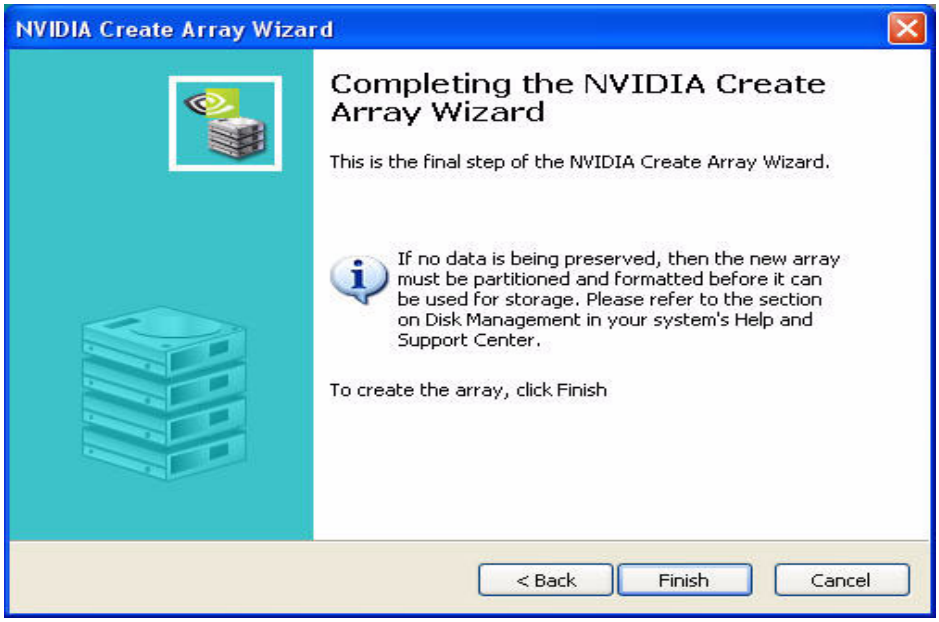


Figure 3.40 Completing the NVIDIA Create Array Wizard

9 Click **Finish** and the following screen shot will appear:

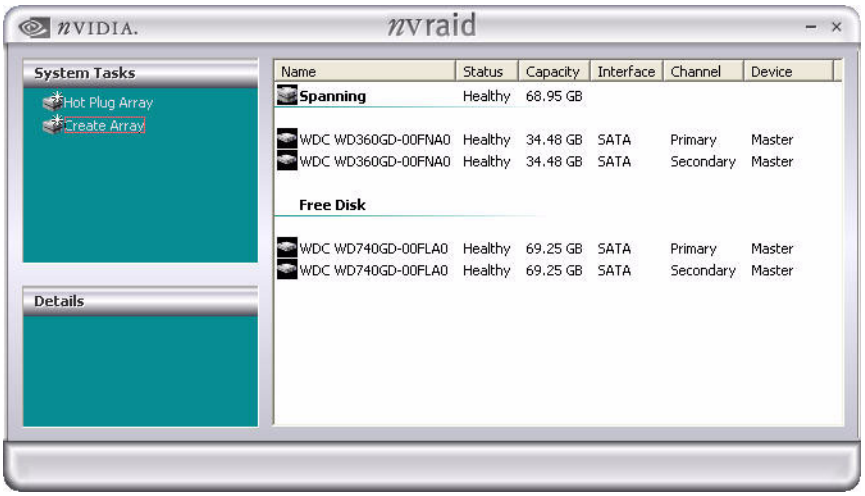


Figure 3.41 RAID Spanned Array Created

A Spanned Array has been created.

Creating a RAID 5 Array

MediaShield can be used to create a RAID 5 array using at least 3 disks and up to the maximum supported number of disks in the system.

To create a 3 disk RAID 5 Array do the following:

1 Make sure the drives that you want to use are RAID-enabled in the system BIOS.

2 Select the Custom option in the MediaShield Create Wizard.

3 :Click **Next** and the following screen shot will appear:

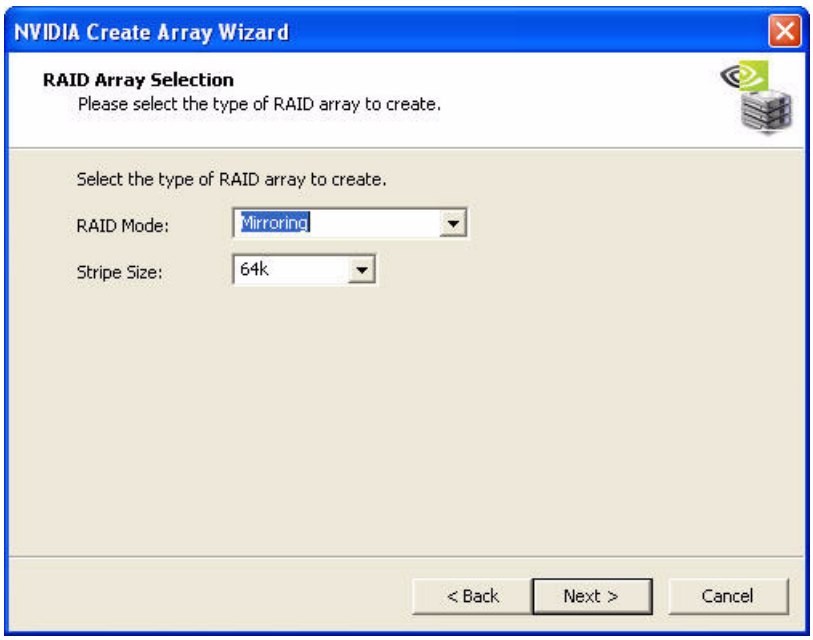


Figure 3.42 RAID Array Selection Page

4 Click the RAID Mode list arrow and select RAID 5, and leave the "Stripe Size" with its default value as shown in the following screen shot:

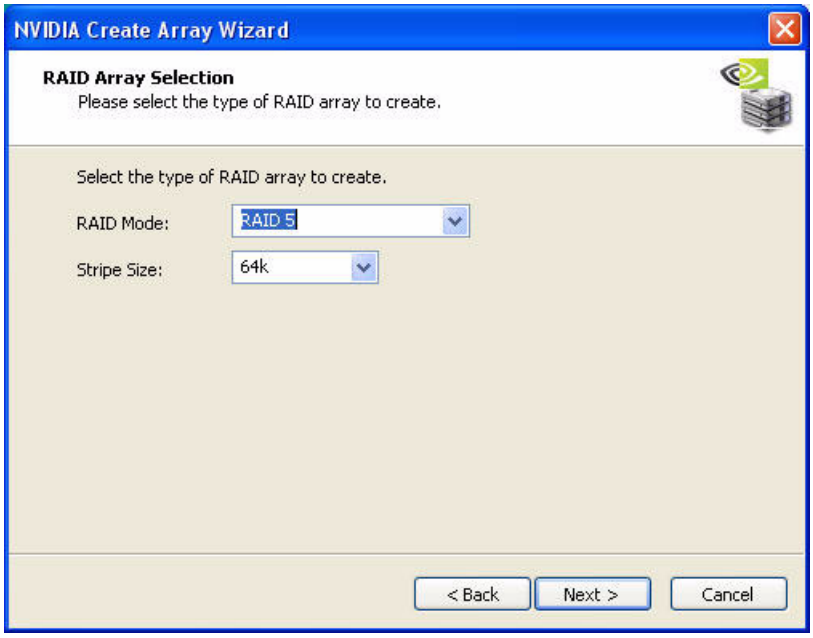


Figure 3.43 RAID Array Selection—RAID 5

5 Click **Next**, and the following screen shot will appear:

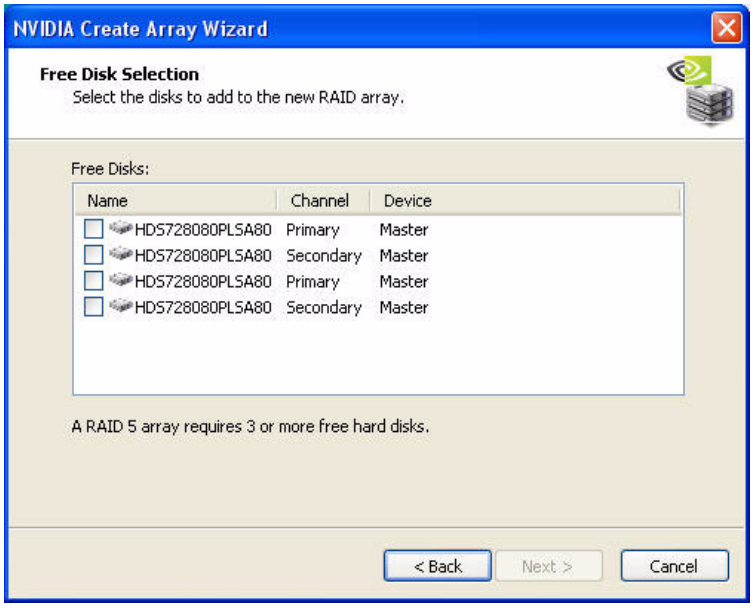


Figure 3.44 Free Disk Selection Page

6 Select the three disks that you want to include in the RAID 5 array.

In this example the upper three disks were selected as shown in Figure 3.19.

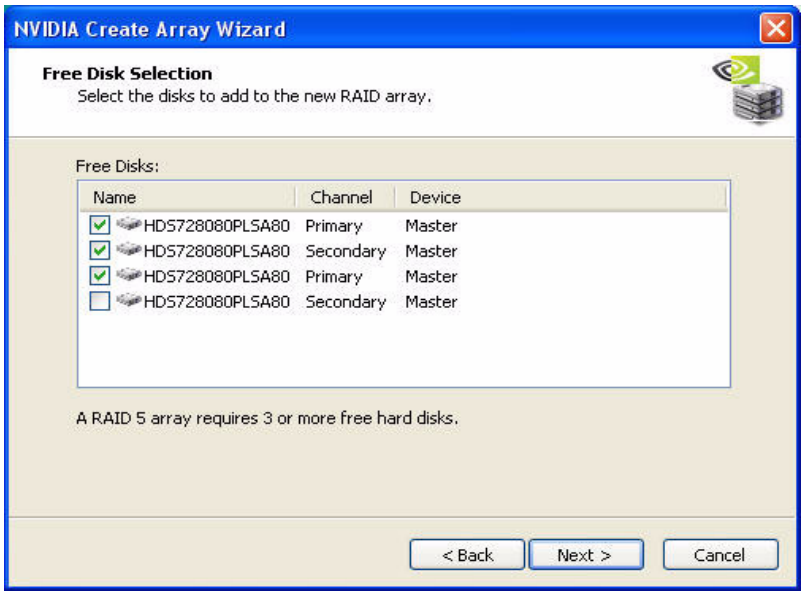


Figure 3.45 Free Disk Selection Page—Selecting Disks

To create a RAID 5 array with more disks, select additional disks from the list.

7 Click **Next** and **Next** again, the following screen shot will appear:

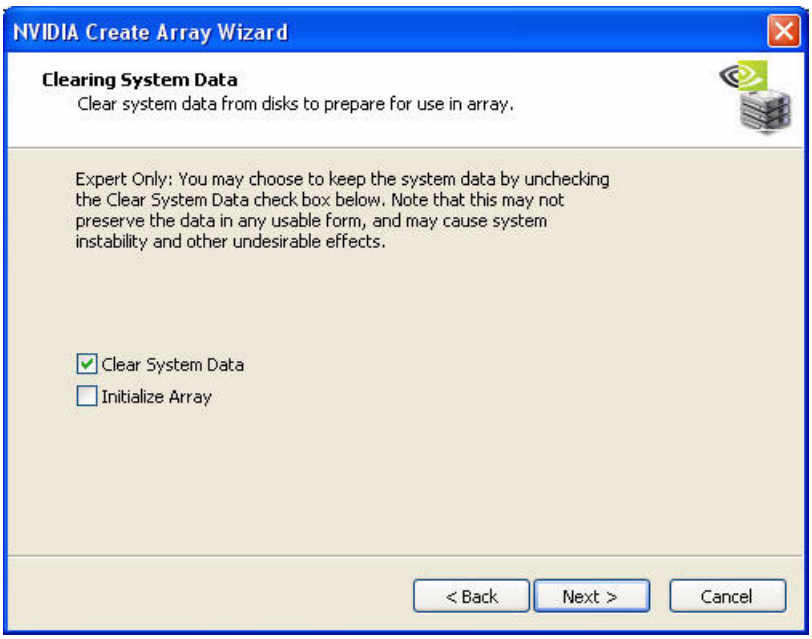


Figure 3.46 Clearing System Data

8 To clear all system data from the drives click **Next.**

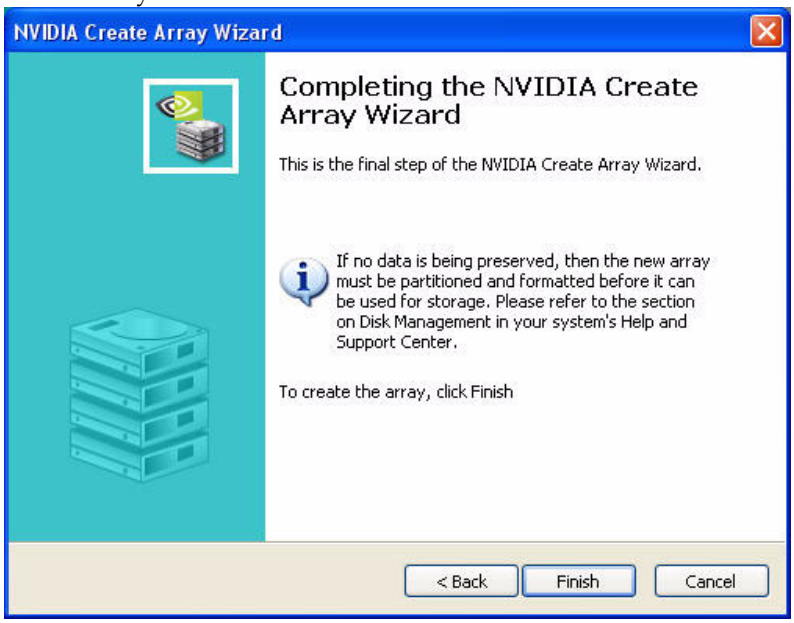


Figure 3.47 Completing the NVIDIA Create Array Wizard

9 Click **Finish** and the following screen shot will appear:

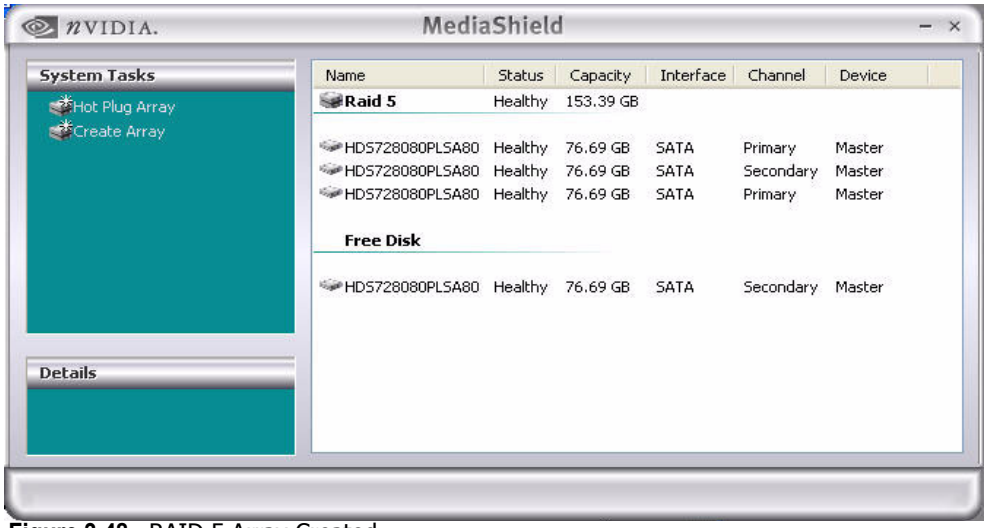


Figure 3.48 RAID 5 Array Created

As you can see from the above screen shot a RAID 5 array with 3 SATA disks has been created, while the other one disk is allocated as a Free Disk. Similarly, to create an array with four or more disks, simply make sure to add the number of disks that you want to use in the array during creation.

You can also "extend" the size of an existing RAID 5 array but that requires that you use migrating— the ability to convert from one RAID array to another as described in "Migrating From One RAID Array to Another" on page 69

Deleting a RAID Array

MediaShield can be used to delete an Array.

To delete an Array do the following:

1 Launch the MediaShield application and right click on the RAID array that you want to delete (assuming that you have a RAID array already created) as shown in the following screen shot:

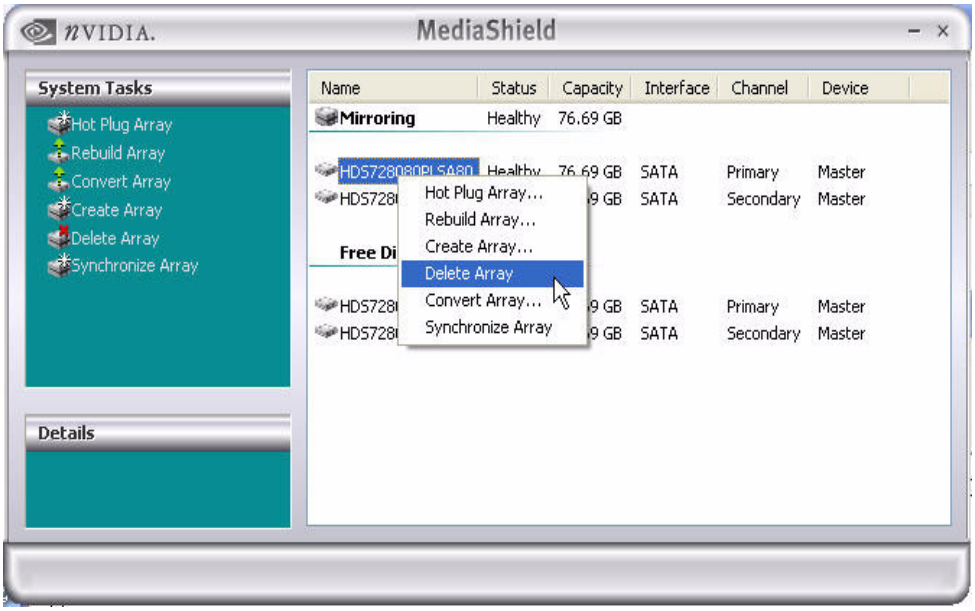


Figure 3.49 Selecting "Delete Array" from the Pop Up Menu

The above screen shot shows that there is a Mirrored array that will be deleted.

After the "Delete Array..." has been selected, the following screen shot appear:

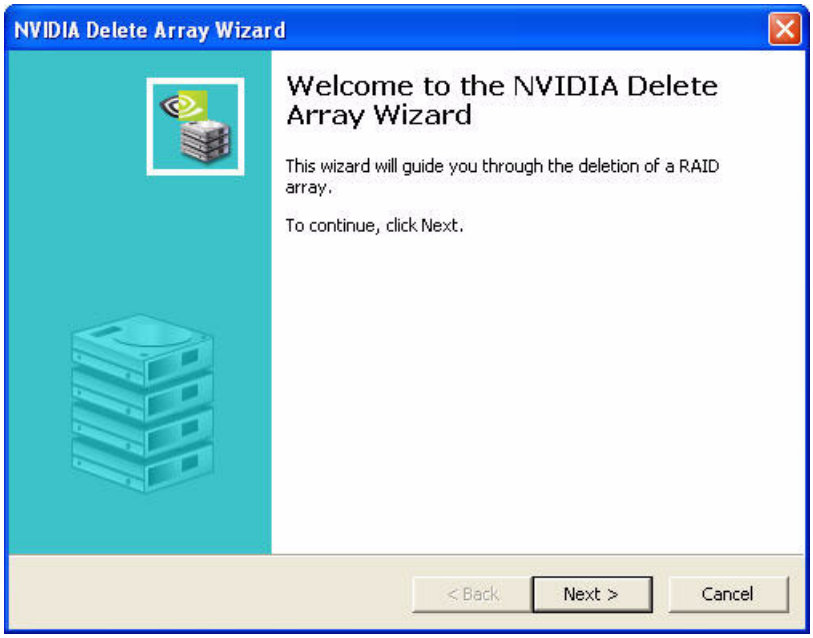


Figure 3.50 Delete Array Wizard—Welcome Page

2 Click **Next** and the following screen shot will appear:

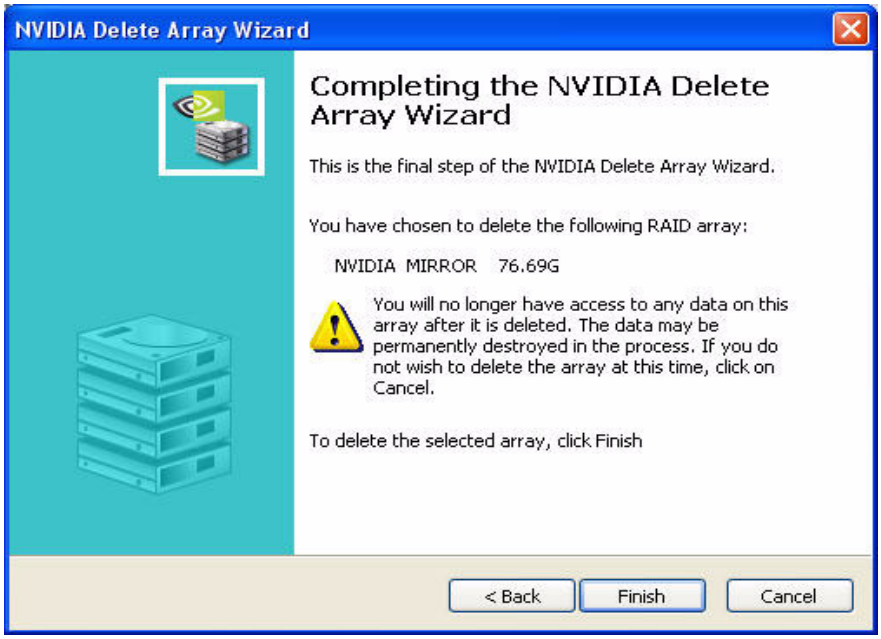


Figure 3.51 Completing the NVIDIA Delete Array Wizard Page

3 Click **Finish** and the array will be deleted and the following screen shot will appear showing all the free disks:

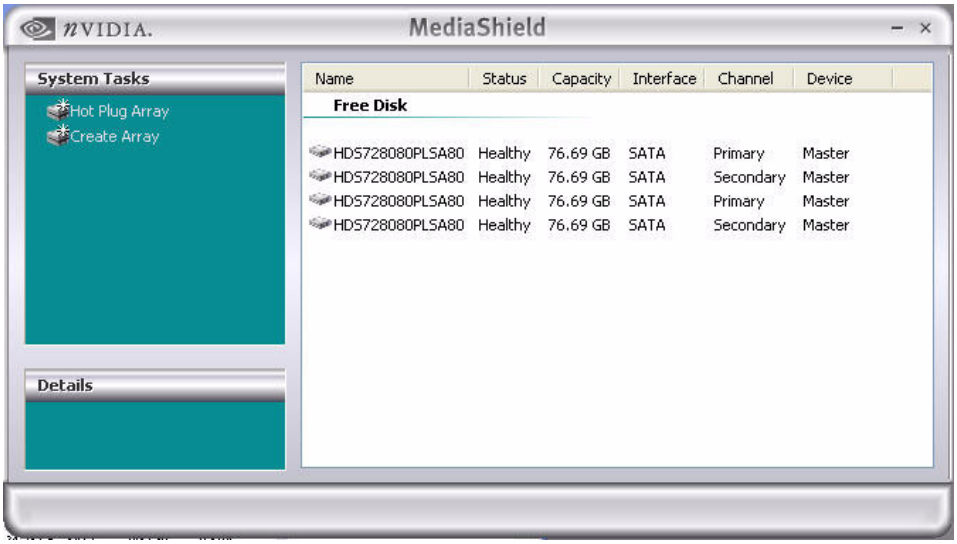


Figure 3.52 RAID Array Deleted

A similar process can be applied to delete any array created by MediaShield RAID.

Migrating From One RAID Array to Another

In a traditional RAID environment, when a user wants to change the current state of a disk or a current array to a new RAID configuration, the process of reconfiguring the new array involves multiple steps. The user must back up the data, delete the array, re-boot the PC, and then reconfigure the new array.

MediaShield RAID allows the end user to change the current state of the disk or array to another with a one-step process called "Migrating". This section describes the NVIDIA Migrating process and explains how to use Migrating to convert from one RAID array type to another.

General Migrating Principles

MediaShield RAID includes extensive support for migrating, a process of converting from one RAID mode to another RAID mode.

General Requirements and Limitations

- The new array capacity must be equal to or greater than the previous array.

  For example, it is possible to migrate from a RAID 1 array to a RAID 0 array as long as the RAID 0 array is the same size as (or larger than) the RAID 1 array.

- You cannot migrate
  - To or from a JBOD (Spanning) array
  - From RAID 1 to RAID 1
  - From RAID 0+1 to RAID 1
  - From RAID 5 to 1

- Free disks used for migrating must be no smaller than any of the current disks in the array.

Specific Migrating Requirements

The following table lists the disk requirements for a new RAID array for various migrating combinations.

Table 3.1 RAID Array Disk Requirements for Migrating

From	To	New Array Disk Requirements[i]
RAID 0	**RAID 0**	*m* > *n* Number of disks in the new array must be greater than the original array.
	RAID 1	*m*=2, *n*=1 RAID 1 array must include two disks, converted from a one disk RAID 0 array.
	RAID 0+1	*m* >= 2 x *n* Number of RAID 0+1 disks must be equal to or greater than twice the number of RAID 0 disks.
	RAID 5	*m* >= *n* + 1
RAID 1	**RAID 0**	No additional restrictions.
	RAID 1	**** Not a valid combination ****
	RAID 0+1	No additional restrictions.
	RAID 5	*m* >= 3
RAID 0+1	**RAID 0**	*m* >= *n*/2 Number of RAID 0 disks must be equal to or greater than half the number of RAID 0+1 disks.
	RAID 1	**** Not a valid combination ****
	RAID 0+1	*m* >= *n* + 2 ; where *m* must be an even number of disks. The new array must include at least two more disks than the original array, and can include any even number of disks beyond that.
	RAID 5	*m* >= (*n*/2 + 1)
RAID 5	**RAID 0**	*m* >= *n* - 1
	RAID 1	**** Not a valid combination ****
	RAID 0+1	*m* >= 2 x (*n* - 1) ; where *m* is an even number of disks.
	RAID 5	*m* >= *n*

i. *m* = quantity of disks in the new array. *n* = quantity of disks in the original array.

Migrating Instructions

This sections includes specific instructions for the following RAID migrating combinations:

- "Migrating from RAID 0 to RAID 0—Adding a Disk to a Stripe Set" on page 72
- "Migrating from RAID 0 (with One Disk) to RAID 1 (with Two Disks)" on page 77
- "Migrating from RAID 0 to RAID 0+1" on page 81
- "Migrating from RAID 1 to RAID 0" on page 86
- "Migrating from RAID 1 to RAID 0+1" on page 90
- "Migrating from RAID 0+1 to RAID 0" on page 95
- "Migrating from RAID 0+1 to RAID 0+1" on page 99
- "Migrating from RAID 0 to RAID 5" on page 103
- "Migrating from RAID 1 to RAID 5" on page 108
- "Migrating from RAID 0+1 to RAID 5" on page 112
- "Migrating from RAID 5 to RAID 0" on page 115
- "Migrating from RAID 5 to RAID 0+1" on page 118
- "Migrating from RAID 5 to RAID 5" on page 121

Migrating from RAID 0 to RAID 0—Adding a Disk to a Stripe Set

The following example shows you how to expand a RAID 0 array with two disks to include an additional disk.

1. Go to the system BIOS and make sure that the drives that you want to use are RAID **enabled.**

2. Boot to Windows, launch the MediaShield application, then follow the steps outlined in "Creating a Striped Array" on page 47 to create a two disk stripe array.

   When that is done, you should see a screen shot similar to the following:

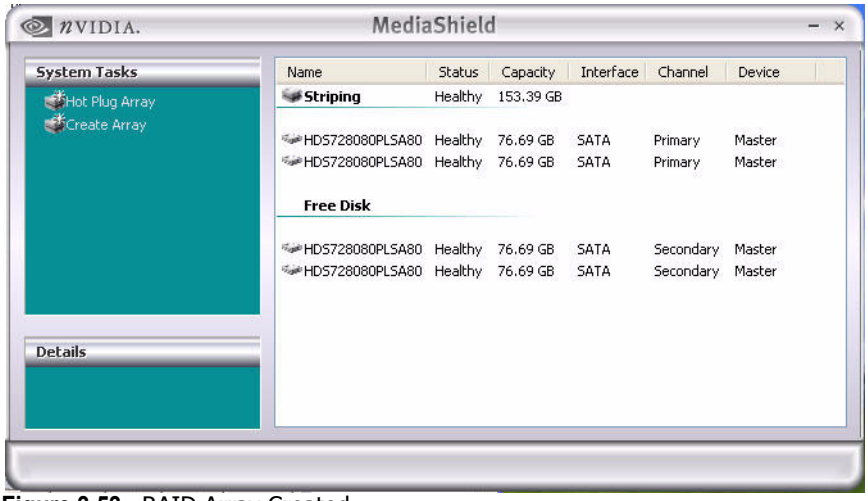


Figure 3.53 RAID Array Created

Now that a two disk stripe array has been created, you can use the MediaShield convert feature to migrate the array from a two-disk RAID 0 into a three-disk RAID 0 array.

3 Right click on the newly created striped array (or existing striped array) and a select "Convert Array..." as shown from the following screen shot:

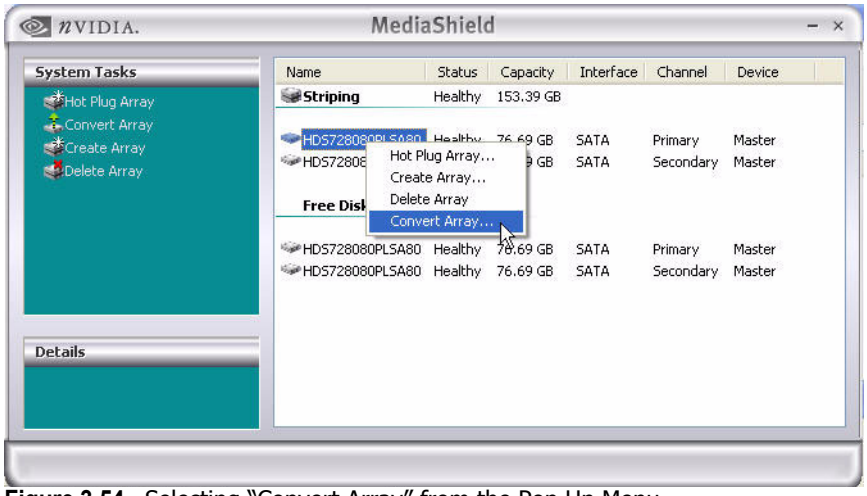


Figure 3.54 Selecting "Convert Array" from the Pop Up Menu

4 After selecting "Convert Array..." the following screen shot will appear:

Figure 3.55 Convert Array Wizard—Welcome Screen

5 Click **Next** and the following screen shot will appear:

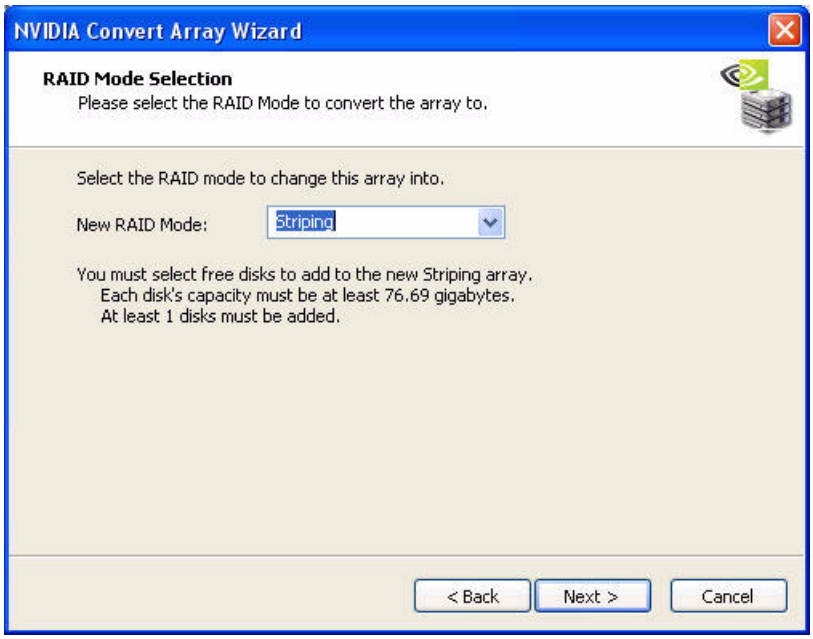


Figure 3.56 RAID Mode Selection Page

6 Click **Next** and the following screen shot will appear:

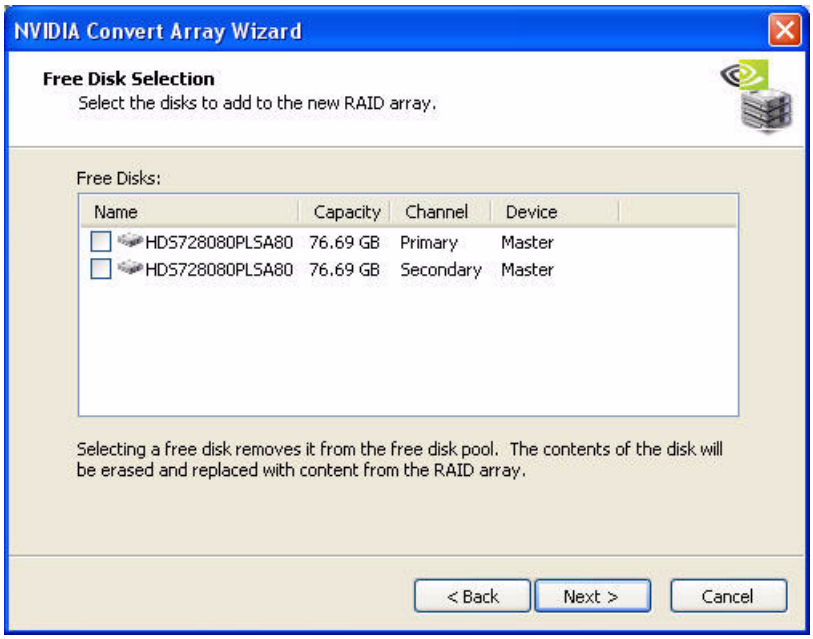


Figure 3.57 Free Disk Selection Page

7 Select the disk (or disks) that you want to add to the existing striped array.

In this example, we are adding one disk (which is the upper disk) to the existing two-disk striped array. So, select the first disk and click **Next** and the following screen shot will appear:

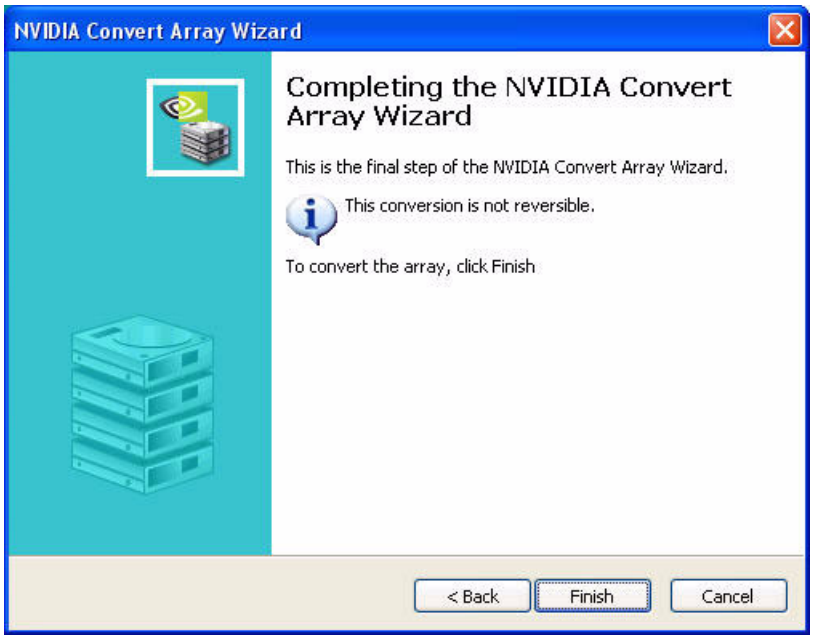


Figure 3.58 Completing the NVIDIA Convert Array Wizard Screen

8 Click **Finish** then click on the newly created three disk striped array and the following screen shot will appear:

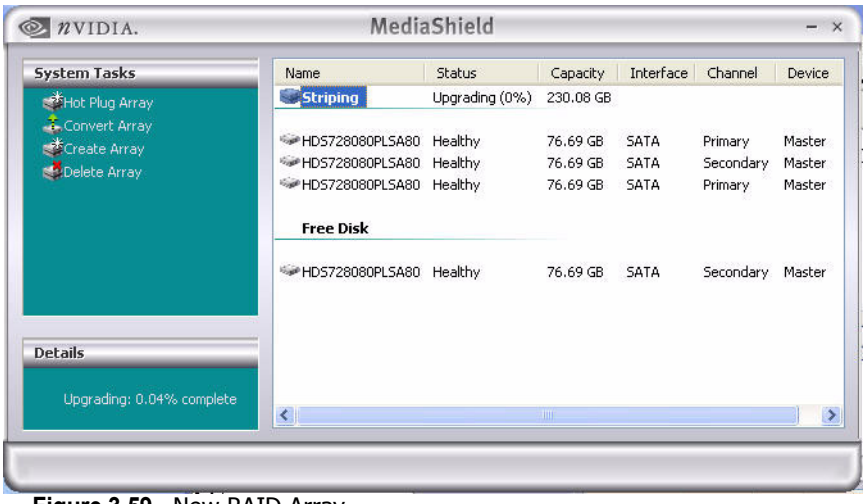


Figure 3.59 New RAID Array

The Migrating Process

As you can see from the screen shot above, a three disk stripe array has been created and the migrating process has begun. A pop up window similar to the following will appear:

followed by the following pop up window:

It will take some time before the entire process is completed. The time it takes to convert an array is dependent on several factors such as the speed of the CPU, the size and type of hard drive being used, the operating system, etc.

More About This Example

When creating a stripe array using hard drives of different sizes, the stripe array uses the stripe size of the smallest drive. For example, if you try to create a 3-disk stripe array that consists of a 10 GB, 20 GB and 40 GB hard drive, the resulting 3-disk stripe array will have a capacity of 30 GB (since 10 GB x 3 = 30 GB).

Migrating from RAID 0 (with One Disk) to RAID 1 (with Two Disks)

The following example shows you how to convert a RAID 0 array with one disk to a RAID 1 array (with two disks)

1 Go to the system BIOS and make sure that the drives that you want to use are RAID **enabled.**

2 Boot to Windows, launch the MediaShield application, then follow the steps outlined in "Creating a Striped Array" on page 47 with the exception that you need to select one disk instead of two disks.

When that is done, you should see a screen shot similar to the following:

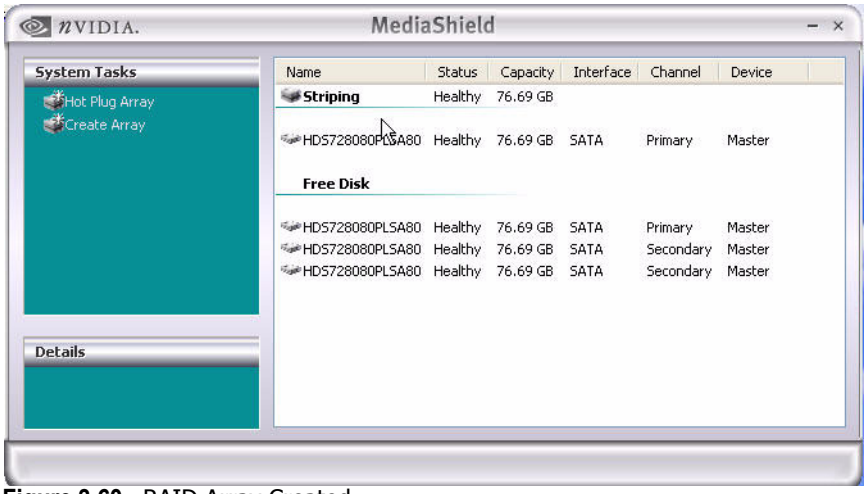


Figure 3.60 RAID Array Created

3 Click click on **Striping** and select "Convert Array..." as shown in the following screen shot:

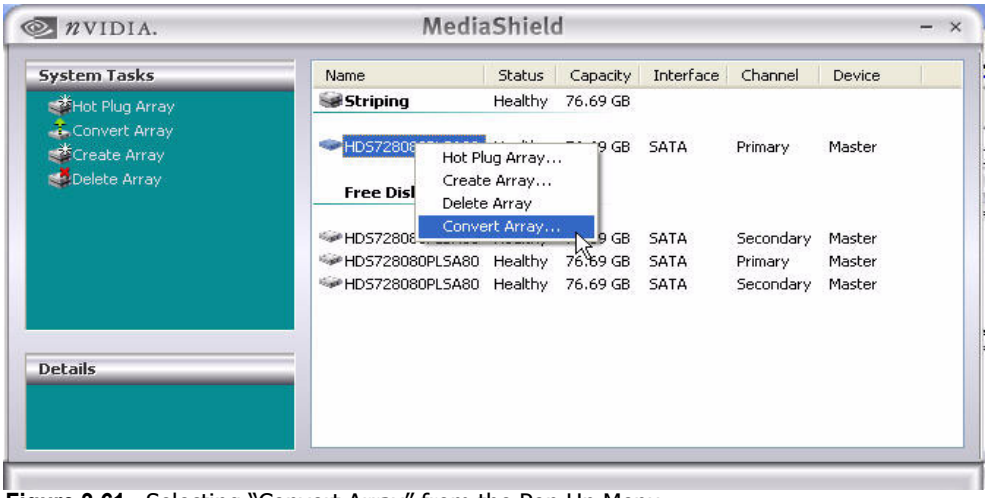


Figure 3.61 Selecting "Convert Array" from the Pop Up Menu

After selecting "Convert Array..." the following screen shot will appear:

Figure 3.62 Convert Array Wizard—Welcome Screen

4 Click **Next** and the following screen shot will appear:

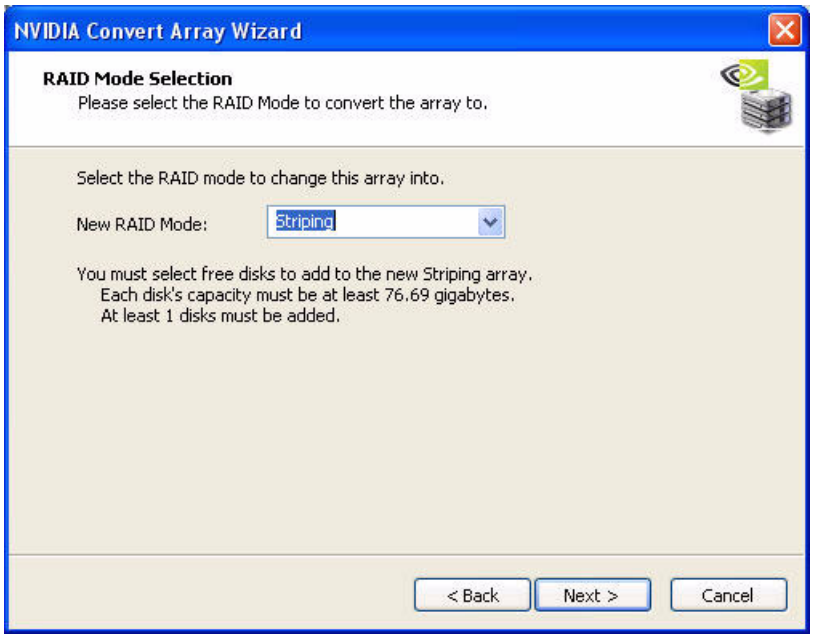


Figure 3.63 RAID Mode Selection Page

5 For the "New RAID Mode:" entry select Mirror as shown in the following screen shot:

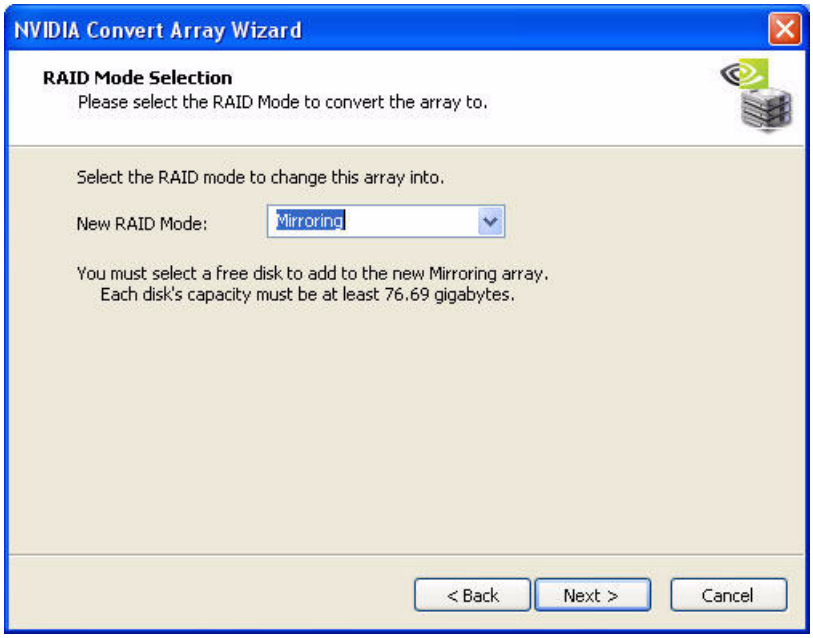


Figure 3.64 RAID Mode Selection Page—Selecting Mirroring

6 Click **Next** and the following screen shot will appear:

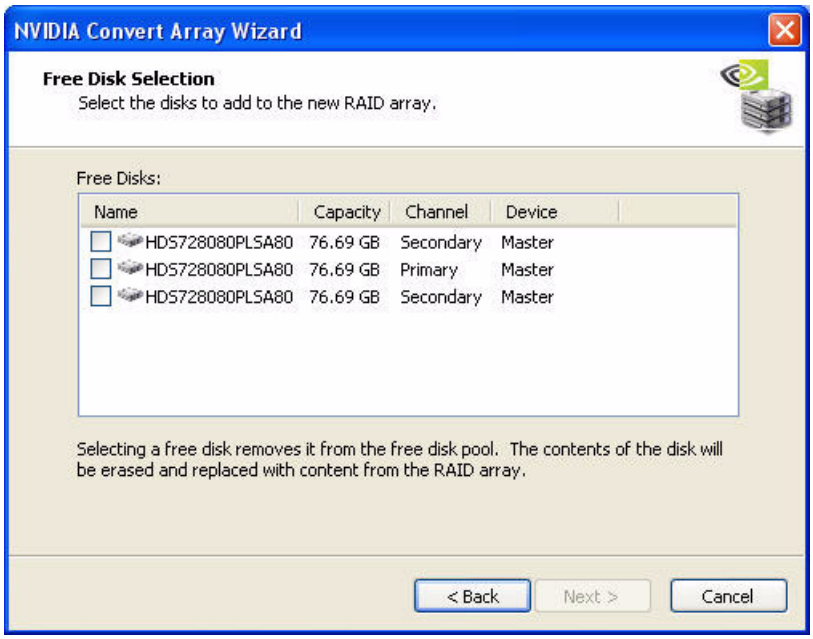


Figure 3.65 Free Disk Selection Page

7 Select one of the disks and click **Next**, then **Finish**.

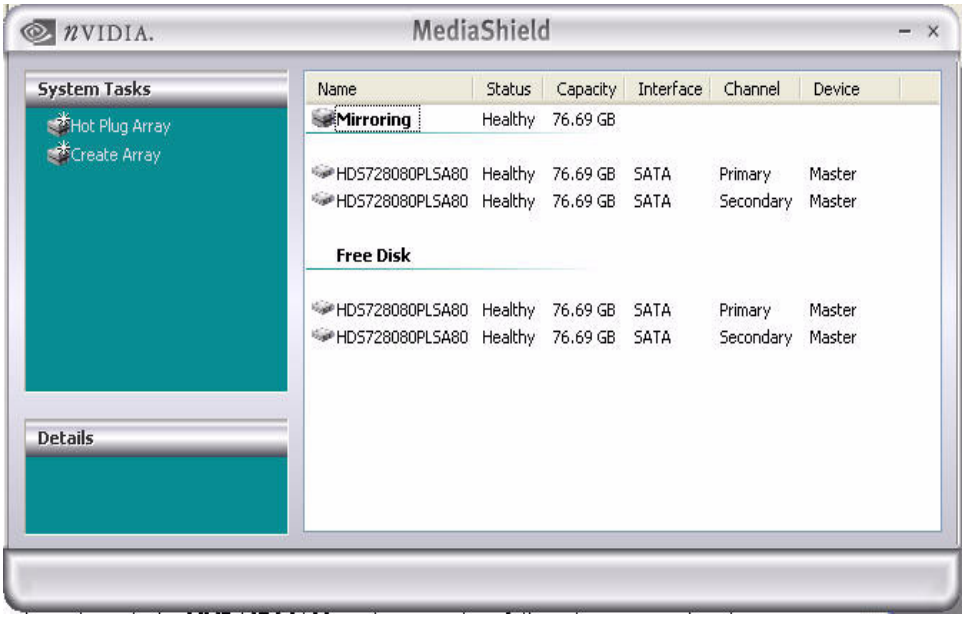
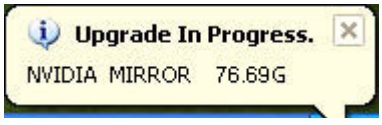


Figure 3.66 New RAID Array

The Migrating Process

As soon as the new two disk mirror array has been created, a pop up window similar to the following will appear:

followed by the following pop up window:



It will take some time before the entire process is completed. The time it takes to convert an array is dependent on several factors such as the speed of the CPU, the size and type of hard drive being used, the operating system, etc.

Migrating from RAID 0 to RAID 0+1

The following example shows you how to convert from a RAID 0 array with two disks to a four disk RAID 0+1 array.

1 Go to the system BIOS and make sure that the drives that you want to use are RAID **enabled.**

2 Boot to Windows, launch the MediaShield application, then follow the steps outlined in "Creating a Striped Array" on page 47 to create a two-disk striped array.

When that is done, you should see a screen shot similar to the following:

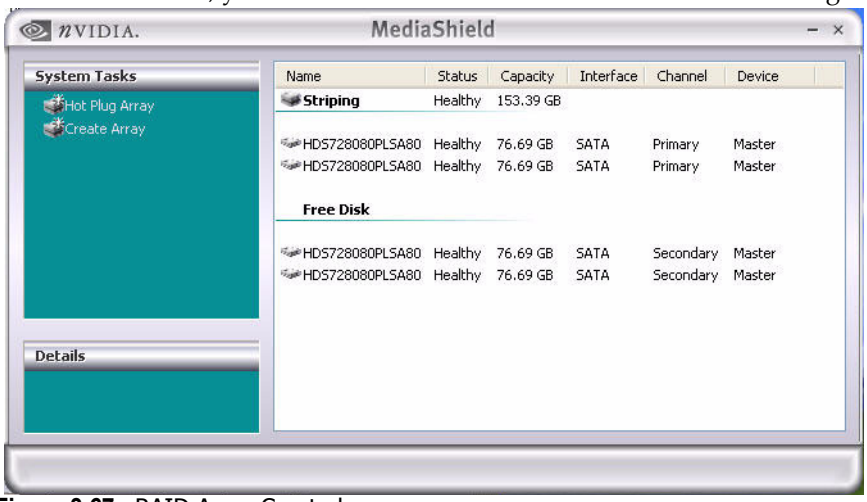


Figure 3.67 RAID Array Created

Now that a two-disk striped array has been created, you can use the MediaShield convert feature to migrate the array from a two-disk RAID 0 into a four-disk RAID 0+1 array.

3 Right click on the newly created striped array (or existing striped array) and a select "Convert Array..." as shown from the following screen shot:

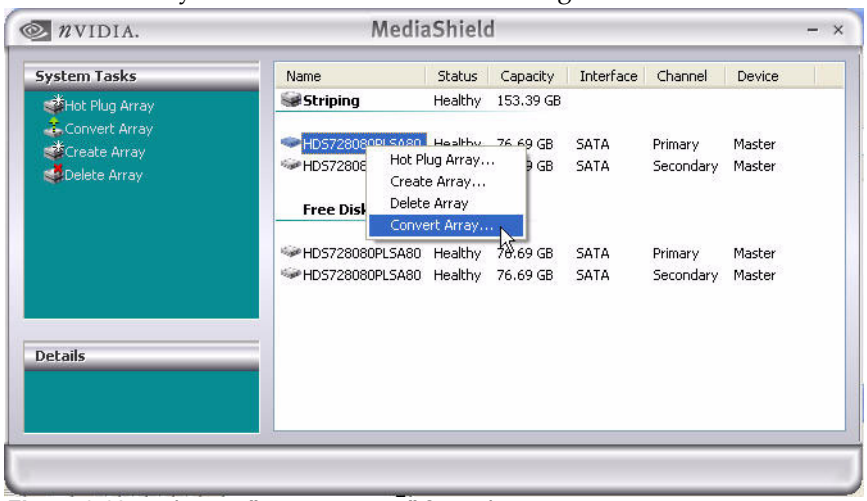


Figure 3.68 Selecting "Convert Array" from the Pop Up Menu

After selecting "Convert Array..." the following screen shot will appear:

Figure 3.69 Convert Array Wizard—Welcome Screen

4 Click **Next** and the following screen shot will appear:

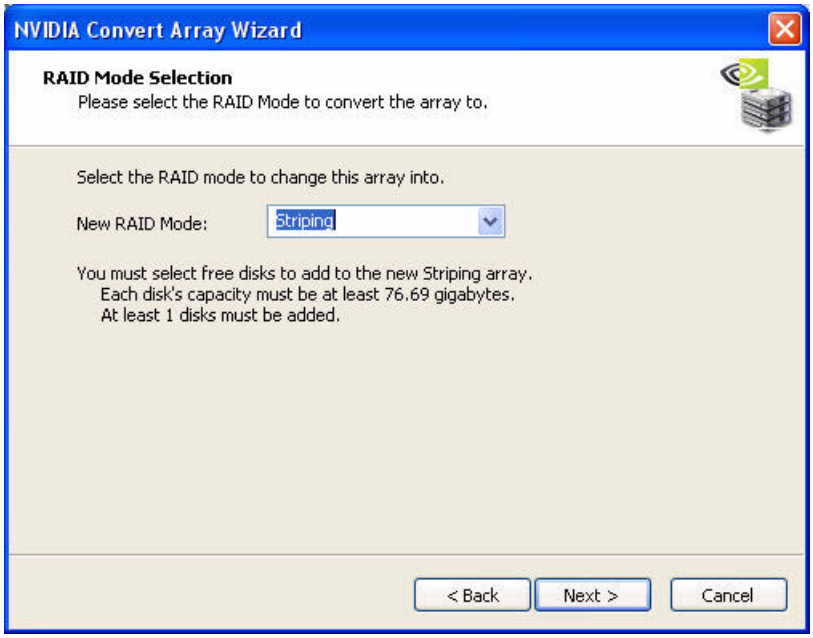


Figure 3.70 RAID Mode Selection Page

5 Change the "New RAID Mode:" to Stripe Mirroring as shown in the following screen shot:

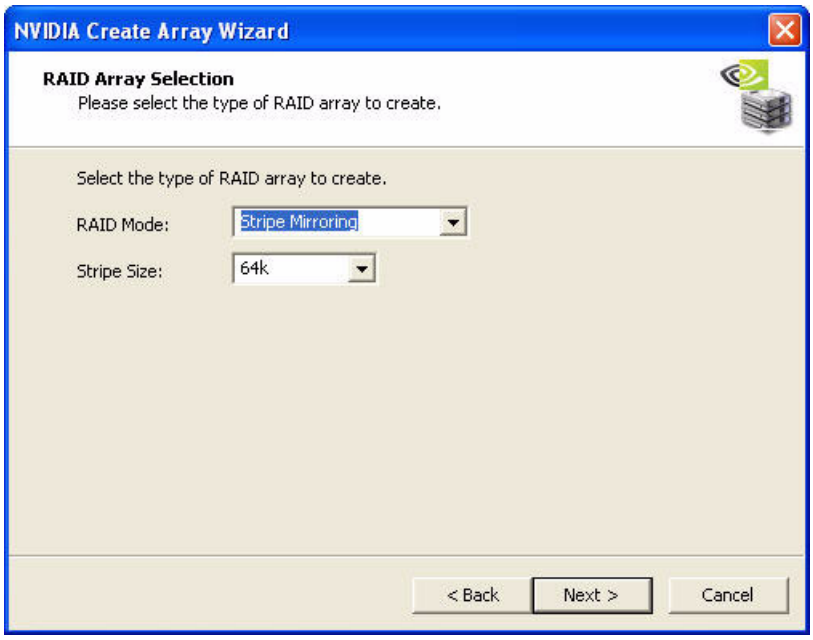


Figure 3.71 RAID Mode Selection Page—Selecting Stripe Mirroring

6 Click **Next** and the following screen shot will appear:

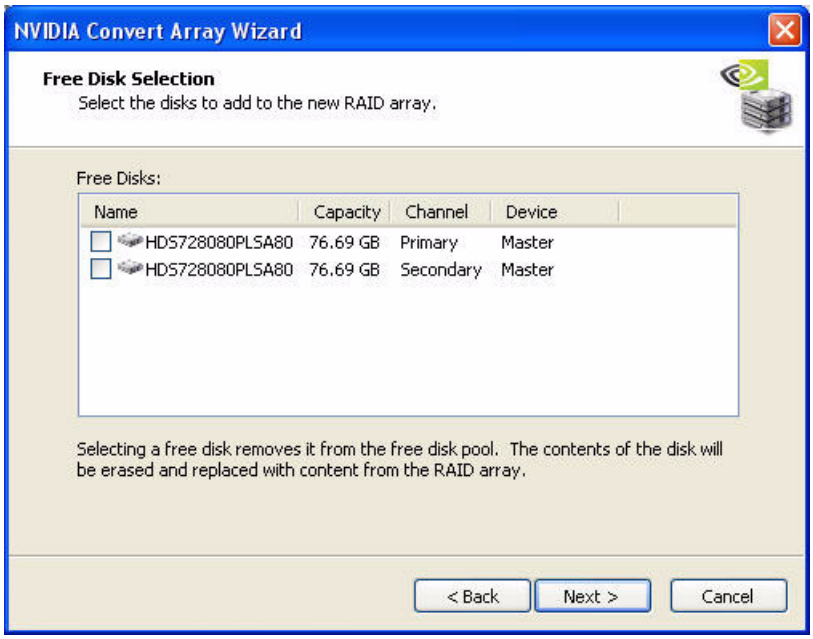


Figure 3.72 Free Disk Selection Page

7 Select the two disks that you want to add to the new stripe mirror array.

In this example, we are adding two disks (which are both of the upper disks) to the existing two-disk mirrored array. So, select both disks and click **Next** and the following screen shot will appear:

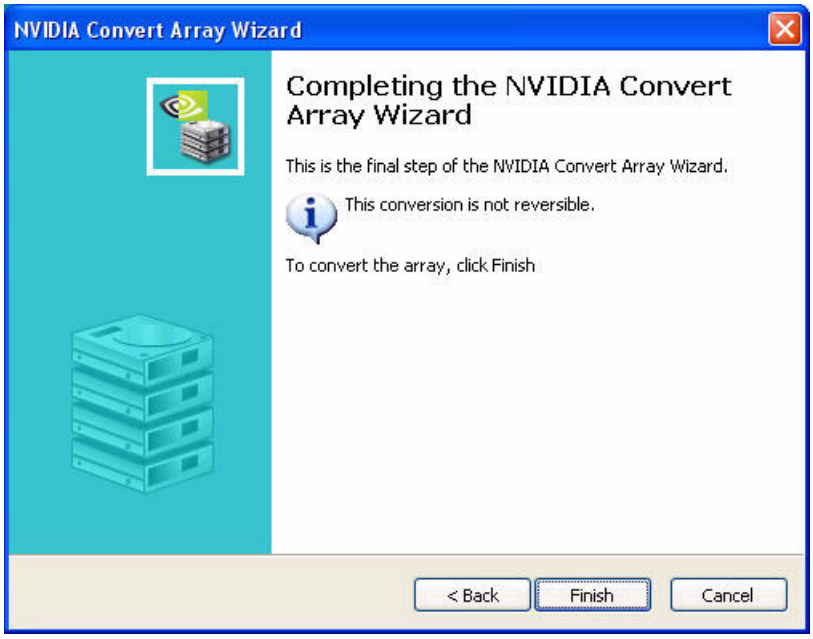


Figure 3.73 Convert Array Wizard—Welcome Screen

8 Click **Finish**, then click the newly created four-disk stripe mirror array and the following screen shot will appear:

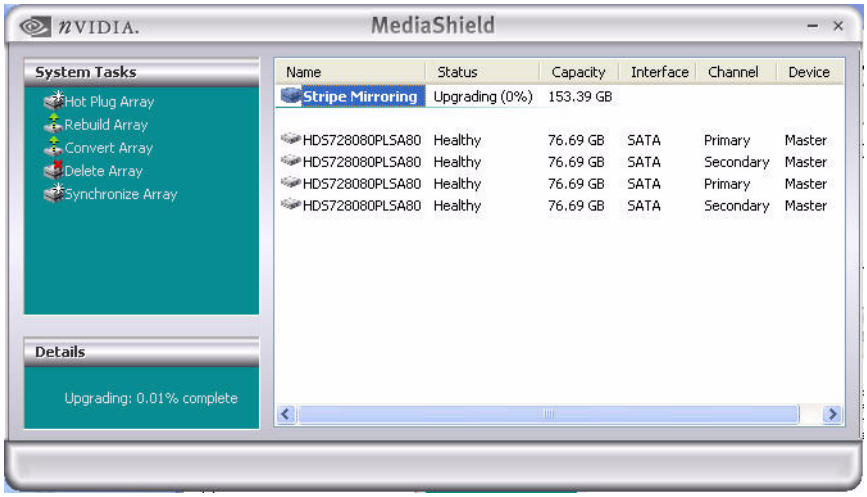


Figure 3.74 New RAID Array

The Migrating Process

As soon as the new four-disk stripe mirror array has been created, a pop up window similar to the following will appear:

followed by the following pop up window:

It will take some time before the entire process is completed. The time it takes to convert an array is dependent on several factors such as the speed of the CPU, the size and type of hard drive being used, the operating system, etc.

Migrating from RAID 1 to RAID 0

The following example shows you how to convert from a RAID 1 array with two disks to a RAID 0 array with two disks.

1 Goto the system BIOS and make sure that the drives that you want to use are RAID **enabled.**

2 Boot to Windows and launch the MediaShield application then follow the steps outlined in "Creating a Mirrored Array" on page 51 to create a two-disk mirror array.

When that is done, you should see a screen shot similar to the following:

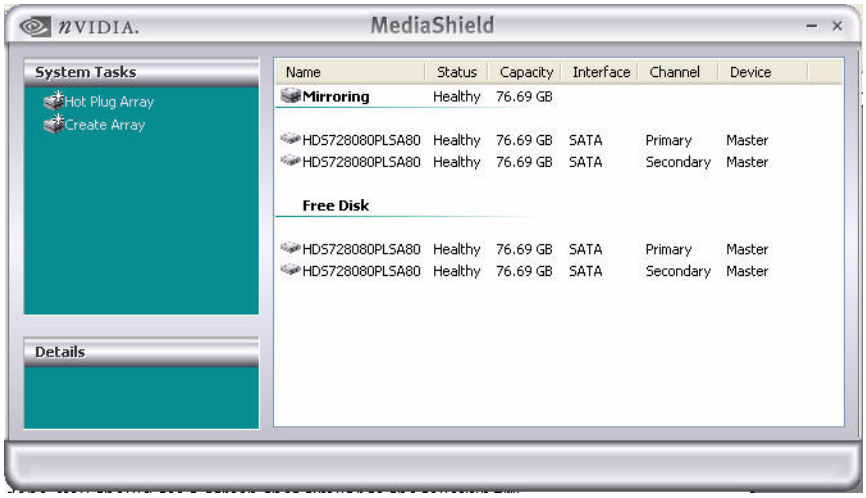


Figure 3.75 RAID Array Created

Now that a two disk mirrored array has been created, you can use the MediaShield convert feature to migrate the array from a two-disk RAID 1 into a two-disk RAID 0 array.

3 Right click on Mirroring and select "Convert Array..." as shown in the following screen shot:

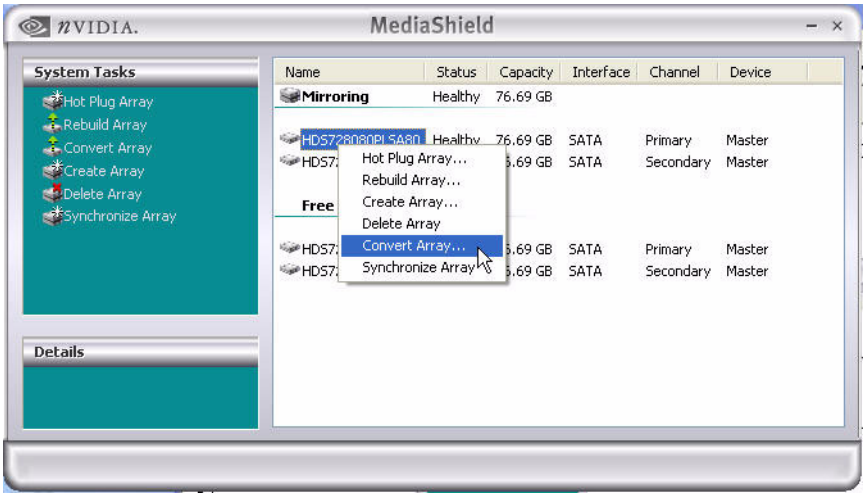


Figure 3.76 Selecting "Convert Array" from the Pop Up Menu

4 After selecting "Convert Array..." the following screen shot will appear:

Figure 3.77 Convert Array Wizard—Welcome Screen

5 Click **Next** and the following screen shot will appear:

Figure 3.78 RAID Mode Selection Page

6 Click on **Stripe Mirroring** and select **Striping**, then click **Next** and the following screen shot will appear:

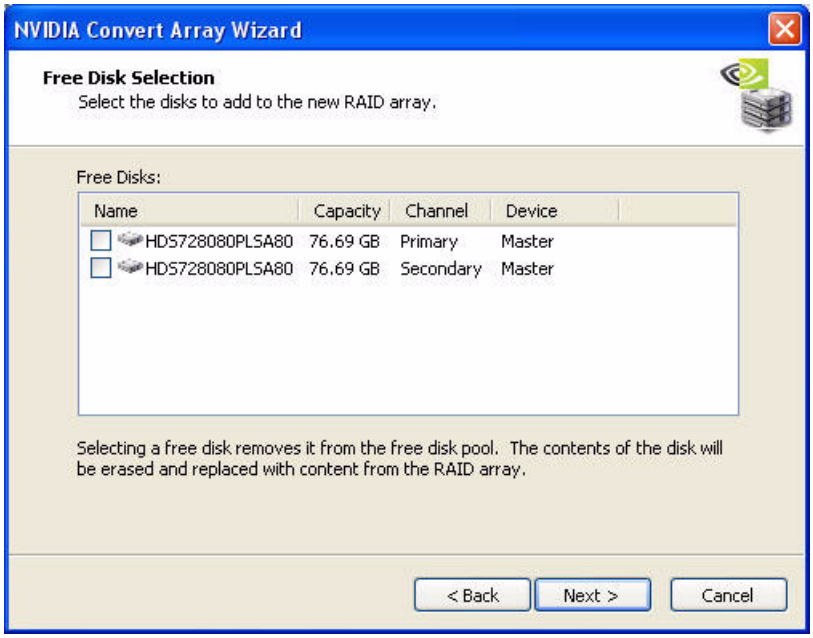


Figure 3.79 Free Disk Selection Page

7 Click **Next**, then click **Finish** to complete the process.

- If you want to convert the existing two-disk mirrored array into a three-disk (or more) striped array, then you need to select the number of disk(s) that you want to add to the newly created striped array and click **Next**.
- In this example, there is no need to select any additional disks since we are simply converting the existing two-disk mirrored array into a two-disk striped array.

8 Click on Striping and the following screen shot will appear:

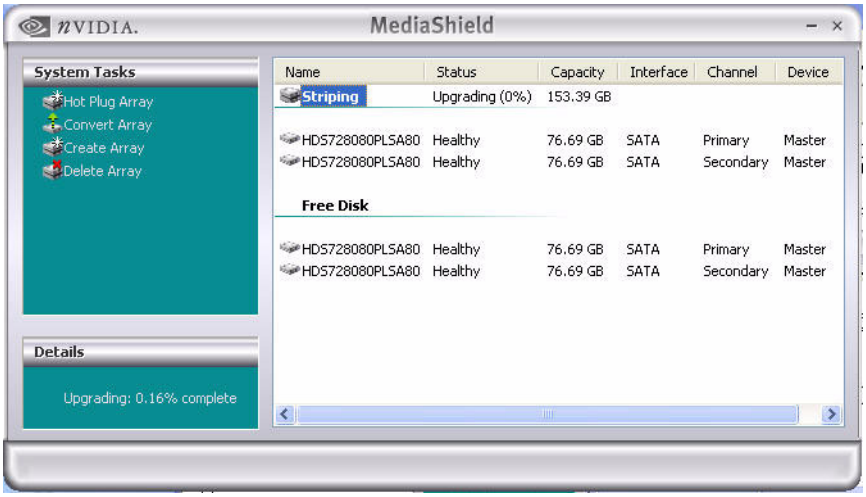
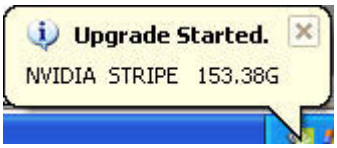


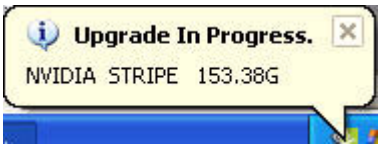
Figure 3.80 New RAID Array

The Migrating Process

As soon as the new array has been created, a pop up window similar to the following will appear:



followed by the following pop up window:



It will take some time before the entire process is completed. The time it takes to convert an array is dependent on several factors such as the speed of the CPU, the size and type of hard drive being used, the operating system, etc.

Migrating from RAID 1 to RAID 0+1

The following example shows you how to convert from a RAID 1 array with two disks to a RAID 0+1 array with four disks.

1 Goto the system BIOS and make sure that the drives that you want to use are RAID **enabled.**

2 Boot to Windows, launch the MediaShield application, then follow the steps outlined in "Creating a Mirrored Array" on page 51 to create a two-disk mirrored array. When that is done, you should see a screen shot similar to the following:

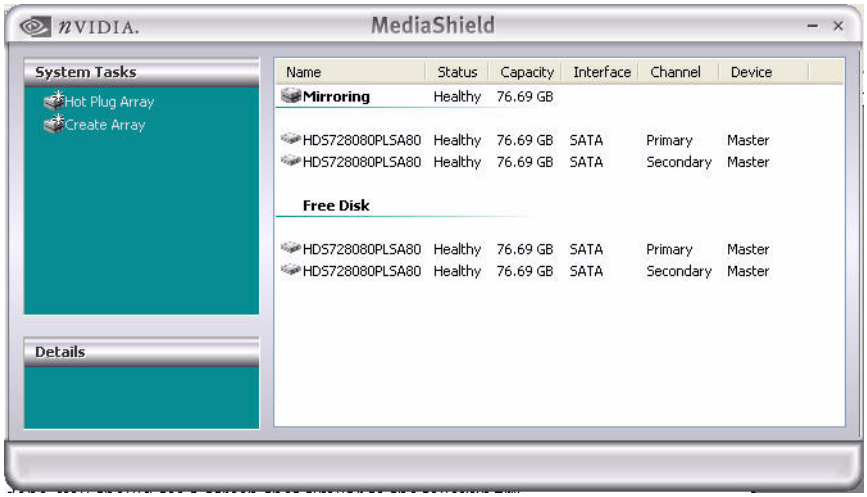


Figure 3.81 RAID Array Created

Now that a two-disk mirrored array has been created, you can use the MediaShield convert feature to migrate the array from a two-disk RAID 1 into a four-disk RAID 0+1 array.

3 Right click on Mirroring and select "Convert Array..." as shown in the following screen shot:

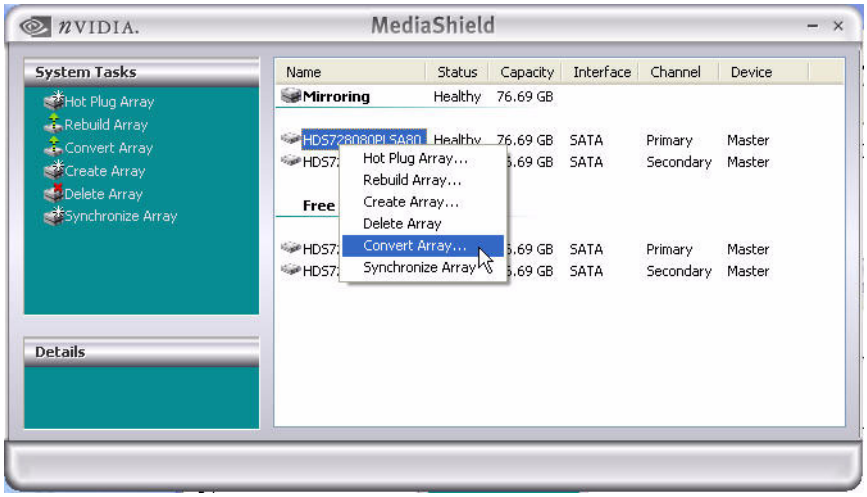


Figure 3.82 Selecting "Convert Array" from the Pop Up Menu

4 After selecting "Convert Array..." the following screen shot will appear:

Figure 3.83 Convert Array Wizard—Welcome Screen

5 Click **Next** and the following screen shot will appear:

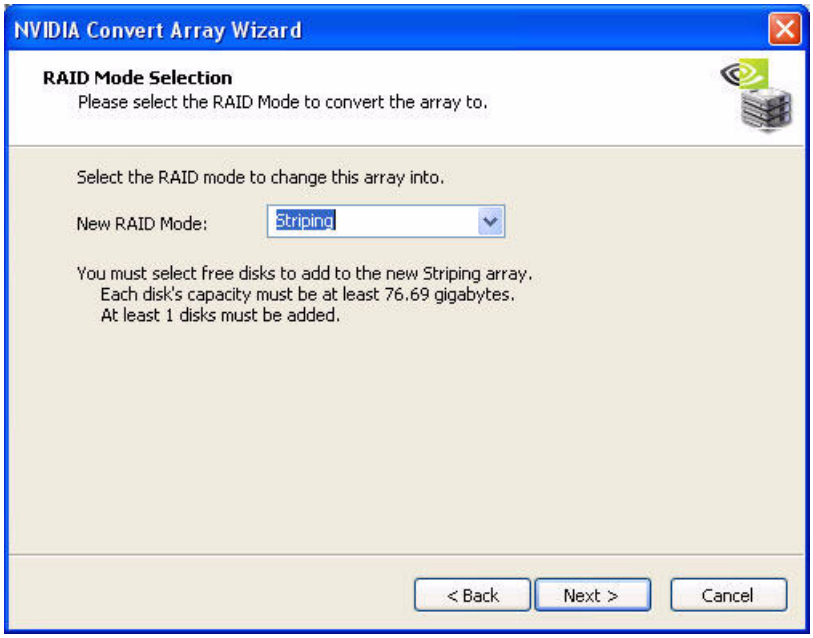


Figure 3.84 RAID Mode Selection Page

6 From the "New RAID Mode:" entry select "Stripe Mirroring" as shown in the following screen shot:

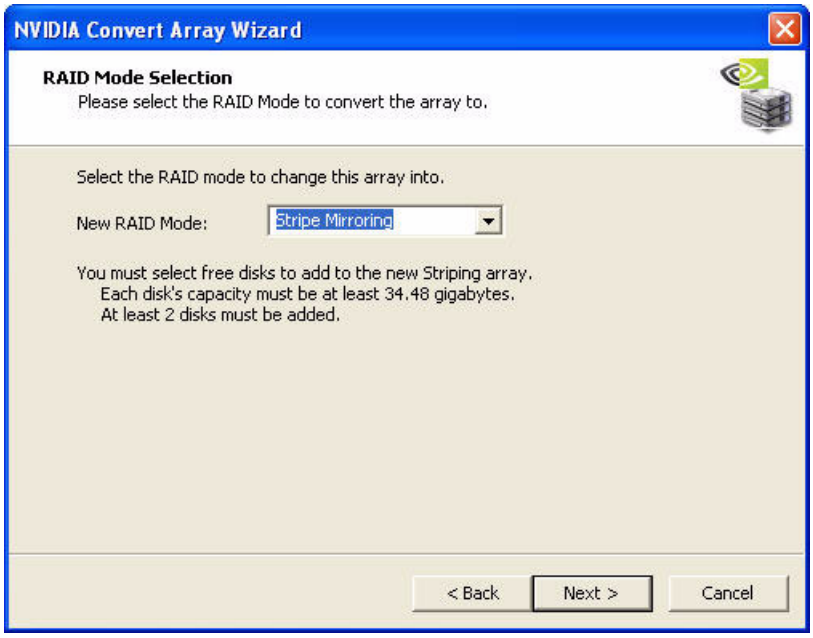


Figure 3.85 RAID Mode Selection Page—Selecting Stripe Mirroring

7 Click **Next** and the following screen shot will appear:

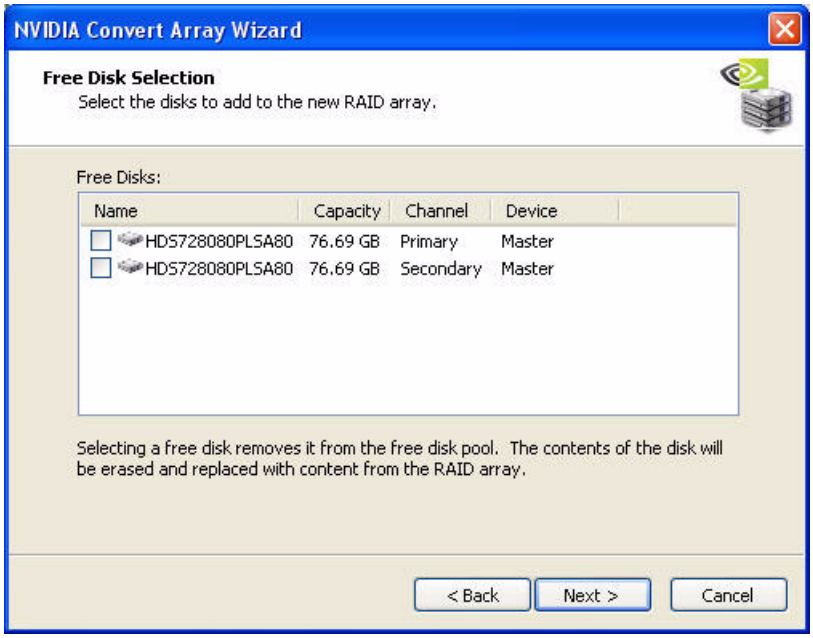


Figure 3.86 Free Disk Selection Page

8 Select both of the disks and click **Next**, then click **Finish**.

9 Click on Strip Mirror and the following screen shot will appear:

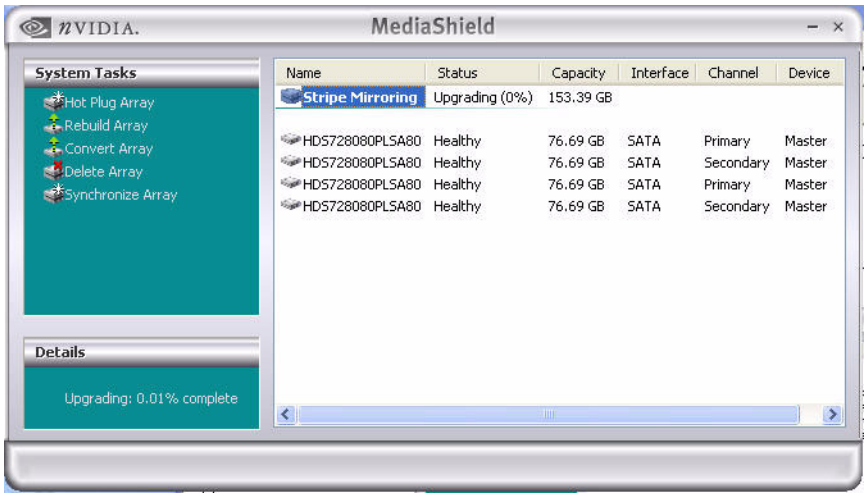
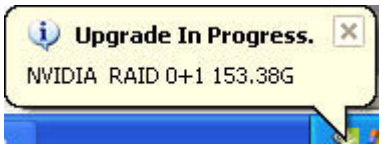


Figure 3.87 New RAID Array

The Migrating Process

As soon as the new four-disk stripe mirror array has been created, a pop up window similar to the following will appear:

followed by the following pop up window:



It will take some time before the entire process is completed. The time it takes to convert an array is dependent on several factors such as the speed of the CPU, the size and type of hard drive being used, the operating system, etc.

Migrating from RAID 0+1 to RAID 0

The following example shows you how to convert from a RAID 0+1 array with four disks to a RAID 0 array with four disks.

1 Go to the system BIOS and make sure that the drives that you want to use are RAID **enabled.**

2 Boot to Windows, launch the MediaShield application, then follow the steps outlined in "Creating a Stripe Mirroring Array" on page 54 to create a four-disk mirrored stripe array. When that is done, you should see a screen shot similar to the following:

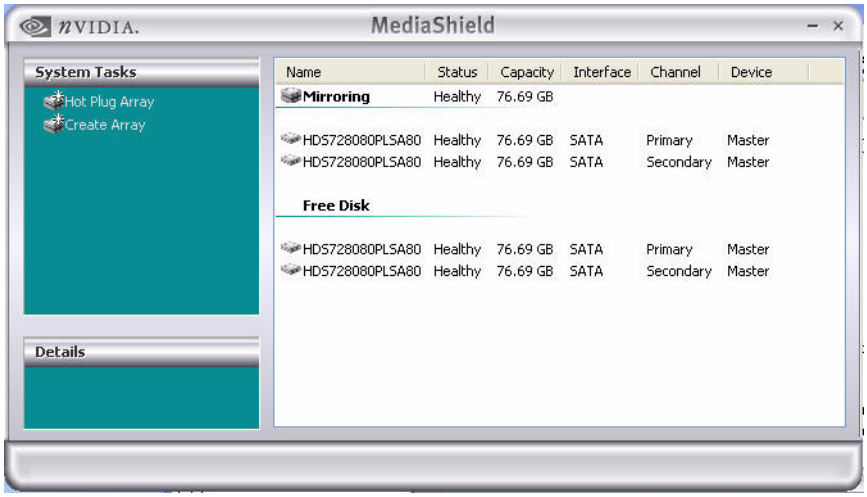


Figure 3.88 RAID Array Created

Now that a four-disk mirrored stripe array has been created, you can use the MediaShield convert feature to migrate the array from a four-disk RAID 0+1 into a four-disk RAID 0 array.

3 Right click on Stripe Mirroring and select "Convert Array..." as shown in the following screen shot:

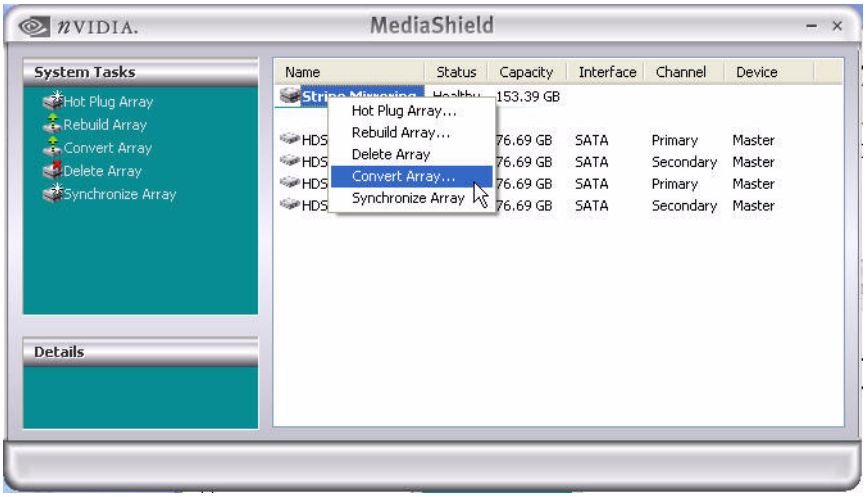


Figure 3.89 Selecting "Convert Array" from the Pop Up Menu

4 After selecting "Convert Array..." the following screen shot will appear:

Figure 3.90 Convert Array Wizard—Welcome Screen

5 Click **Next** and the following screen shot will appear:

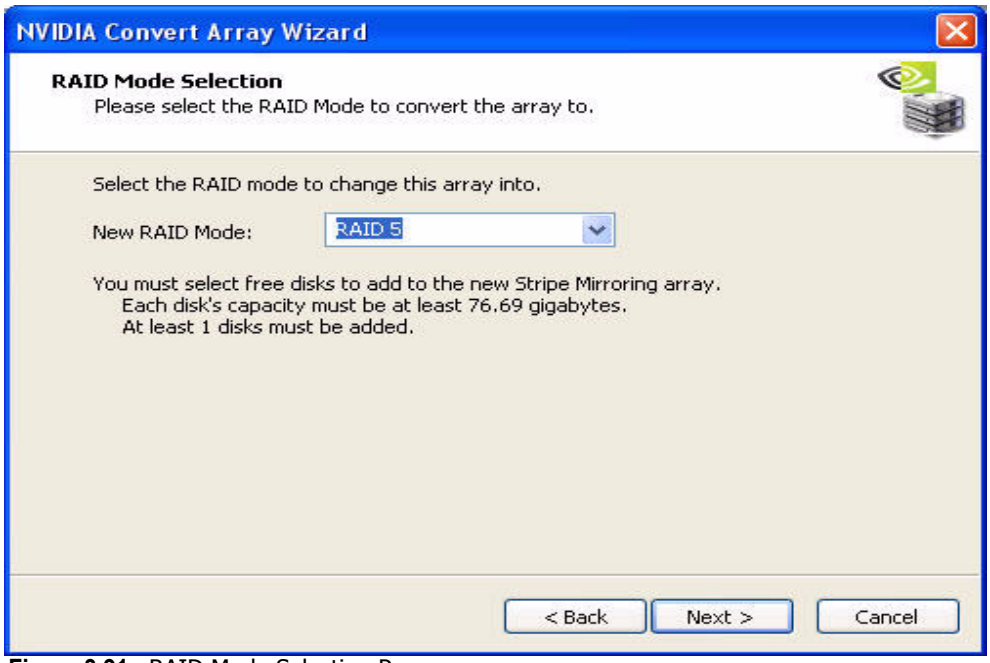


Figure 3.91 RAID Mode Selection Page

6 From the "New RAID Mode:" entry select "Striping" as shown in the following screen shot:

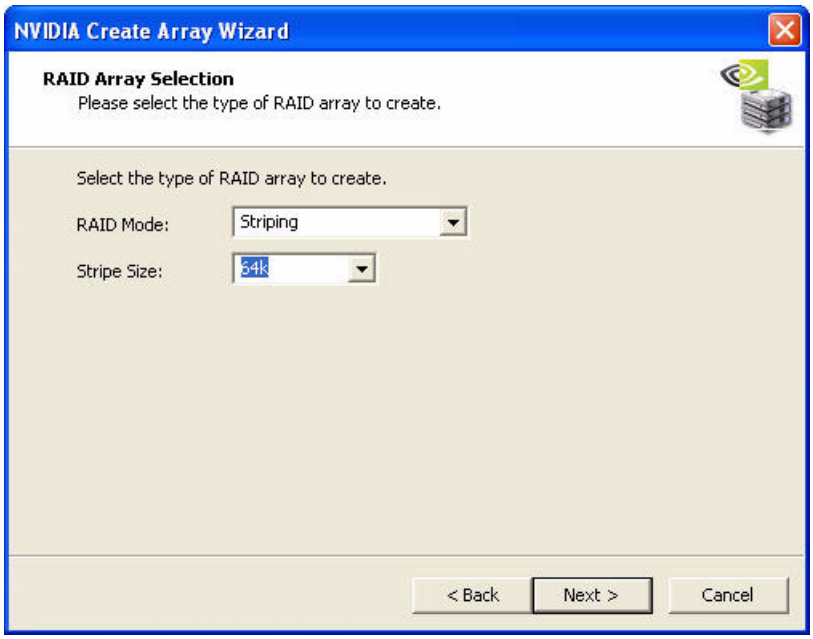


Figure 3.92 RAID Array Selection Page—Selecting Striping

7 Click **Next**, then click **Finish**.

8 Click on Striping and the following screen shot will appear:

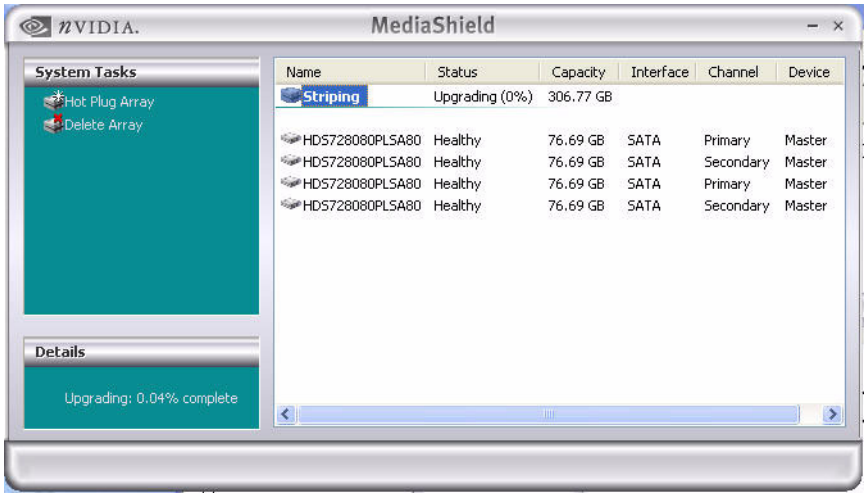


Figure 3.93 New RAID Array

The Migrating Process

As soon as the new four-disk striped array has been created, a pop up window similar to the following will appear:

followed by the following pop up window:

It will take some time before the entire process is completed. The time it takes to convert an array is dependent on several factors such as the speed of the CPU, the size and type of hard drive being used, the operating system, etc.

Migrating from RAID 0+1 to RAID 0+1

The following example shows you how to convert from a RAID 0+1 array with four disks to a RAID 0+1 array with six disks.

Note: To migrate from a RAID 0+1 array with four disks to a RAID 0+1 array with six disks, you must have at least six hard drives in the system. In this example, the system has six free RAID enabled disks.

1 Goto the system BIOS and make sure that the drives that you want to use are RAID **enabled.**

2 Boot to Windows, launch the MediaShield application, then follow the steps outlined in "Creating a Stripe Mirroring Array" on page 54 to create a four-disk mirrored stripe array. When that is done, you should see a screen shot similar to the following:

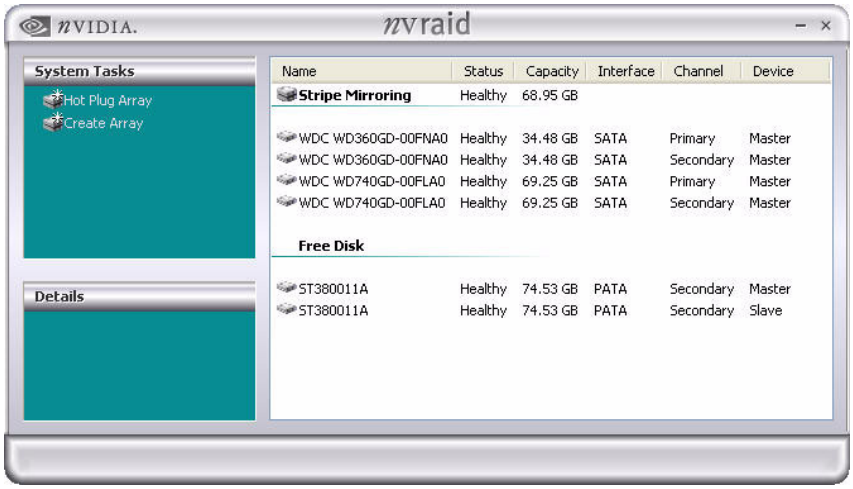


Figure 3.94 RAID Array Created

Now that a four-disk stripe mirror array has been created, you can use the MediaShield convert feature to migrate the array from a four-disk RAID 0+1 into an six-disk RAID 0+1 array.

3 Right click on Stripe Mirroring and select "Convert Array..." as shown in the following screen shot:

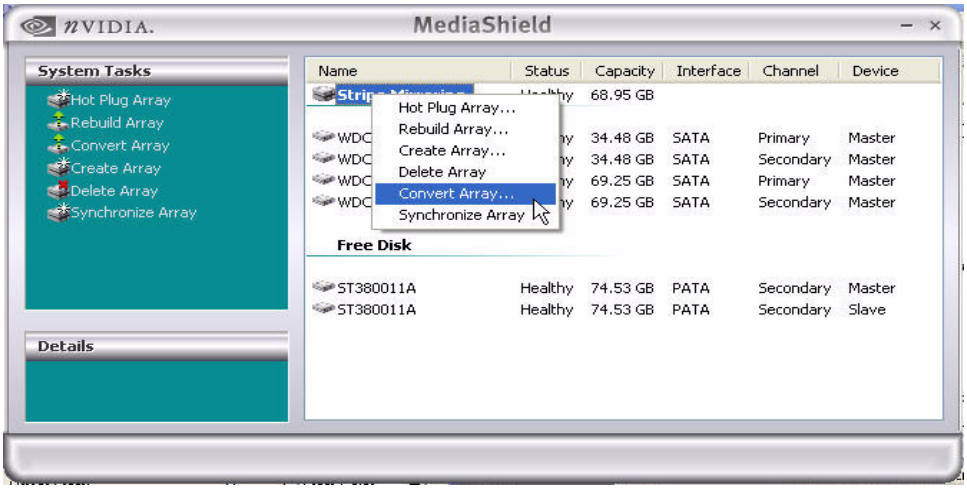


Figure 3.95 Selecting "Convert Array" from the Pop Up Menu

4 After selecting "Convert Array..." the following screen shot will appear:

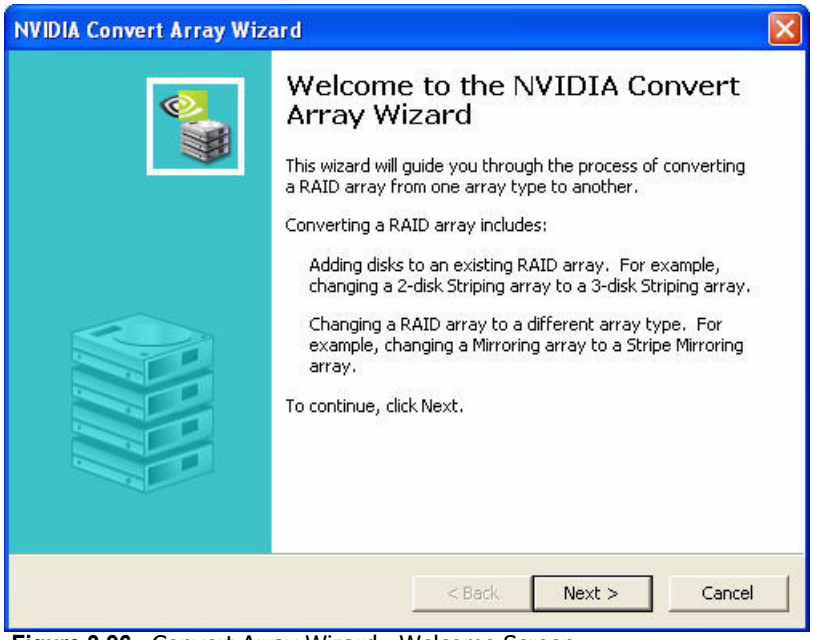


Figure 3.96 Convert Array Wizard—Welcome Screen

5 Click **Next** and the following screen shot will appear:

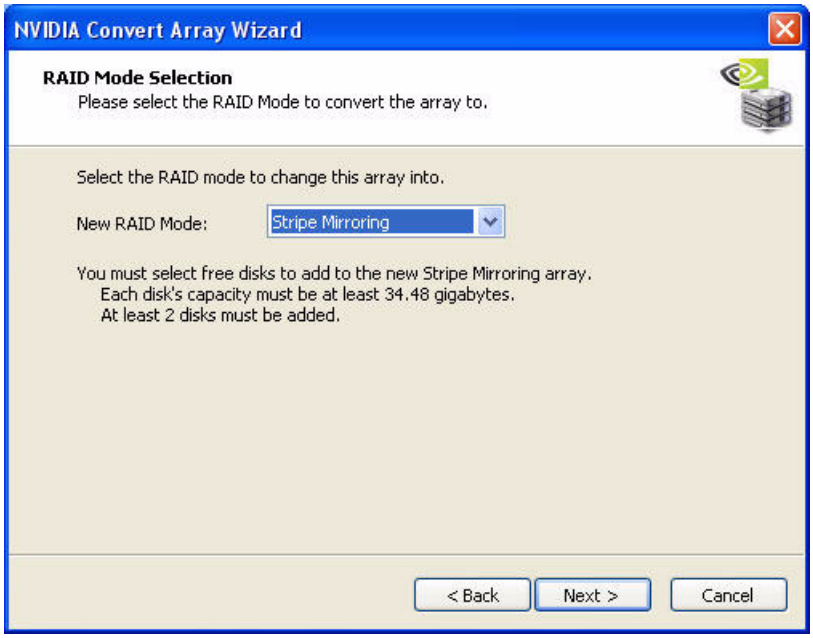


Figure 3.97 RAID Mode Selection Page

6 From the "New RAID Mode:" make sure that "Stripe Mirroring" is selected, then click **Next** and the following screen shot will appear:

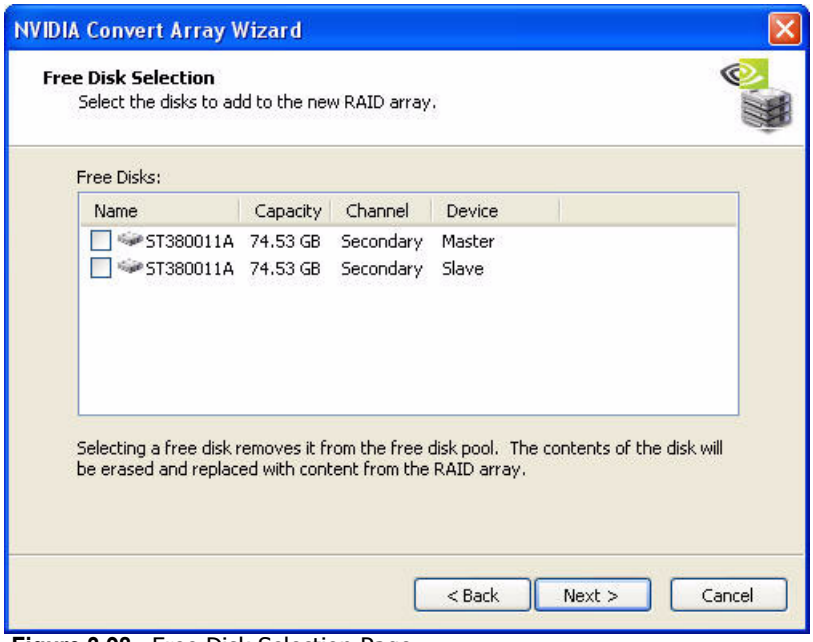


Figure 3.98 Free Disk Selection Page

7 Select the disks that you want to migrate (in increments of two), then click **Next** and **Finish**.

8 Click on Stripe Mirroring and the following screen shot will appear:

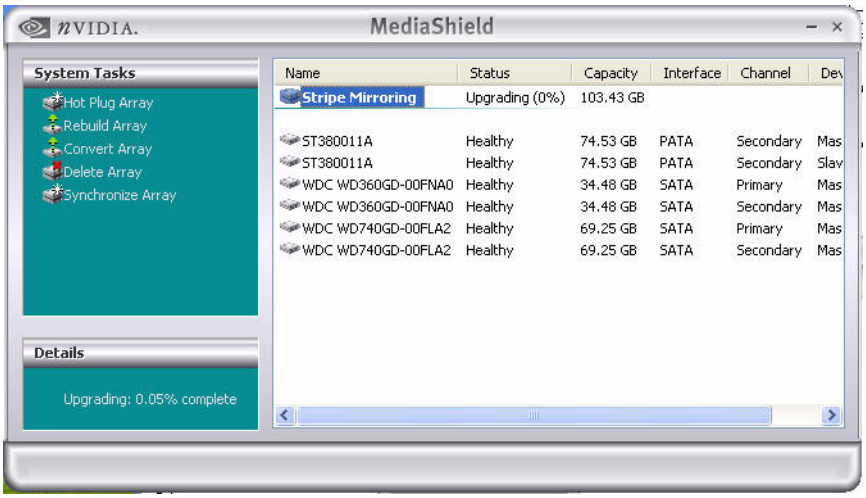
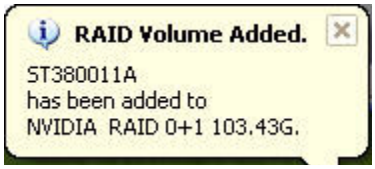


Figure 3.99 Array Migrating Started

When migrating from one RAID 0+1 array to another RAID 0+1 array, be sure to have a total of at least six available disks in the system, otherwise you will not be able to complete the operation.

The Migrating Process

As soon as the new six-disk stripe mirror array has been created, a pop up window similar to the following will appear:



followed by the following pop up window:

It will take some time before the entire process is completed. The time it takes to convert an array is dependent on several factors such as the speed of the CPU, the size and type of hard drive being used, the operating system, etc.

Migrating from RAID 0 to RAID 5

The following example shows you how to migrate from a RAID 0 array with two disks to a RAID 5 array with three disks.

1 Go to the system BIOS and make sure that the drives that you want to use are RAID **enabled.**

2 Boot to Windows, launch the MediaShield application, then follow the steps outlined in "Creating a Striped Array" on page 47 to create a two disk stripe array.

When that is done, you should see a screen shot similar to the following:

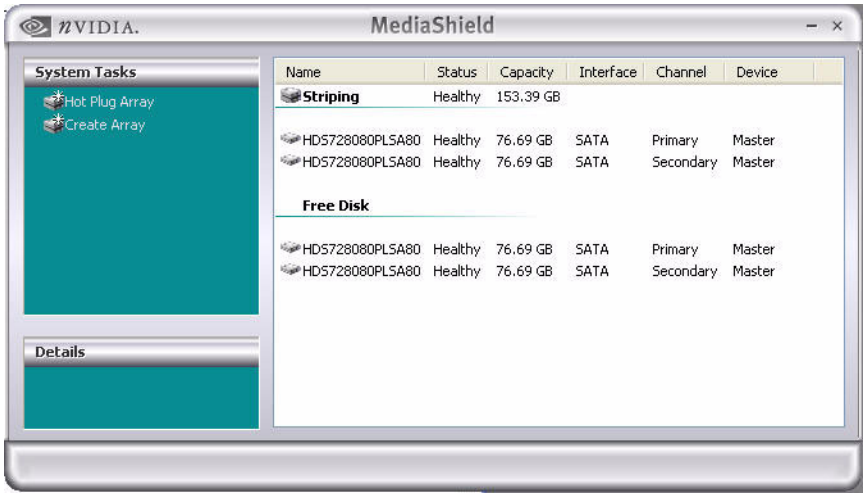


Figure 3.100 RAID Array Created

Now that a two disk stripe array has been created, you can use the MediaShield convert feature to migrate the array from a two-disk RAID 0 into a three-disk RAID 5 array.

3 Right click on the newly created striped array (or existing striped array) and a select "Convert Array..." as shown from the following screen shot:

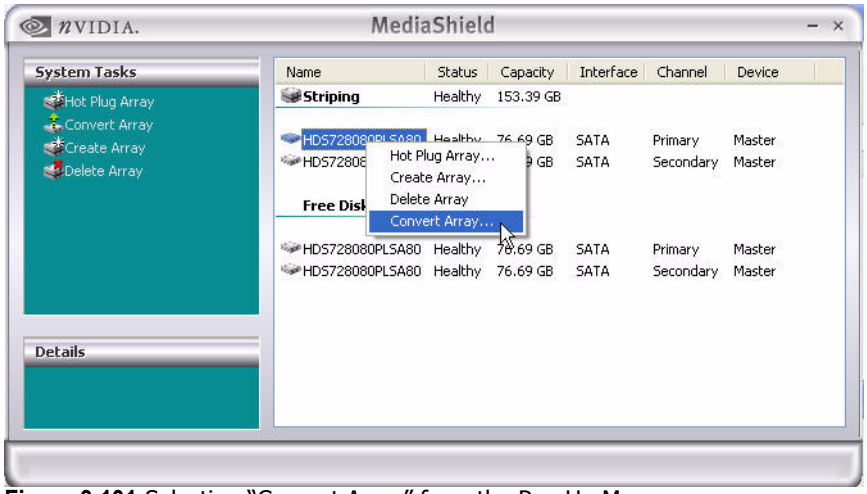


Figure 3.101 Selecting "Convert Array" from the Pop Up Menu

4 After selecting "Convert Array..." the following screen shot will appear:

Figure 3.102 Convert Array Wizard—Welcome Screen

5 Click **Next** and the following screen shot will appear:

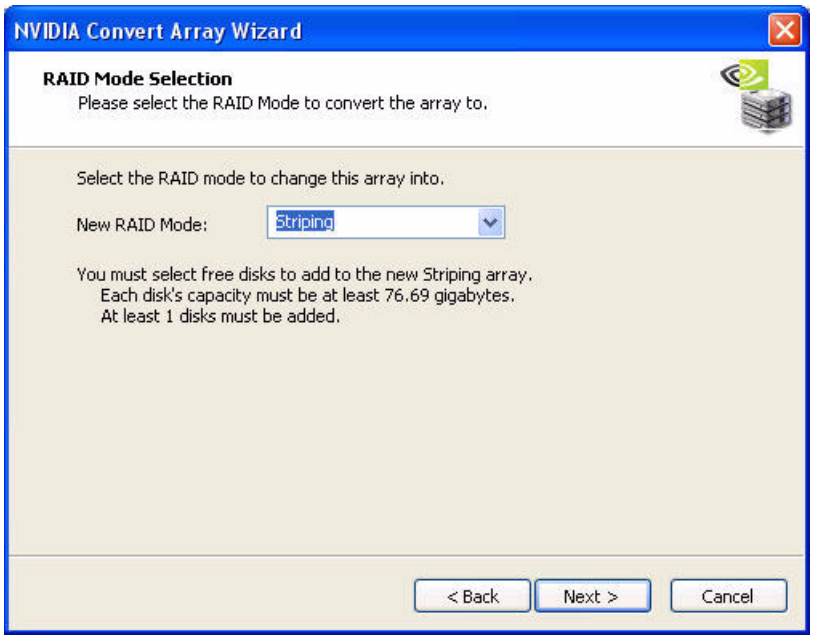


Figure 3.103 RAID Mode Selection Page

6 Click on **Striping** and select RAID 5 then click on **Next** and the following screen shot will appear:

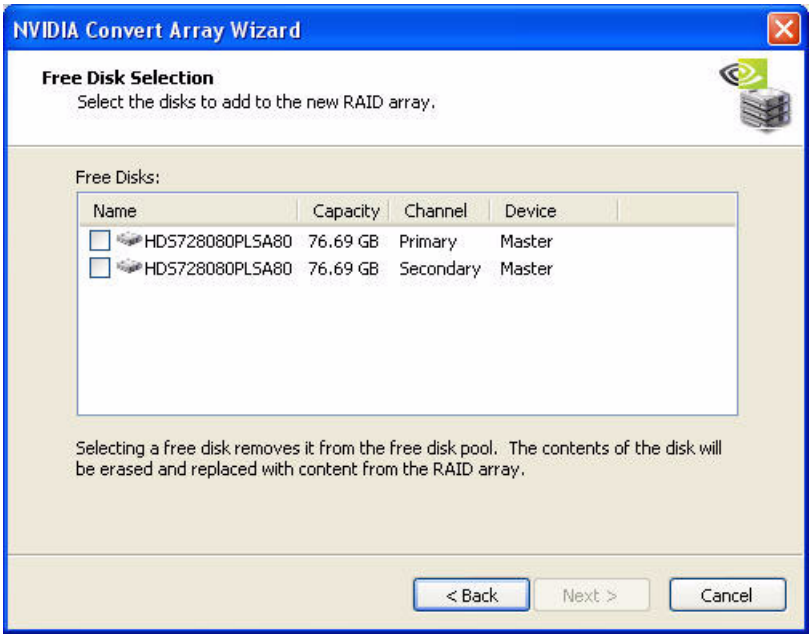


Figure 3.104 Free Disk Selection Page

7 Select the disk (or disks) that you want to add to migrate to the RAID 5 array.

In this example, we are adding one disk (which is the upper disk) to the new three disk RAID 5 array. So, select the first disk and click **Next** and the following screen shot will appear:

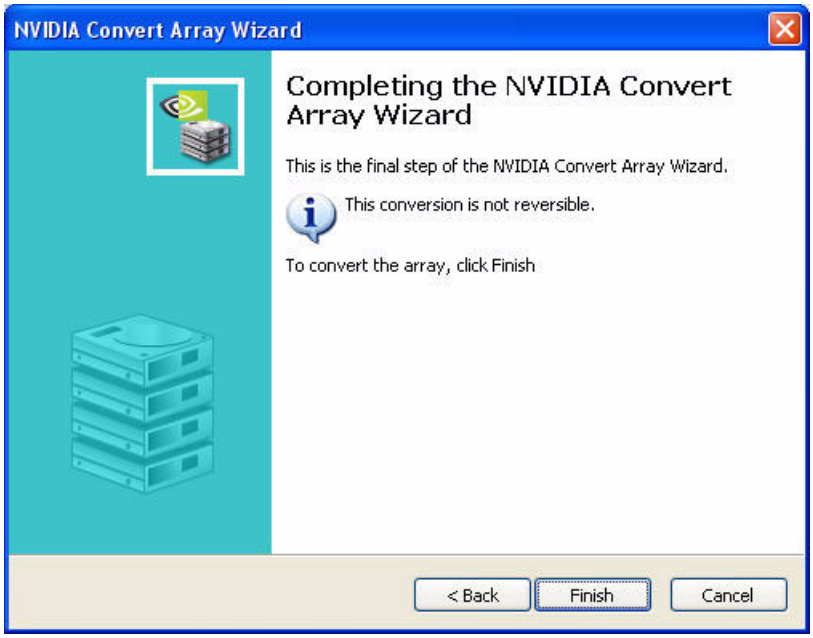


Figure 3.105 Completing the NVIDIA Convert Array Wizard Screen

8 Click **Finish** then click on the newly created three disk striped array and the following screen shot will appear:

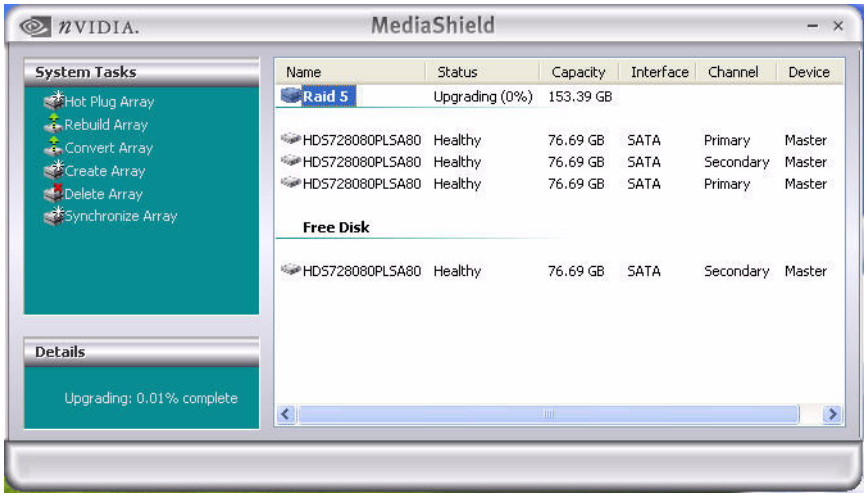


Figure 3.106 New RAID Array

Note: As you can see from the above screen shot, only 2/3 of the disk space is actually used by RAID 5 since 1/3 of the disk space is used for to store parity information.

The Migrating Process

As you can see from the screen shot above, a three disk RAID 5 array has been created and the migrating process has begun. A pop up window similar to the following will appear:

followed by the following pop up window:

It will take some time before the entire process is completed. The time is takes to convert an array is dependent on several factors such as the speed of the CPU, the size and type of hard drive being used, the operating system, etc.

Migrating from RAID 1 to RAID 5

The following example shows you how to convert a RAID 1 array with two disks to a RAID 5 array with three disks.

1 Go to the system BIOS and make sure that the drives that you want to use are RAID **enabled.**

2 Boot to Windows, launch the MediaShield application, then follow the steps outlined in "Creating a Mirrored Array" on page 51.

When that is done, you should see a screen shot similar to the following:

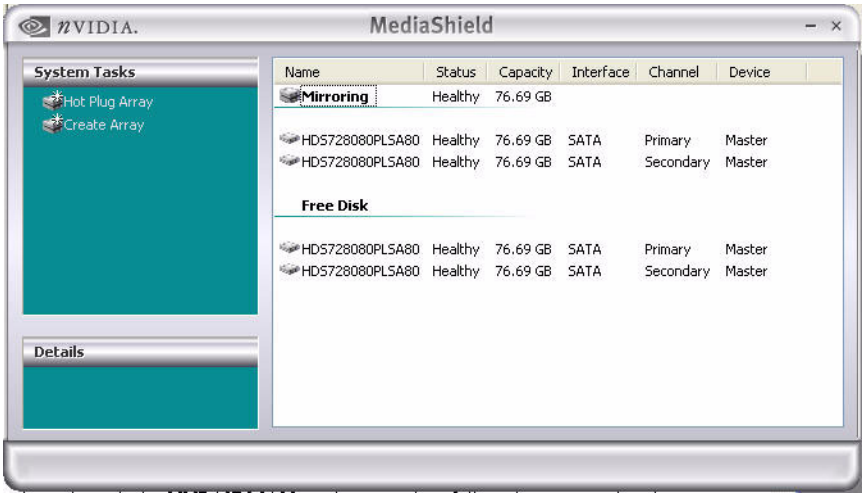


Figure 3.107 RAID Array Created

3 Click click on Mirroring and select "Convert Array..." as shown in the following screen shot:

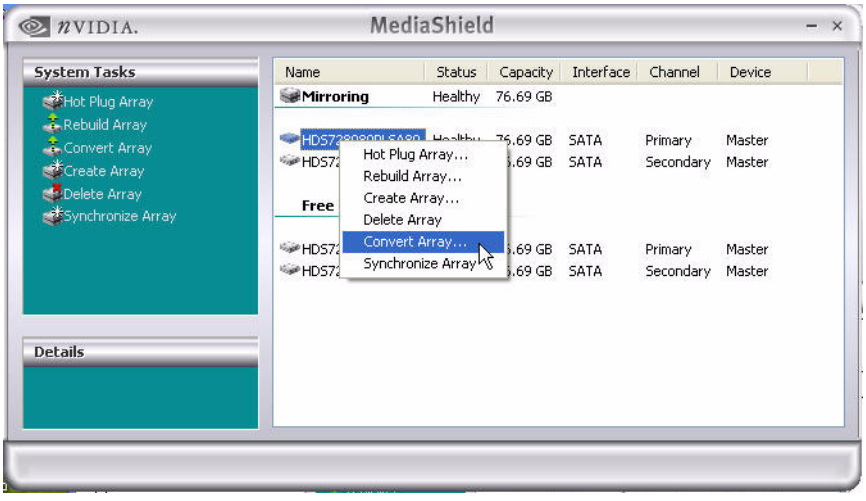


Figure 3.108 Selecting "Convert Array" from the Pop Up Menu

After selecting "Convert Array..." the following screen shot will appear:

Figure 3.109 Convert Array Wizard—Welcome Screen

4 Click **Next** and the following screen shot will appear:

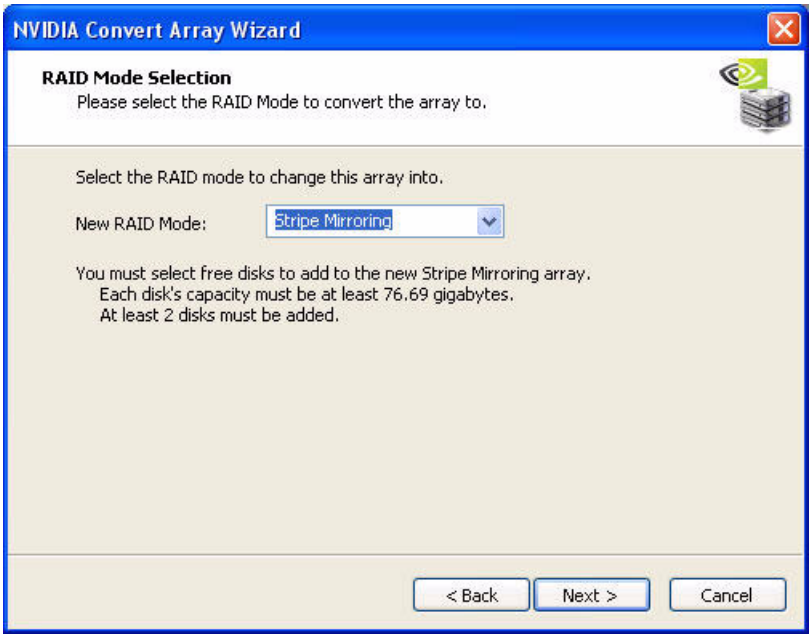


Figure 3.110 RAID Mode Selection Page

5 For the "New RAID Mode:" entry select RAID 5 as shown in the following screen shot:

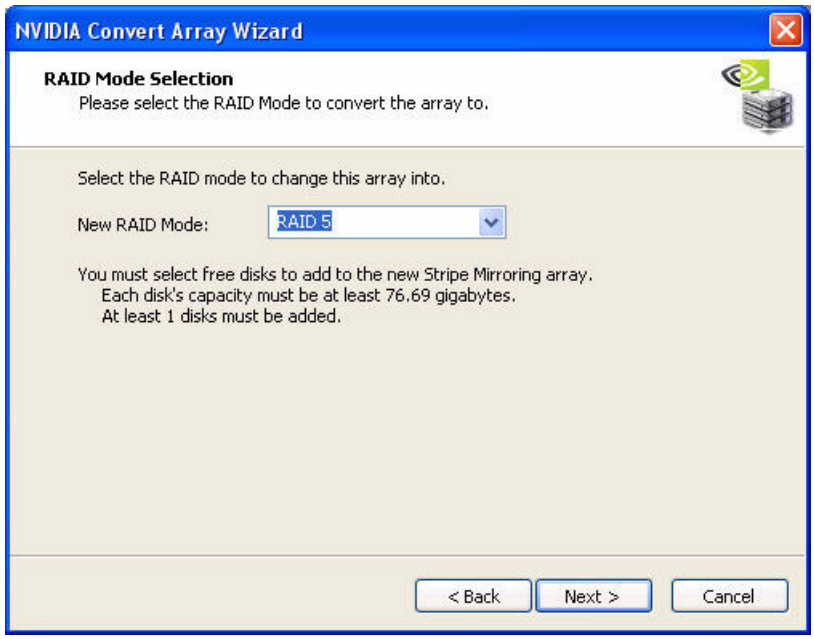


Figure 3.111 RAID Mode Selection Page—Selecting RAID 5

6 Click **Next** and the following screen shot will appear:

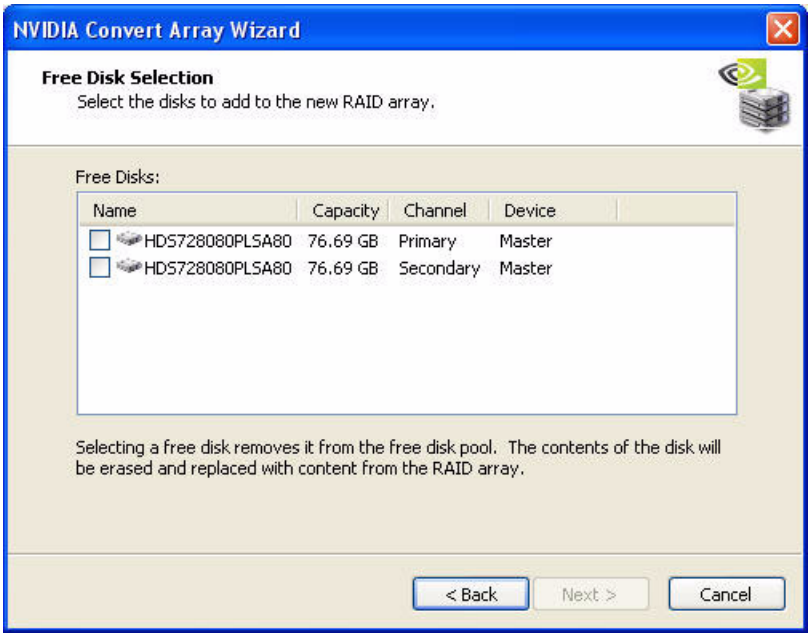


Figure 3.112 Free Disk Selection Page

7 Select one of the disks and click **Next**, then **Finish**..

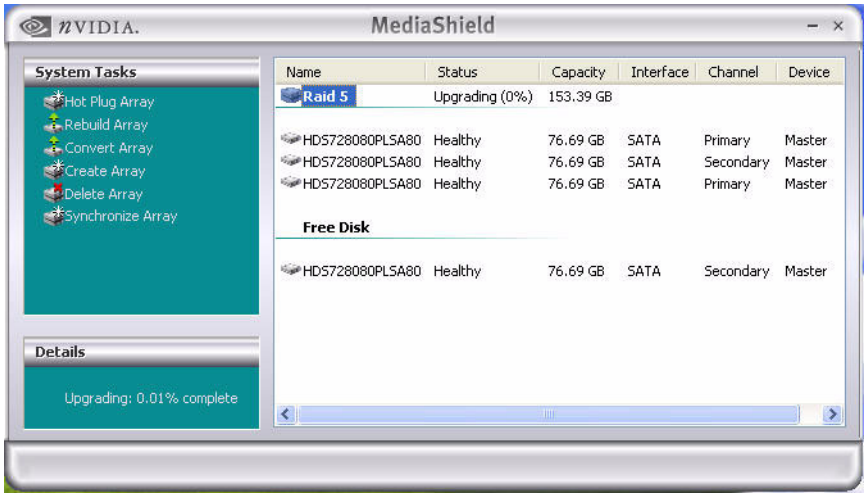


Figure 3.113 New RAID Array

Note: As you can see from the above screen shot, only 2/3 of the disk space is actually used by RAID 5 since 1/3 of the disk space is used for to store parity information.

The Migrating Process

As you can see from the screen shot above, a three disk RAID 5 array has been created and the migrating process has begun. A pop up window similar to the following will appear:

followed by the following pop up window:

It will take some time before the entire process is completed. The time is takes to convert an array is dependent on several factors such as the speed of the CPU, the size and type of hard drive being used, the operating system, etc.

Migrating from RAID 0+1 to RAID 5

The following example shows you how to convert a RAID 0+1 array with four disks to a RAID 5 array with four disks.

1 Go to the system BIOS and make sure that the drives that you want to use are RAID **enabled.**

2 Boot to Windows, launch the MediaShield application, then follow the steps outlined in "Creating a Stripe Mirroring Array" on page 54.

When that is done, you should see a screen shot similar to the following:

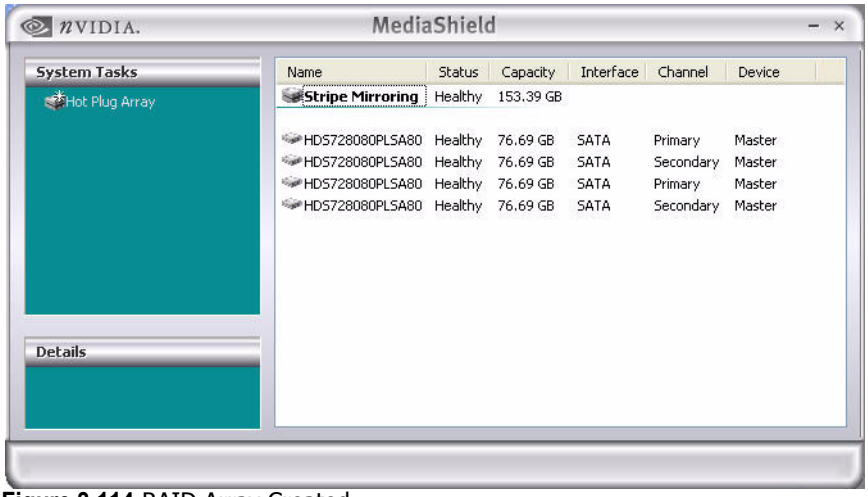


Figure 3.114 RAID Array Created

3 Click click on "Stripe Mirroring" and select "Convert Array..." as shown in the following screen shot:

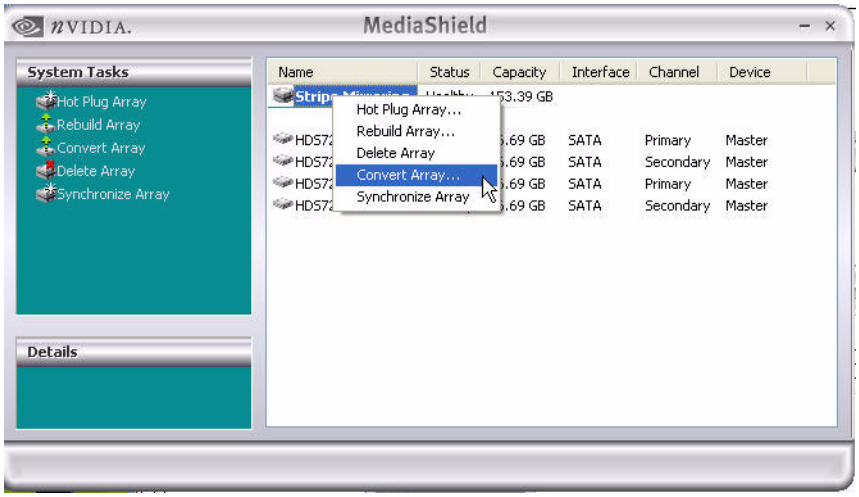


Figure 3.115 Selecting "Convert Array" from the Pop Up Menu

After selecting "Convert Array..." the following screen shot will appear:

Figure 3.116 Convert Array Wizard—Welcome Screen

4 Click **Next** and the following screen shot will appear:

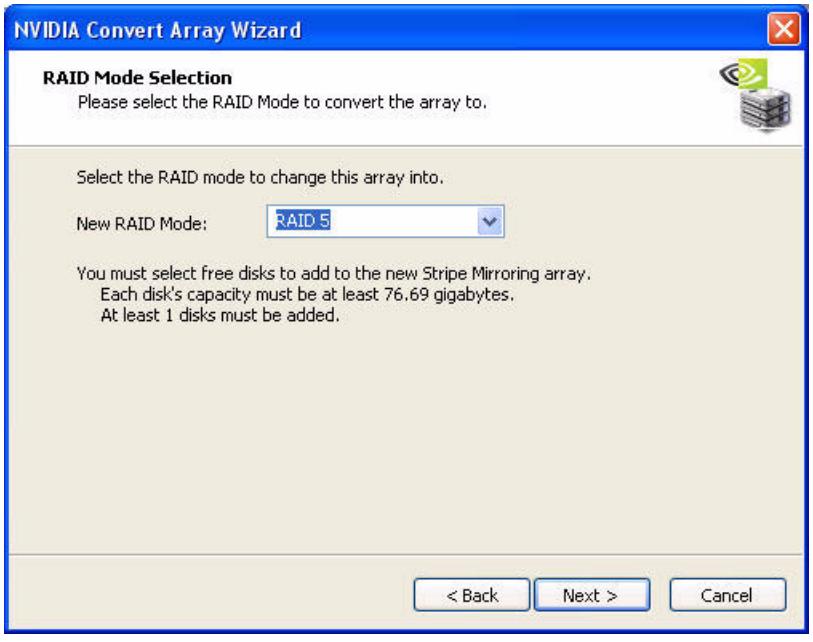


Figure 3.117 RAID Mode Selection Page

5 Make sure RAID 5 is selected.

6 Click **Next**, then **Finish** and the following screen shot will appear showing the four disk RAID 5 array.

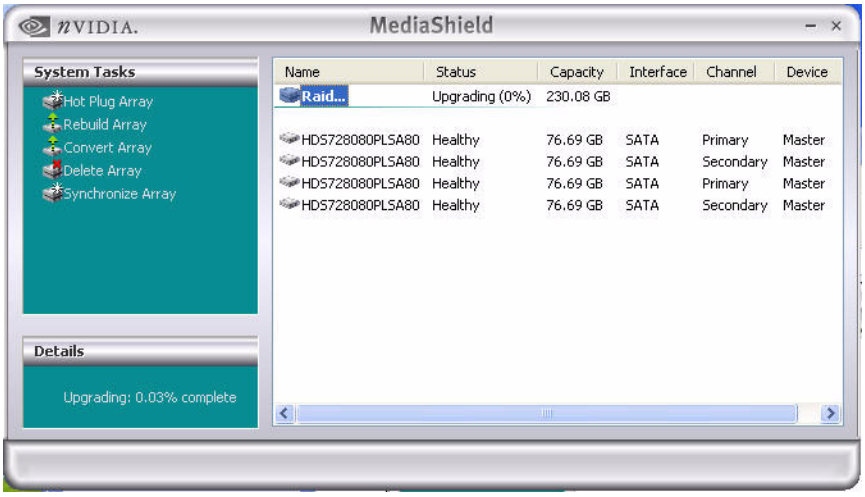


Figure 3.118 New RAID Array

Note: As you can see from the above screen shot, only 3/4 of the disk space is actually used by RAID 5 since 1/4 of the disk space is used for to store parity information.

The Migrating Process

As you can see from the screen shot above, a four disk RAID 5 array has been created and the migrating process has begun. A pop up window similar to the following will appear:

followed by the following pop up window:

It will take some time before the entire process is completed. The time is takes to convert an array is dependent on several factors such as the speed of the CPU, the size and type of hard drive being used, the operating system, etc.

Migrating from RAID 5 to RAID 0

The following example shows you how to convert a RAID 5 array with three disks to a RAID 0 array with three disks.

1 Go to the system BIOS and make sure that the drives that you want to use are RAID **enabled.**

2 Boot to Windows, launch the MediaShield application, then follow the steps outlined in "Creating a RAID 5 Array" on page 62.

When that is done, you should see a screen shot similar to the following:

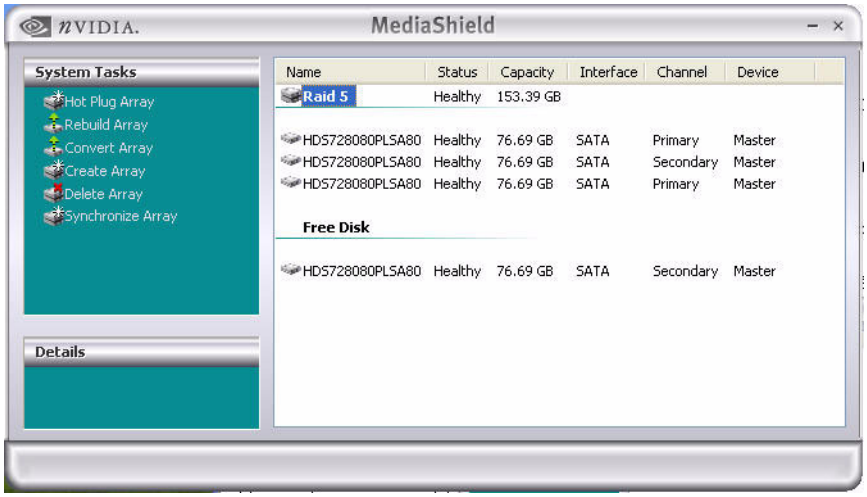


Figure 3.119 RAID Array Created

3 Click on RAID 5 and select "Convert Array..." as shown in the following screen shot:

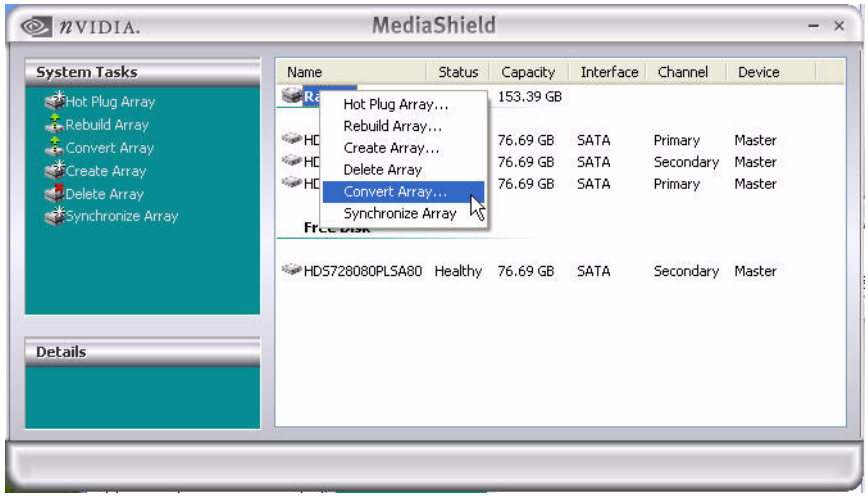


Figure 3.120 Selecting "Convert Array" from the Pop Up Menu

After selecting "Convert Array..." the following screen shot will appear:

Figure 3.121 Convert Array Wizard—Welcome Screen

4 Click **Next**, then select **Striping** and click on **Next**, then the following screen shot will appear:

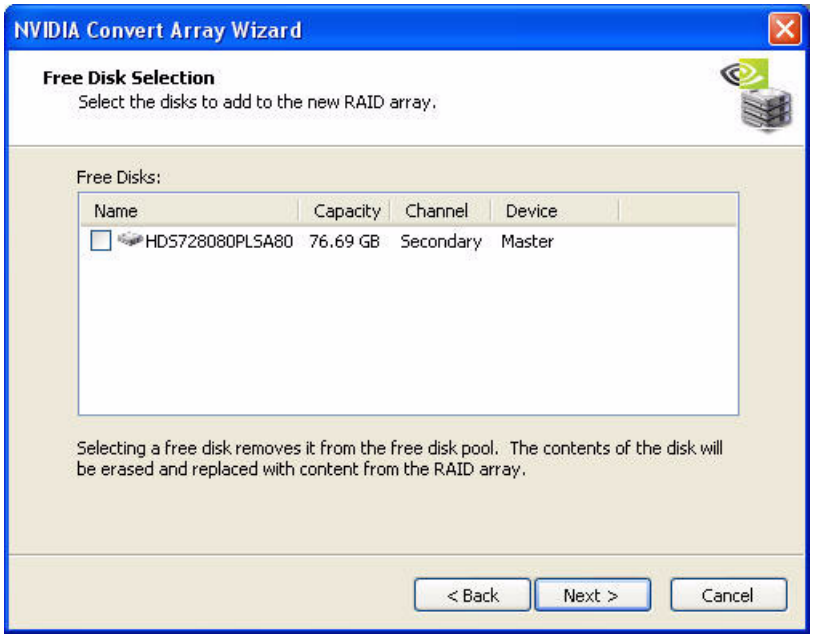


Figure 3.122 Free Disk Selection Page

5 Click **Next**, then **Finish**.

In this example, the WD360GD was chosen as shown in Figure 3.66.

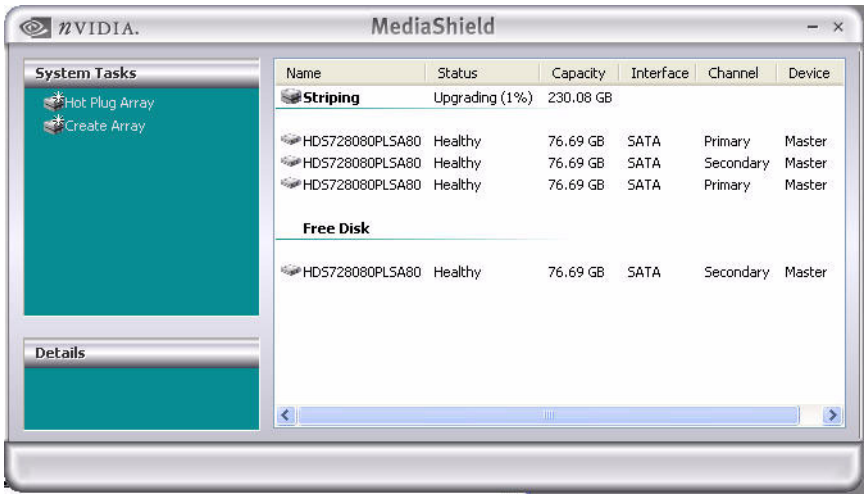
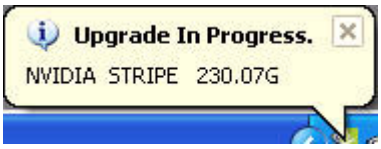


Figure 3.123 New RAID Array

The Migrating Process

As you can see from the screen shot above, a three disk RAID 0 array has been created and the migrating process has begun. A pop up window similar to the following will appear:

followed by the following pop up window:



It will take some time before the entire process is completed. The time is takes to convert an array is dependent on several factors such as the speed of the CPU, the size and type of hard drive being used, the operating system, etc.

Migrating from RAID 5 to RAID 0+1

The following example shows you how to convert a RAID 5 array with three disks to a 0+1 array with four disks.

1 Go to the system BIOS and make sure that the drives that you want to use are RAID **enabled.**

2 Boot to Windows, launch the MediaShield application, then follow the steps outlined in "Creating a RAID 5 Array" on page 62.

When that is done, you should see a screen shot similar to the following:

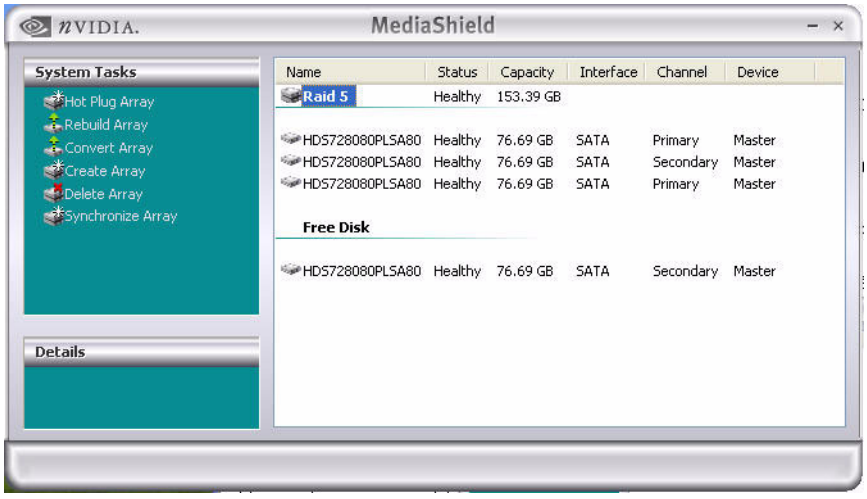


Figure 3.124 RAID Array Created

3 Click on RAID 5 and select "Convert Array..." as shown in the following screen shot:

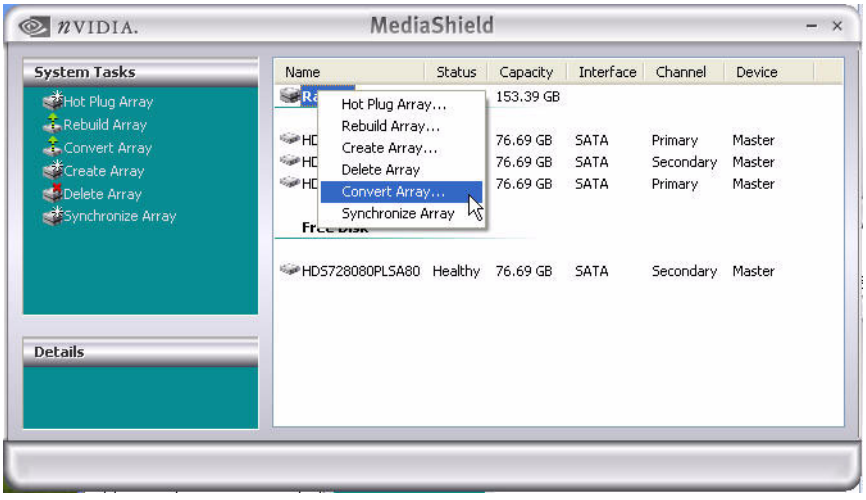


Figure 3.125 Selecting "Convert Array" from the Pop Up Menu

After selecting "Convert Array..." the following screen shot will appear:

Figure 3.126 Convert Array Wizard—Welcome Screen

4 Click **Next**, then select **Stripe Mirroring** and click on **Next**, then the following screen shot will appear:

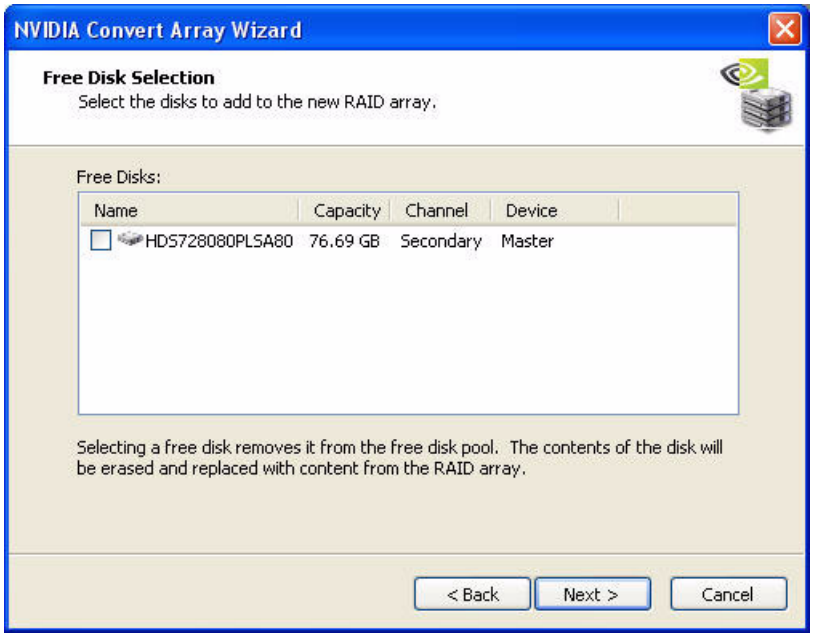


Figure 3.127 Free Disk Selection Page

5 Select a Free Disk, then Click **Next**, then **Finish**.

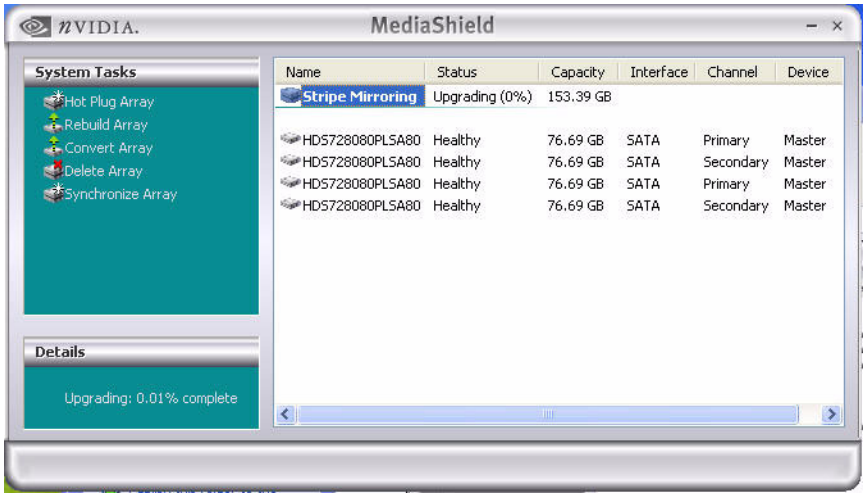
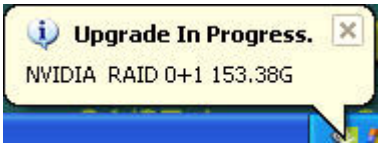


Figure 3.128 New RAID Array

The Migrating Process

As you can see from the screen shot above, a four disk RAID 0+1 array has been created and the migrating process has begun. A pop up window similar to the following will appear:

followed by the following pop up window:



It will take some time before the entire process is completed. The time is takes to convert an array is dependent on several factors such as the speed of the CPU, the size and type of hard drive being used, the operating system, etc.

Migrating from RAID 5 to RAID 5

The following example shows you how to convert a RAID 5 array with three disks to a RAID 5 array with four disks.

1 Go to the system BIOS and make sure that the drives that you want to use are RAID **enabled.**

2 Boot to Windows, launch the MediaShield application, then follow the steps outlined in "Creating a RAID 5 Array" on page 62.

When that is done, you should see a screen shot similar to the following:

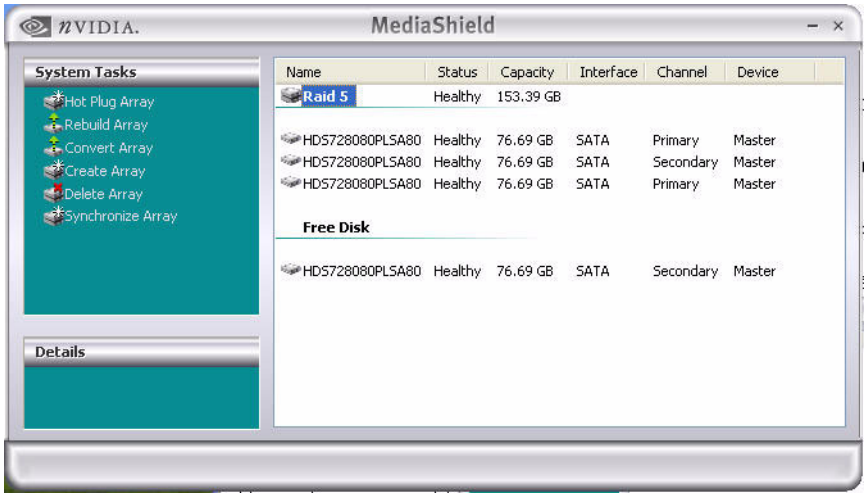


Figure 3.129 RAID Array Created

3 Click on RAID 5 and select "Convert Array..." as shown in the following screen shot:

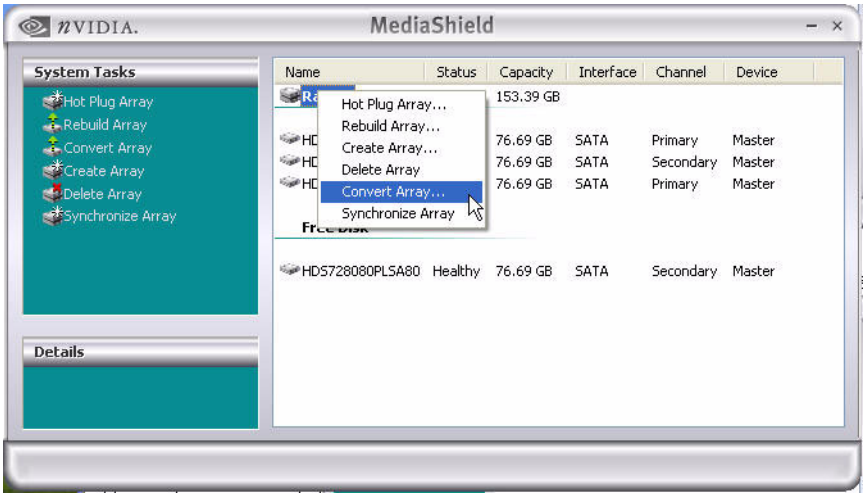


Figure 3.130 Selecting "Convert Array" from the Pop Up Menu

After selecting "Convert Array..." the following screen shot will appear:

Figure 3.131 Convert Array Wizard—Welcome Screen

4 Click **Next**, then select **RAID 5** and click on **Next**, then the following screen shot will appear:

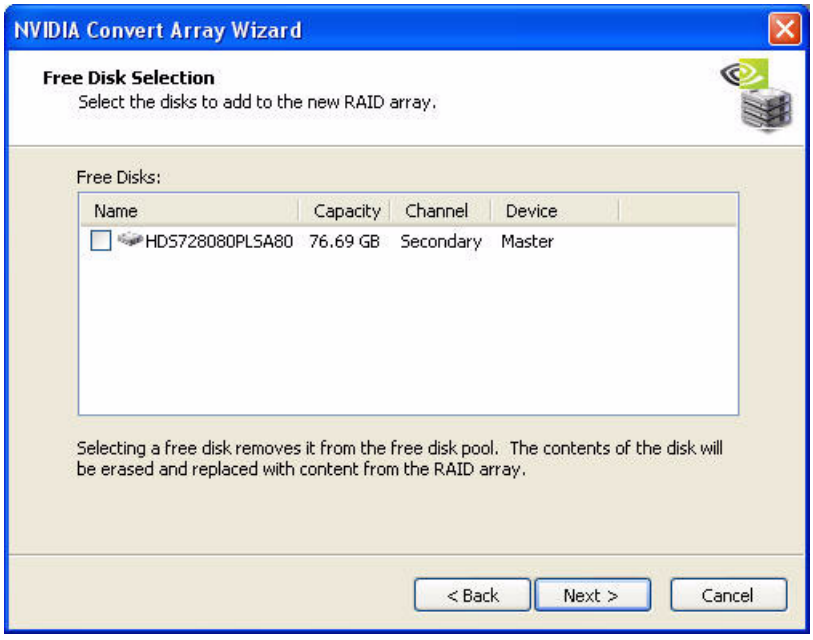


Figure 3.132 Free Disk Selection Page

5 Select a Free Disk, then Click **Next**, then **Finish**.

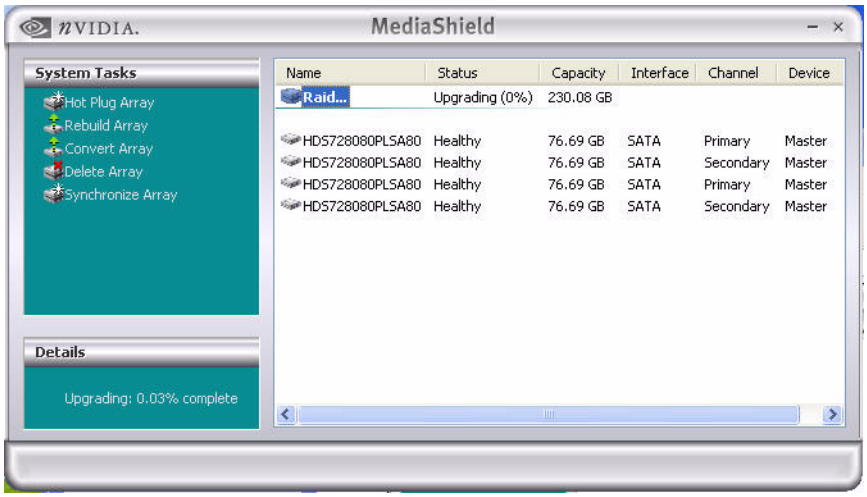


Figure 3.133 New RAID Array

The Migrating Process

As you can see from the screen shot above, a four disk RAID 5 array has been created and the migrating process has begun. A pop up window similar to the following will appear:

followed by the following pop up window:

It will take some time before the entire process is completed. The time is takes to convert an array is dependent on several factors such as the speed of the CPU, the size and type of hard drive being used, the operating system, etc.

Hot Plug Array

NVIDIA MediaShield arrays can be moved from one NVIDIA-based system to another. There are two scenarios for doing this.

- System has been properly shut down

  See Hot Plug Array with System Shutdown.

- System is running

  See Hot Plug Array with System Running.

Hot Plug Array with System Shutdown

When the system is properly shutdown, the Hot Plug Array Wizard is not required. You can simply add or remove the array, modify the BIOS RAID settings accordingly, and then power the system back up.

Hot Plug Array with System Running

If required, you can also add or remove a MediaShield array while the system is still running by using the nForce SATA hot plug capability. However, in order to do this without the state of the array changing to Degraded or an Error state, you need to alert MediaShield that the array is about to be removed/added. This is done using the Hot Plug Array wizard. When the wizard prompts that it is safe to add disks, disks for the array can be added/removed at that time.

See the following instructions and screen shots for the Hot Plug Array wizard:

1 Launch MediaShield and click on "Hot Plug Array" and the following screen shot will appear:

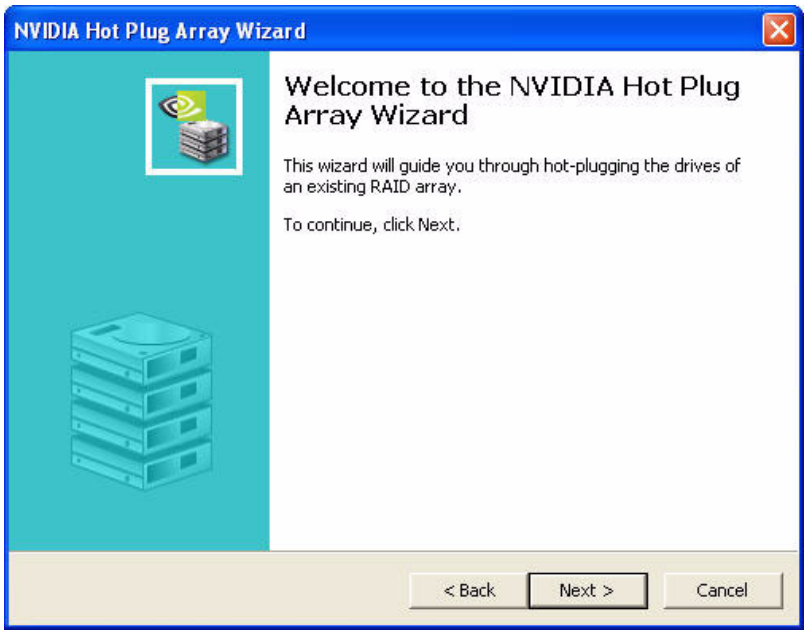


Figure 3.134 NVIDIA Hot Plug Array Wizard—Welcome Screen

2 Click **Next** and the following screen shot will appear:

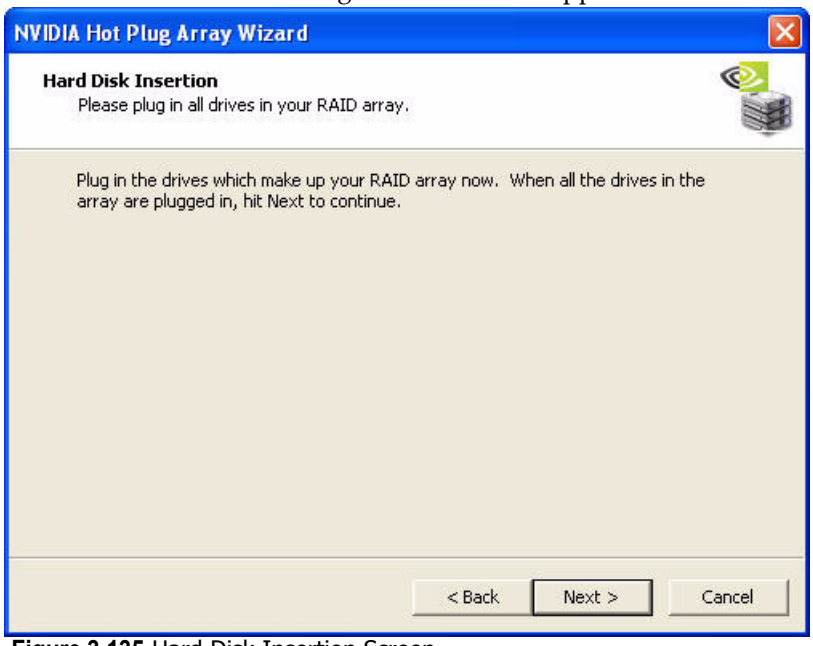


Figure 3.135 Hard Disk Insertion Screen

3 Connect the RAID disk that you want to use with any given RAID array.

4 Click **Next** and the following screen shot will appear:

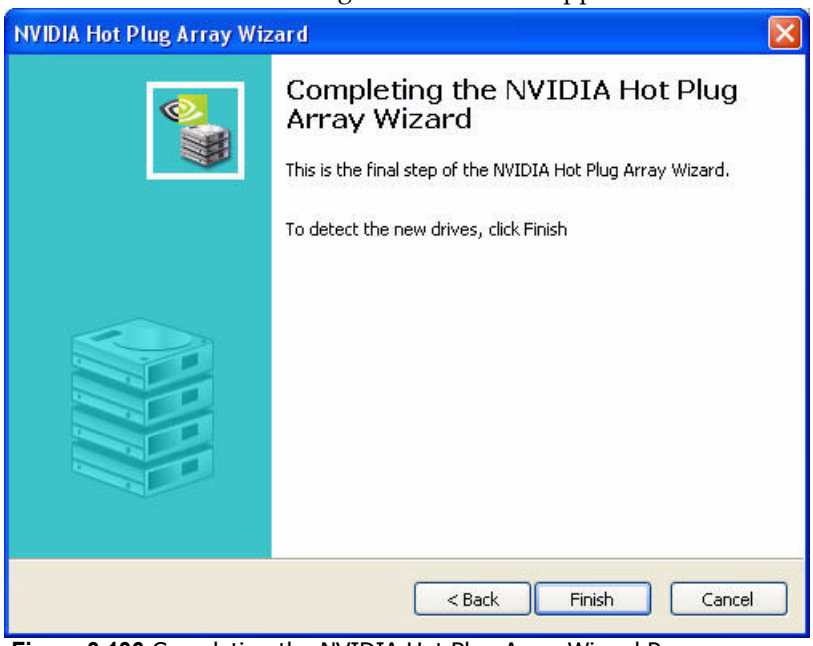


Figure 3.136 Completing the NVIDIA Hot Plug Array Wizard Page

5 Click **Finish**.

CHAPTER

4

INITIALIZING, REBUILDING, AND SYNCHRONIZING RAID ARRAYS

This chapter describes the following MediaShield tasks:

- Initializing a RAID Array
  - Erase the data on the array by writing all zeros to the sectors of each hard disk.
- Rebuilding a RAID Array
  - Rebuild a broken mirrored array
  - Watch the progress of rebuilding of an array
  - Only applies to RAID 1, RAID 0+1, and RAID 5 arrays
- Synchronizing a RAID Array
  - Rebuild the redundancy in RAID 1 or RAID 0+1 arrays (copy the data to the redundant disk—the same operation as rebuilding)
  - Rebuild the parity in RAID 5 arrays

Initializing a RAID Array

Initializing a RAID array erases all the data that is stored on that array, and writes all zeros to the disks. Initialization of newly configured RAID arrays is recommended to ensure consistency and reliable performance on any supported fault tolerant array such as RAID 5, RAID 0, and RAID 0+1.

Use this feature only if you are absolutely sure that you want to wipe out all the data on that array.

Initialization of a fault tolerant array can only be done when the array is being created. To initialize an array, perform the following steps:

Note: In this example, a mirror array is initialized.

1 From the MediaShield window, right click on any available free disk and select **Create Array** as show in Figure 4.1.

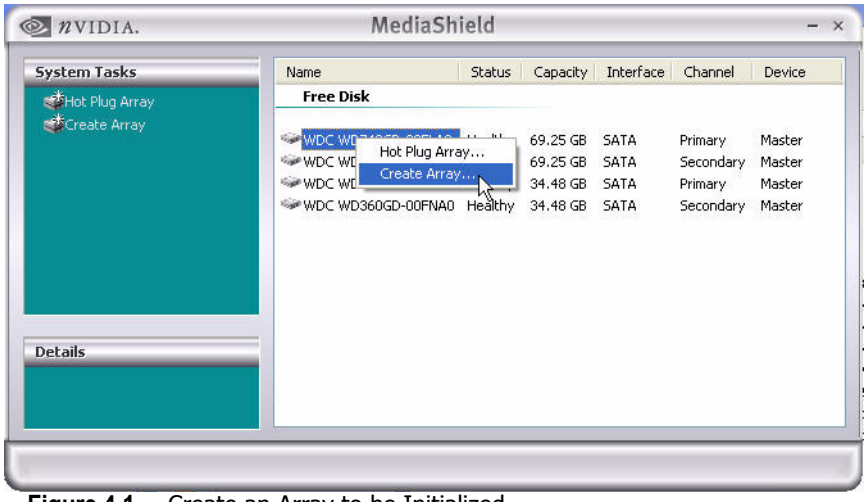


Figure 4.1 Create an Array to be Initialized

The Create Array Wizard opens.

2 Follow the Wizard to create a Mirror array.

See "Creating a Mirrored Array" on page 51.

3 At the Create Array Wizard Welcome screen, click **Next**.

4 At the RAID Array Selection page, make sure that RAID Mode is set to "**Mirroring**" and Stripe Size is set to its default value of 64K, then click **Next**.

5 At the Free Disk Selection page, select the two drives that you want to Mirror and click **Next**.

6 Click **Next** again and the following screen shot will appear:

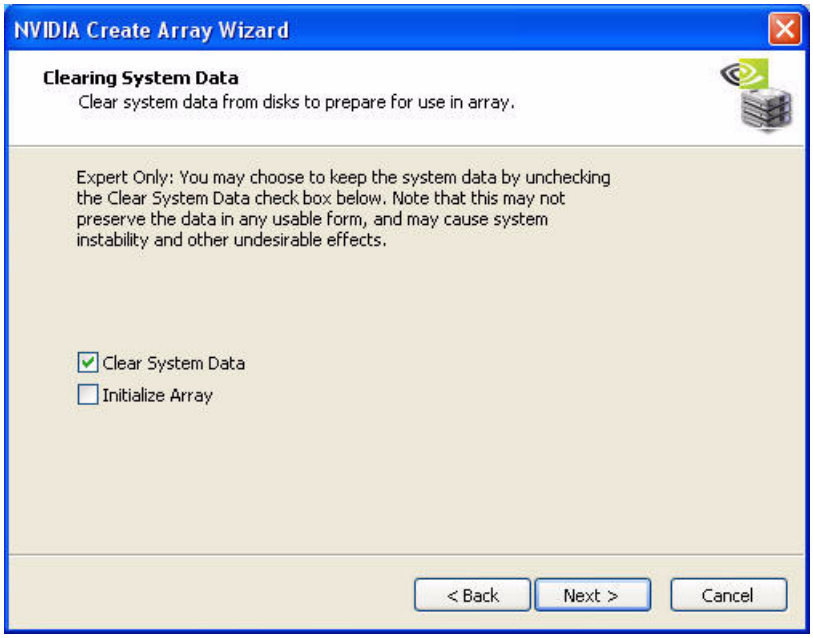


Figure 4.2 Clearing System Data Screen

7 Check "Intialize Array" and then click **Next**.

The Initialization Warning dialog appears.

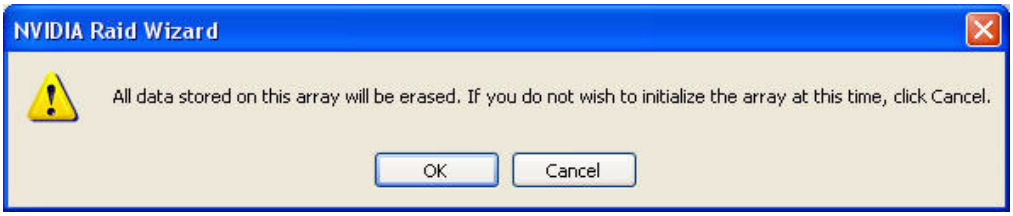


Figure 4.3 Initialization Warning

8 Click **OK**.

The Clearing System Data screen appears again with the Initialize Array check box checked as shown in Figure 4.4.

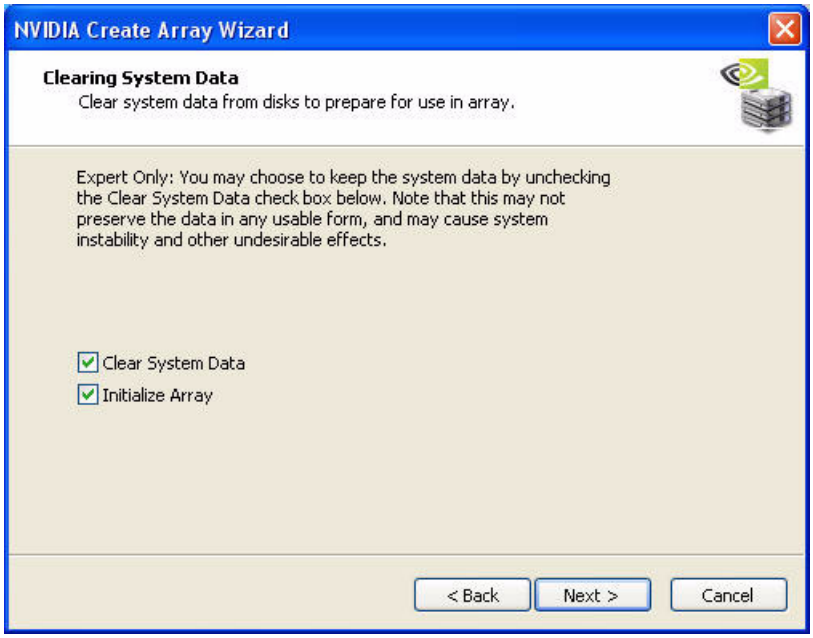


Figure 4.4 Clearing System Data and Initialize Array

9 Click **Next**, then click **Finish** at the Completing the NVIDIA Create Array Wizard screen.

The MediaShield window shows the created RAID array as shown in Figure 4.5.

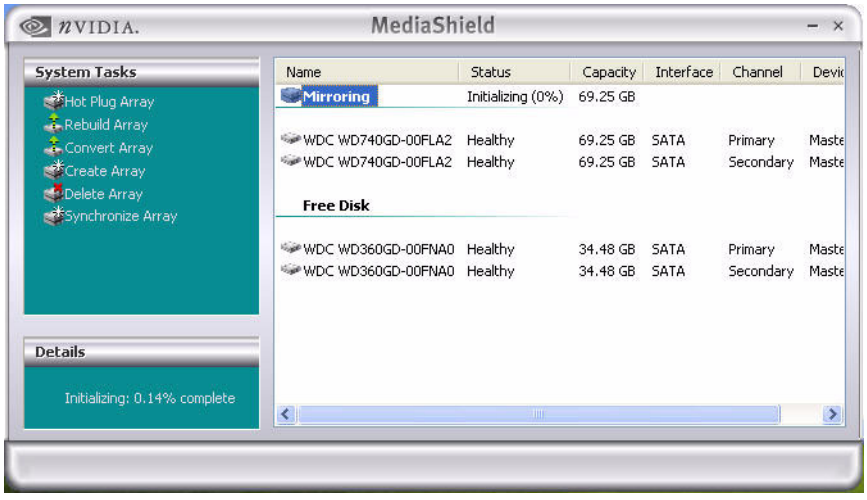
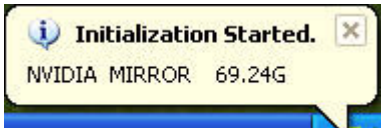


Figure 4.5 Mirrored RAID Array Initializing

The Initialization Process

As you can see from the screen shot above, the initialization process has started and it will be completed in a short period of time. As soon as the Initialization process starts, a pop-up window similar to the following will appear:



followed by the following pop-up window:

Rebuilding a RAID Array

Rebuilding is the process of restoring data to a hard drive from other drives in the array. This applies only to fault tolerant arrays such as RAID 1, RAID 0+1, as well as a RAID 5.

For example, assuming you have a three disk RAID 5 array, and one of the drives fail, then you need to replace the failed drive with a new one, and rebuild the array to re-generate the lost data on the newly added drive.

Rebuilding Instructions

After creating a mirrored array, you can rebuild the array using the following steps:

1 Go to Windows and run the NVIDIA MediaShield RAID Management utility.

Figure 4.6 shows an example of a system with one mirrored array and two free disks.

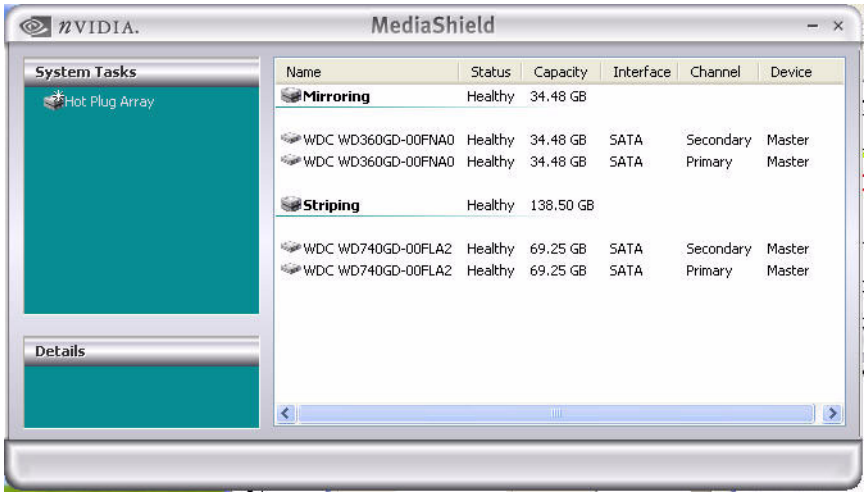


Figure 4.6 Mirrored Array

2 Right-click on Mirroring.

The popup menu appears.

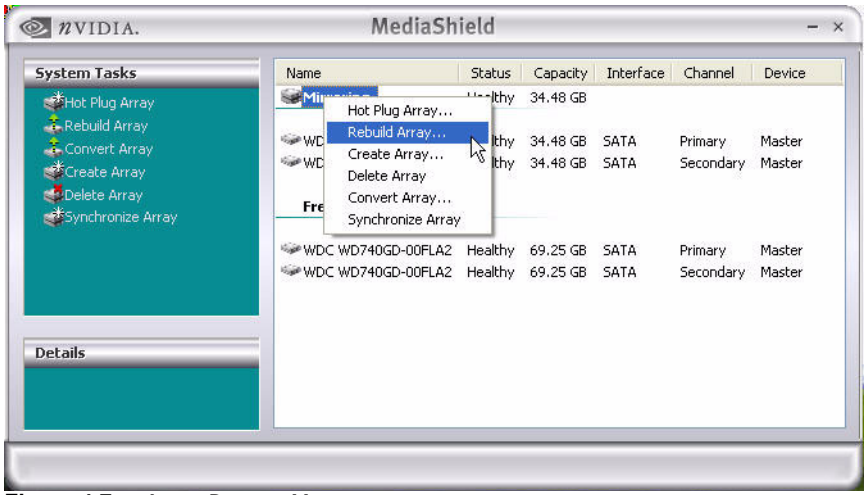


Figure 4.7 Array Pop-up Menu

3 From the popup menu, click **Rebuild Array**.

The NVIDIA Rebuild Array Wizard appears.

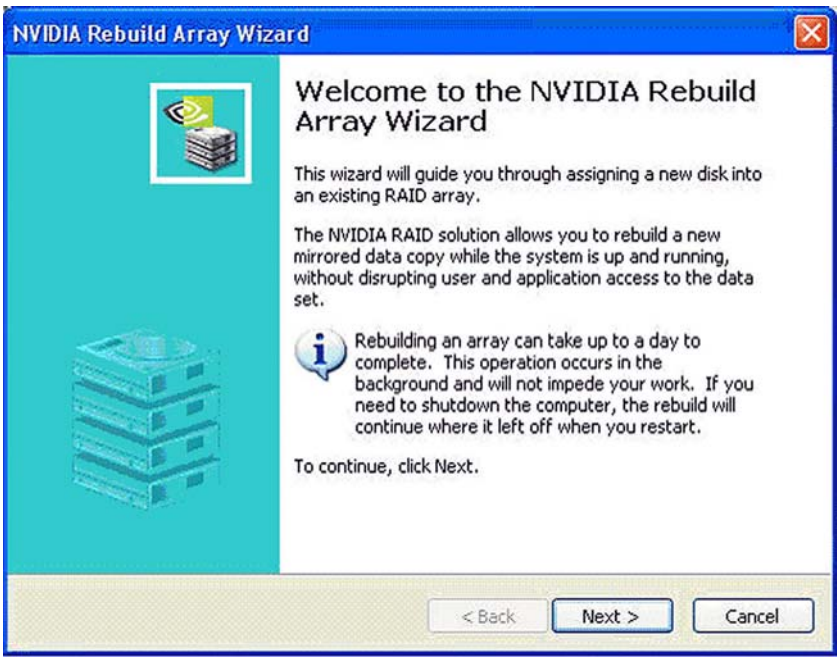


Figure 4.8 NVIDIA Rebuild Array Wizard

4 Click **Next.**

The Disk Selection page appears.

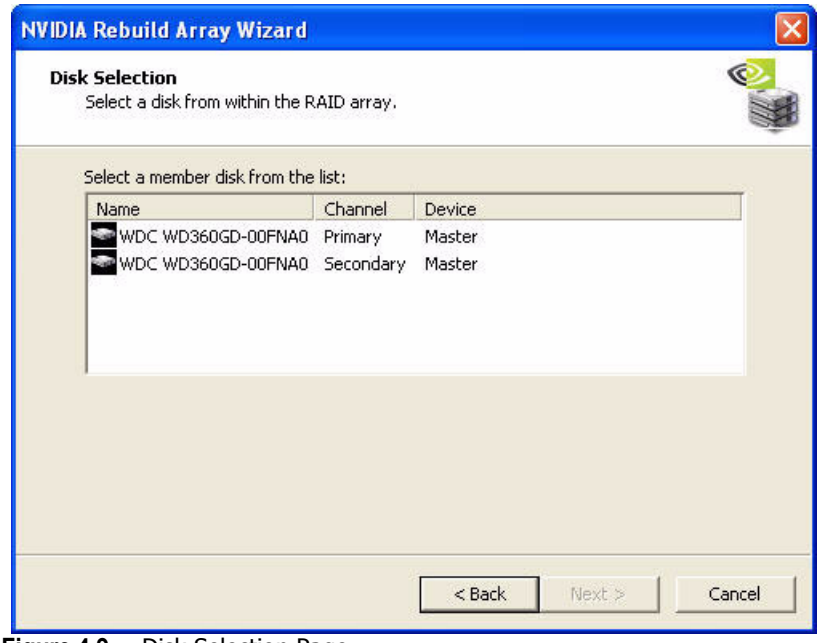


Figure 4.9 Disk Selection Page

5 Select the drive that you want to rebuild by clicking it from the list, then click **Next**.

The Completing the NVIDIA Rebuild Array page appears.

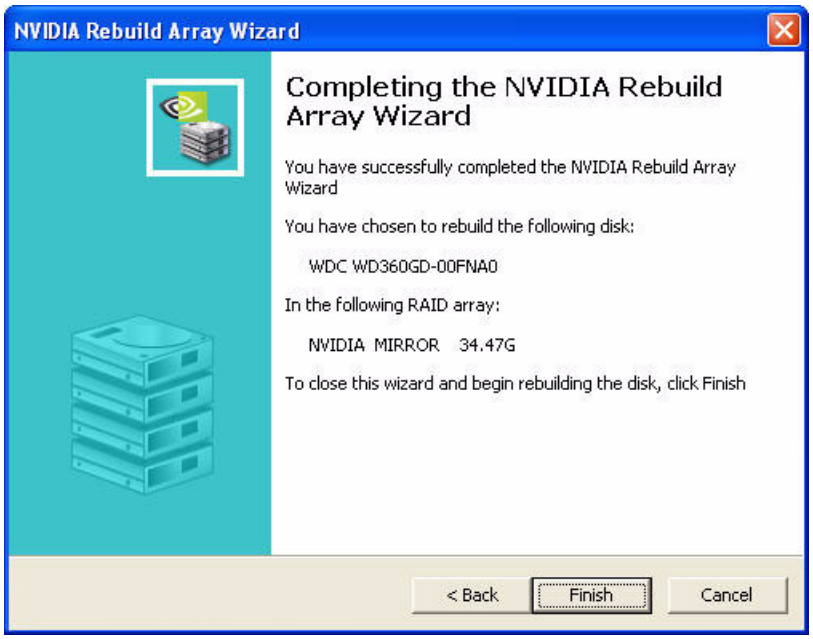


Figure 4.10 Completing the NVIDIA Rebuild Array Wizard Page

6 Click **Finish**.

The array rebuilding starts after a few seconds, and a small pop-up message appears towards the bottom right corner of the screen as shown in Figure 4.11.

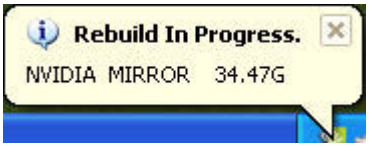


Figure 4.11 Rebuild Bubble Message

When the rebuilding process is finished you will see the pop up box shown inFigure 4.12.

Figure 4.12 Rebuild Finished Bubble Message

During the rebuilding process, the NVIDIA MediaShield RAID Management utility screen shows the status under the System Tasks and Details sections.

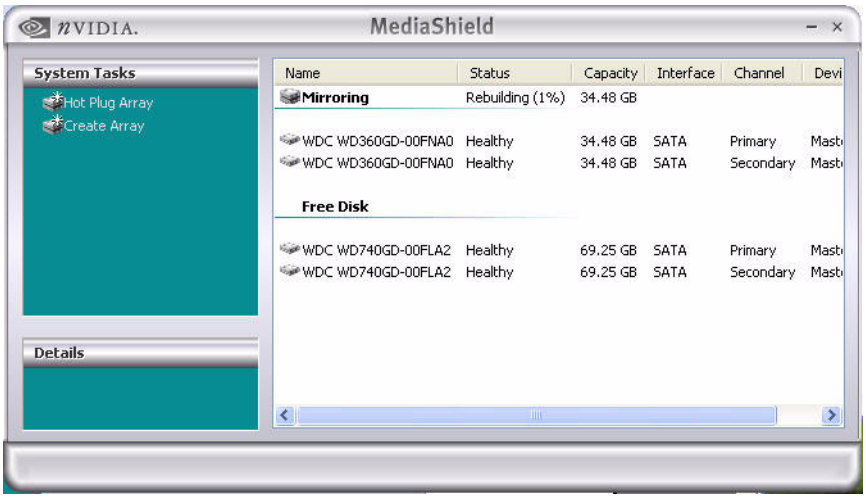


Figure 4.13 Array Rebuilding Status Detail

More About Rebuilding Arrays

- **Rebuilding Occurs in the Background**

  The rebuilding process takes some time to complete, and occurs in the background so as not to affect the performance of the system.

- **Rebuilding Applies Only to RAID 1, RAID 0+1, or RAID 5 Arrays**

  Rebuilding an array works only when using RAID 1 , RAID 0+1, or RAID 5. Rebuilding does not apply to RAID 0 and JBOD arrays.

- **Rebuilding applies to a degraded fault tolerant array**

  You can rebuild a degraded mirrored array using any available Free Disk or Dedicated Disk.

  For example, Figure 4.14 shows a mirrored array using two 34.48 GB drives while having two Free Disks each 55.90 GB large.

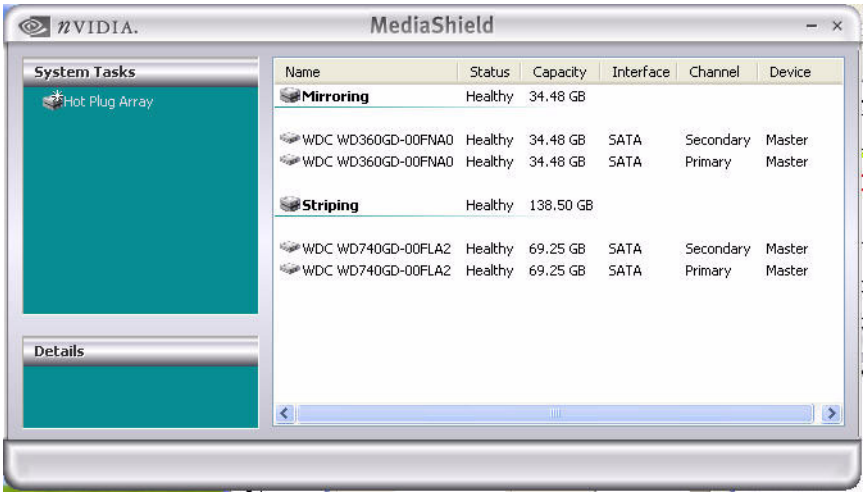


Figure 4.14 Free Disks Available for Rebuilding

To use one of these available free disks to rebuild your array, follow the same steps as explained in "Rebuilding a RAID Array" on page 132, except when prompted to select a disk, choose one of the two available free disks.

Synchronizing a RAID Array

Synchronizing an array will force a rebuild of redundancy or parity. The operation is applicable to any fault tolerant array such as RAID 1, 0+1 and RAID 5.

- For RAID1 and RAID 0+1, “sync” results in copying the data to the redundancy disk,
- For RAID 5, “sync” results in rebuilding the parity

To sync an array, do the following (This example assumes you have already created a fault tolerant array such as RAID 1):

1 Right click on “Mirroring” and select **Synchronize Array** as shown in Figure 4.15.

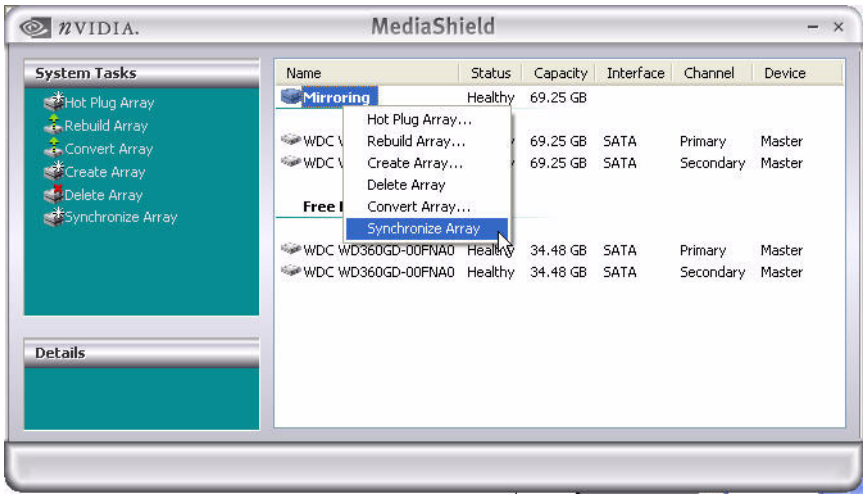


Figure 4.15 Array Pop-up Menu

The Synchronize Array Wizard Welcome screen appears.

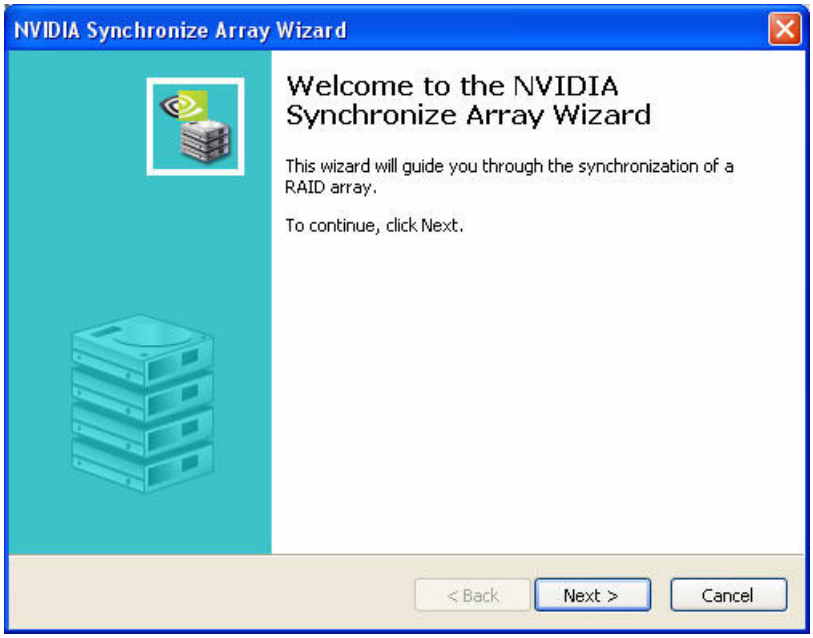


Figure 4.16 Synchronize Array Wizard—Welcome Screen

2 Click on **Next** and then click **Finish** at the Wizard Completion screen.

The MediaShield window indicates that the array is synchronizing, as shown in Figure 4.17.

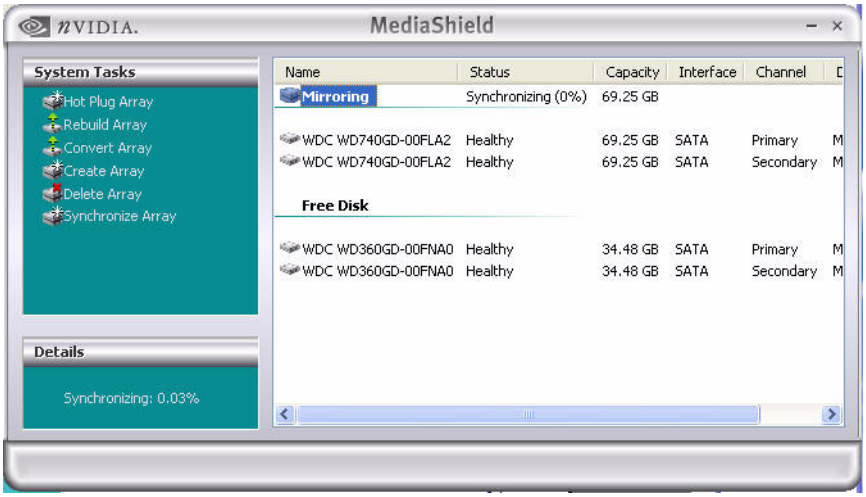


Figure 4.17 Mirrored Array Synchronizing

As you can see from the screen shot above, the synchronization process has started and it will be completed in a short period of time.

CHAPTER

5

USING DISK ALERT

About Disk Alert

The RAID manager application includes a disk alert feature that provides a graphical indication of the status of the hard disks in the system.

When the RAID manager application detects a failure condition of an attached drive, a pop-up box appears in the clock area of the Windows system tray. Click the pop-up box to view the manufacturer-provided bitmap image of the system motherboard. The image shows the hard drive connector ports and provides a visual indication of the location and status of the drives as follows:

- **Red rectangle**: A red rectangle will flash around the port connector that is attached to the failed drive.
- **Green rectangle:** Ports that have a drive attached, and are in a healthy state, are indicated with a green rectangle around the port connector.
- **Yellow rectangle**: Ports that have a drive attached, are members of a failed RAID array, but are not the cause of the failure have a yellow rectangle around the port connector.

Unconnected ports have no visual indication.

Disk Alert Examples

Figure 5.1 through Figure 5.3 illustrate how the Disk Alert feature is implemented on an NVIDIA reference board. The actual picture in your system will depend on the motherboard.

Example of All Good Drives

Figure 5.1 shows four green connections indicating four active SATA ports—all SATA ports are OK.

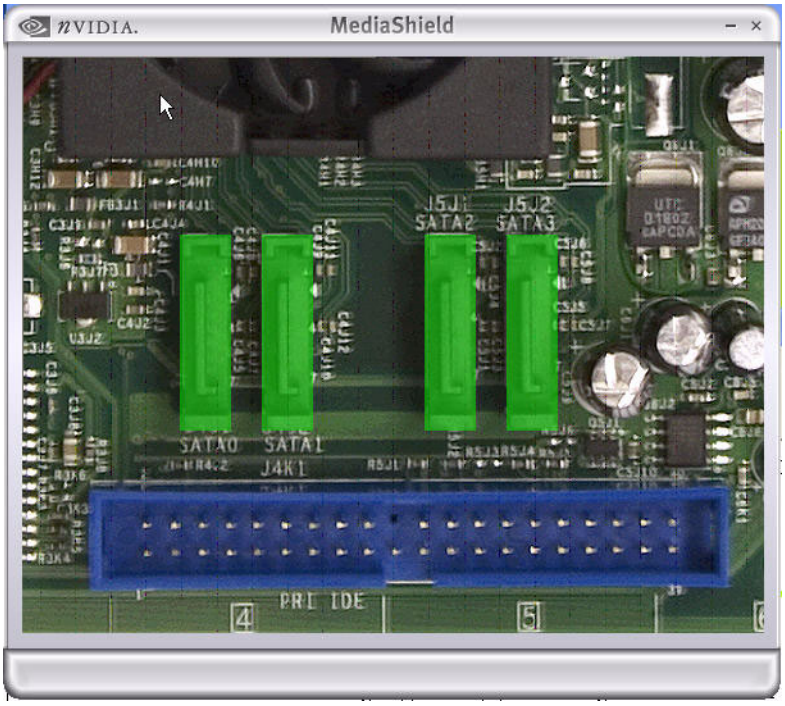


Figure 5.1 Disk Alert Example—All SATA Drive Connections OK

Example of a Degraded Array

Figure 5.2 shows a yellow SATA port indicating that an array has been degraded as well as a single black SATA port indicating that there is no longer a SATA hard drive connected to that port.

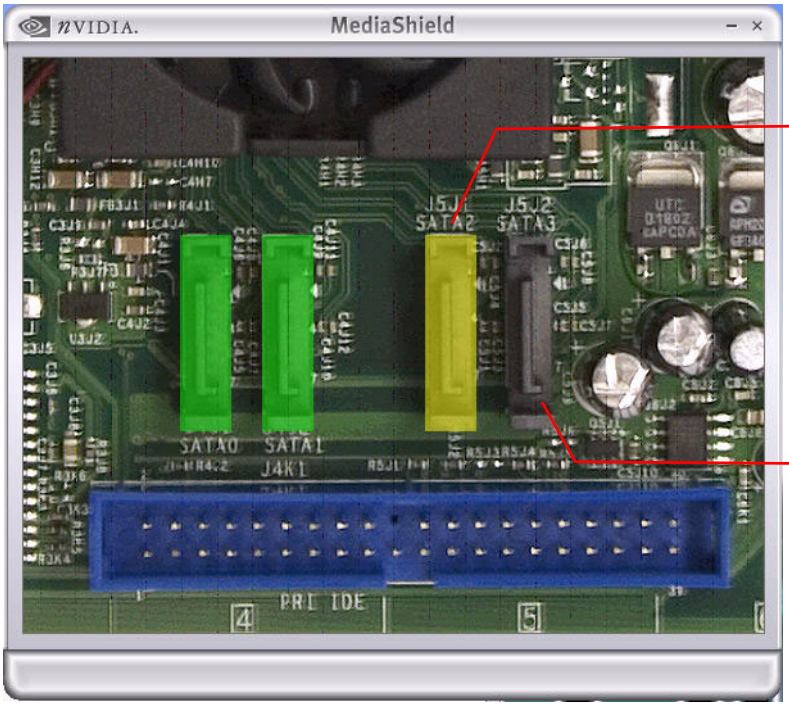


Figure 5.2 Disk Alert Example—Degraded and Missing SATA Connection

Example of a Failed Drive

Figure 5.3 shows a red SATA port indicating that a drive failure (or a RAID error) has occured.

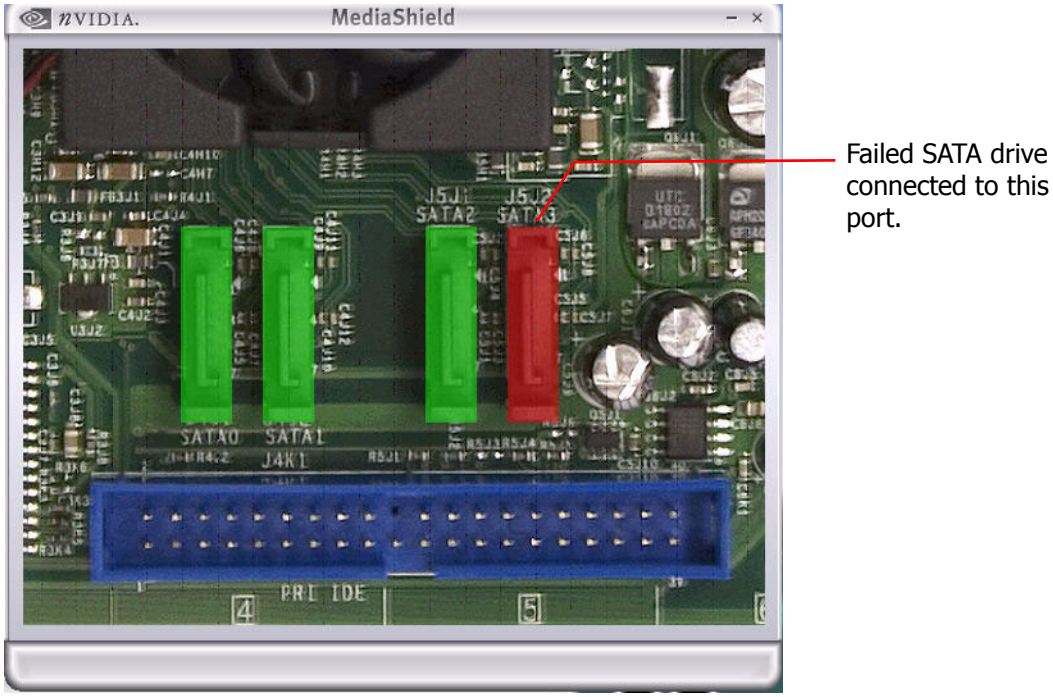


Figure 5.3 Disk Alert Example—Failed SATA Drive

CHAPTER

6

MEDIASHIELD RAID FREQUENTLY ASKED QUESTIONS

The FAQ in this chapter are organized by the following categories:

- "Basic RAID Questions" on page 144
- "RAID ROM Setup Questions" on page 145
- "Rebuilding Arrays Questions" on page 145
- "Dedicated Disk Questions" on page 146
- "Array Migrating Questions" on page 146
- "Windows RAID Application" on page 146

Basic RAID Questions

- ***What is RAID?***

  RAID stands for ***R****edundant* ***A****rray of* ***I****ndependent* ***D****isks,* and refers to the grouping of 2 or more disk drives that the system views as a single drive. Different groupings have difference advantages that include better performance and data fault tolerance.

  See "About NVIDIA® MediaShield™" on page 1 for detailed descriptions of the different types of RAID arrays.

- ***What type of RAID array is right for me?***

  In general, for better throughput of non-critical data, use RAID 0; for fault tolerance, use RAID1 or RAID 5, and for better throughput as well as fault tolerance use RAID 0+1.

  See "About NVIDIA® MediaShield™" on page 1 for detailed descriptions of the different types of RAID arrays.

- ***What is the difference between a bootable and a non-bootable RAID array?***

  A system with a non-bootable RAID array includes a separate hard disk that contains the OS and is not part of the RAID array.

  See "Setting Up a Non-Bootable RAID Array" on page 13 for more information.

  In a bootable RAID array, the OS is installed on the RAID array disks.

  See "Setting Up a Bootable RAID Array" on page 21 for more information.

- ***I just configured a RAID 1 array—why is the array size one-half the total cumulative size of the drives?***

  RAID 1 uses one-half the total disk space for data redundancy.

  See "RAID 1" on page 6 for more information on RAID1 arrays.

- ***What is the optimal hard drive configuration for RAID 1 (mirror)?***

  In a mirrored array, a mirror is created using the maximum drive size of the smaller of the two drives. Ideal configuration is achieved using drives of identical size.

- ***How do I configure a multiple array system?***

  Two different arrays can be configured and active at the same time. For example, a mirrored array with two hard drives, as well as a striped array using three hard drives can exist at the same time. You need to configure each array separately in the RAID BIOS as well as initialize the arrays in Windows as described in "Setting Up Your RAID Configuration" on page 13.

- ***Why is the cumulative size of a RAID 0 (Stripe) or RAID 0+1 (Stripe-Mirror) not equal to the sum of the drives?***

  The drive size is controlled by stripe blocks.

  For RAID 0 : Array size = (smallest drive size) x (number of disks in the array)

  For RAID 0+1 : Array size is = ((smallest drive size) x (number of disks in the array)) / 2

- ***Why can I not get into Windows after adding a non-bootable array?***

  Possible cause would be adding the boot drive to the array and then clearing the array.

RAID ROM Setup Questions

- ***Why can I not get into the RAID ROM Setup?***

  You must enable RAID functionality in the system BIOS as explained in "Setting Up the BIOS" on page 13.

- ***Why do my hard drives not appear in the RAID ROM Setup?***

  From the **RAID Config** window, you must enable RAID and then enable the disks that you want to use as RAID disks. See "Setting Up the BIOS" on page 13 for more information.

- ***What is the Optimal Striping Block Size in the RAID ROM Setup?***

  The default optimal striping block size is 64KB. NVIDIA recommends using the optimal block size.

- ***What does BBS stand for in the RAID ROM [F10] setup?***

  BBS stands for ***B****IOS* ***B****oot* ***S****pecification.* This indicates that the boot device is defined in the BIOS.

- ***What does "Clear Disk" mean in the RAID ROM Setup?***

  Clear Disk clears the MBR (Master Boot Record). This is needed to prevent invalid data from appearing in the MBR space on any of the drives included in the array. Not doing so could render the system unstable.

Rebuilding Arrays Questions

- ***How long does the RAID rebuilding process take?***

  In the rebuilding process, all data is copied from one hard drive to another and then the data is synchronized between the two hard drives. Because the rebuilding process occurs in the background in a way that does not affect system performance, the process can take some time and the time it takes depends on the size of the drive, system performance and other factors.

  See "Rebuilding a RAID Array" on page 132 for more information.

Dedicated Disk Questions

- ***Can I assign a dedicated disk to a striped array/JBOD or use a free disk with striped array/JBOD?***

  No, free disks and dedicated disks can be only used with a mirrored array or a striped-mirrored array.

- ***Once a dedicated disk has been assigned to a RAID 1, RAID 0+1, or RAID 5 array, can I remove it?***

  Yes, a dedicated disk can be removed from a RAID 1, RAID 0+1, or a RAID 5 array.

Array Migrating Questions

- ***Is it possible to migrate a single bootable drive to a two-disk stripe array?***

  That is, if I have a single drive in the system that is not RAID enabled, then decide to add a second drive to the system, will I then be able to migrate the single bootable drive to a two-disk stripe array?

  If "RAID Enable" in the BIOS RAID Config screen is not enabled when the OS is installed, it is not possible to convert the SATA boot drive into a multi-disk bootable RAID array.

  Therefore, if you want to retain the capability to migrate a single SATA boot drive into a multi-disk RAID array at a future time, you must perform the OS install onto a single disk stripe array. You can do this by following the instructions in "Setting Up a Bootable RAID Array" on page 21 and selecting "RAID Mode" striping and then adding just your single boot disk. Then install the OS using the **F6** install mechanism as described in Installing the RAID Drivers.

  Later, when you want to migrate the single disk into a multi-disk RAID array, follow the instructions in "Migrating From One RAID Array to Another" on page 69.

- ***Can I delete an array while it is being migrateed?***

  Yes, but doing so will erase all the data stored on the soon to be migrateed array.

- ***Can I migrate a bootable RAID array?***

  Yes, you can migrate to and from any supported RAID configuration.

Windows RAID Application

- ***What functions can be performed using the MediaShield application?***

  The following tasks can be performed:

  - View information about RAID 0, 1, 0+1, 5 and JBOD (as well as any supported configuration if you have more than one RAID array active)

- Assign a dedicated disk to RAID 1, RAID 0+1 and RAID 5
- Remove a dedicated disk from a RAID 1, RAID 0+1 or RAID 5 array
- View Free Disks
- Rebuild a RAID 1, RAID 0+1 or RAID 5 array
- View the status of the rebuilding process
- Create a RAID Array
- Delete a RAID Array
- Migrate a RAID Array
- Hot Plug Array
- Initialize Array
- Synchronize Array

CHAPTER 7

MEDIASHIELD APPLICATION NOTES

This chapter includes several application notes that address specific issues that may be encountered when trying to install the NVIDIA MediaShield software or other software required to run NVIDIA RAID.

- "Windows 2000 Limitation with Bootable RAID" on page 150

  describes how to create a bootable RAID volume with Windows 2000 via the migrating method.

- "Installing the NVIDIA IDE Driver in Windows 2000" on page 150

  describes how to install Windows 2000 Service Pack 4, which required for installing the NVIDAI IDE driver.

- "Using GHOST with NVIDIA RAID" on page 151

  describes how to use disk cloning software with a RAID array.

- "How to Build a Slipstream XP-SP2 CD" on page 152

  describes how to use NVIDIA storage drivers to build an XP-SP2 slipstream that can be installed onto an NVIDIA SATA RAID controller.

Windows 2000 Limitation with Bootable RAID

Problem

In Windows 2000 (Service Pack 2 or previous versions), the end user cannot install this operating system to a bootable RAID volume.

Solution

The user must create a combination installation CD that includes Windows 2000 and SP3 or SP4 fixes integrated in. To create the combination installation CD, refer to the following website:

http://www.microsoft.com/windows2000/downloads/servicepacks/sp4/HFdeploy.htm

Note: If the end user chooses not to install Windows 2000 Service Pack 3 or 4, RAID is still supported on Windows 2000. However, the end user will not be able to create a bootable RAID volume.

Installing the NVIDIA IDE Driver in Windows 2000

Problem

In Windows 2000 (Service Pack 2 or previous versions), the end user cannot install the NVIDIA IDE Driver without upgrading Windows 2000 with Service Pack 4.

Solution

In order to upgrade Windows 2000 with Service Pack 4:

1. Install Windows 2000 on a selected hard drive.
2. Download and install Windows 2000 Service Pack 4 from the Microsoft website.
3. Reboot the system.
4. When in Windows 2000, install the NVIDIA nForce Driver Package

   The user will have an option to install the NVIDIA IDE driver during the installation process.
5. Reboot the system.

Using GHOST with NVIDIA RAID

Problem

GHOST can interface with hard disk controllers by accessing the appropriate memory and hardware locations directly. However, in doing so, this can bypass the RAID enhancements that are provided by the system BIOS. The system BIOS understands the underlying disk and RAID array structures and formats. In order to properly use GHOST to interact with a RAID volume, the user should ensure that the tool is operating in a mode where it does not talk directly to the hardware resources, but rather communicates using the system BIOS.

Solution

In order to use GHOST in a RAID volume, the user must:

- Disable the GHOST Direct Disk Access
- Force it to rely on Extended INT13 to access the disk

  To set GHOST to use Extended Interrupt 13h (INT13) access:

  a Start GHOST from the DOS prompt. (Not the Windows Command Prompt session)

  b Select the "Options" (**ALT+O**) menu

  c Scroll to the "HDD Access" Tab

  d Select the "Use Extended Interrupt 13h disk access" (**ALT+E**)

  e Select the "Disable direct IDE access support" (**ALT+B**)

  f Select the "Disable direct ASPI/SCSI access support" (**ALT+B**)

  g Press (**ALT+A**) to activate the "Accept" button to use the new settings

  h Proceed to run GHOST as normal

These steps will then allow the user to use GHOST to copy the disk image through the RAID array.

Note: Typically, disk cloning software accelerates data transfer through direct disk access, which also allows for overlapping read and write calls, further accelerating the process. Because INT13 calls cannot "overlap", read and write operations must be performed in series, which causes the disk cloning process to perform slower when RAID is enabled.

How to Build a Slipstream XP-SP2 CD

Problem

Create a CD that will install XP-SP2 onto a bootable RAID array.

Solution

Create a slipstream CD that includes MediaShield RAID drivers using the following steps

Initial Setup

There are a number of options on how to setup the directory structures. This is just an example and is not meant to suggest other methods are incorrect.

1. Create the following 3 folders:
   - C:\slipstream\XP
   - C:\slipstream\XP-SP2
   - C:\slipstream\XP-BootImage

   You can use any directory names and structure you wish to create the slipstream. The names and structure used in this app note are for example only.

2. Copy XP Gold CD contents into "XP" (make sure your Folder Options View tab has [Show hidden files and folders] radio button is selected and [Hide protected operating system files] is unchecked.)

3. Download (NOT INSTALL) SP2 from Microsoft website into "XP-SP2" folder

4. Extract SP2 to "XP-SP2" folder with following command:

   WindowsXP-KB835935-SP2-ENU.exe –x

5. Run SP2 on c:\slipstream\XP with the following:

   C\slipstream\XP-SP2\i386\Update\Update.exe -S:C:\slipstream\XP

6. Use IsoBuster or equivalent application to extract the bootable image file to c:\slipstream\XP-BootImage.

Add NVIDIA Drivers

1. Extract the NVIDIA driver files from the nForce package using '-x' option.

2. Copy all *.sys, *.dll, *.inf and *.cat files from "…\IDE\WinXP\sataraid" to "c:\slipstream\XP\i386".

3. Edit "c:\slipstream\XP\i386\txtsetup.sif" and add the following

   a Under [WinntDirectories] section add:

   ```
   300 = nvidia\nvraid
   ```

   This will add a directory to hold the storage driver files.

   b Directly under header [SourceDisksFiles] add the following lines:

   ```
   nvraidco.dll = 1,,,,,,,300,0,0
   nvraid.sys   = 1,,,,,,,300,0,0
   nvraid.inf   = 1,,,,,,,300,0,0
   nvraid.cat   = 1,,,,,,,300,0,0
   NvAtaBus.sys = 1,,,,,,,300,0,0
   idecoi.dll   = 1,,,,,,,300,0,0
   NvAtaBus.sys = 100,,,,,,,4,0,0,,1,4
   nvraid.sys   = 100,,,,,,,4,0,0,,1,4
   ```

   This tells installer to copy all driver files to "%systemroot%\nvidia\nvraid" and then the two .sys files to "%systemroot%\system32\drivers"

   c Now add the device IDs for your SATA controller directly under the [HardwareIdsDatabase] section.

   This will tell OS which drivers to load for SATA controllers on your platform.

   You can get this information from the file `nvraid.inf`. Search for "[NVIDIA]" and you should see something like the following:

   ```
   [NVIDIA]
   %CK804SSS%=Crush11_Inst,PCI\VEN_10DE&DEV_0055&CC_0104
   %CK804SSS%=Crush11_Inst,PCI\VEN_10DE&DEV_0054&CC_0104
   %NVRAID_DESC%=nvraid,GenNvRaidDisk
   %NVRAID_BUS_DESC%=nvraidbus,*_NVRAIDBUS
   %NVRAID_BUS_DESC%=nvraidbus,*NVRAIDBUS
   ```

   You will require an entry for each of these lines in the following format.

   ```
   [HardwareIdsDatabase]
   PCI\VEN_10DE&DEV_0054 = "nvatabus"
   PCI\VEN_10DE&DEV_0055 = "nvatabus"
   ```

```
GenNvRaidDisk          = "nvraid"
*_NVRAIDBUS            = "nvraid"
*NVRAIDBUS             = "nvraid"
```

Note: Your platform will likely have different device IDs, so you should modify your entries accordingly.

d Add NVIDIA storage drivers to the SCSI preload section.

```
[SCSI.Load]
nvatabus = NvAtaBus.sys,4
nvraid = nvraid.sys,4
```

e Add the message that will get displayed during text setup driver load.

```
[SCSI]
nvraid   = "NVIDIA RAID CLASS DRIVER"
nvatabus = "NVIDIA nForce SATA Controller"
```

4 Modify **`hivesft.inf`** to include the driver files location info into the DevicePath registry key.

This tells the GUI mode setup where to find the driver files. Since this example places them in "%systemroot%\nvidia\nvraid", that is what we use here:

```
HKLM,"SOFTWARE\Microsoft\Windows\
CurrentVersion","DevicePath",0x00020002,"%SystemRoot%\
inf";"%systemroot%\nvidia\nvraid"
```

Burning a CD

There are a number of tools that allow you to burn a bootable CD image. Here are some tips when using Nero.

- Select CD-ROM [Boot] option
- Select the Boot tab and
  - Set image to file in c:\slipstream\XP-BootImage
  - Select “Enable expert settings”
  - Set Kind of Emulation to No Emulation
  - Set load segment to 07C0
  - Set number of loaded segments to 4 (Very important!)
- Select ISO 9660 Volume label to
  - XP Professional enter WXPCCP_EN
  - XP Home enter WXHCCP_EN

  - XP Professional OEM enter WXPOEM_EN
  - XP Home OEM enter WXHOEM_EN
- Select everything from c:\slipstreap\XP for burning onto CD